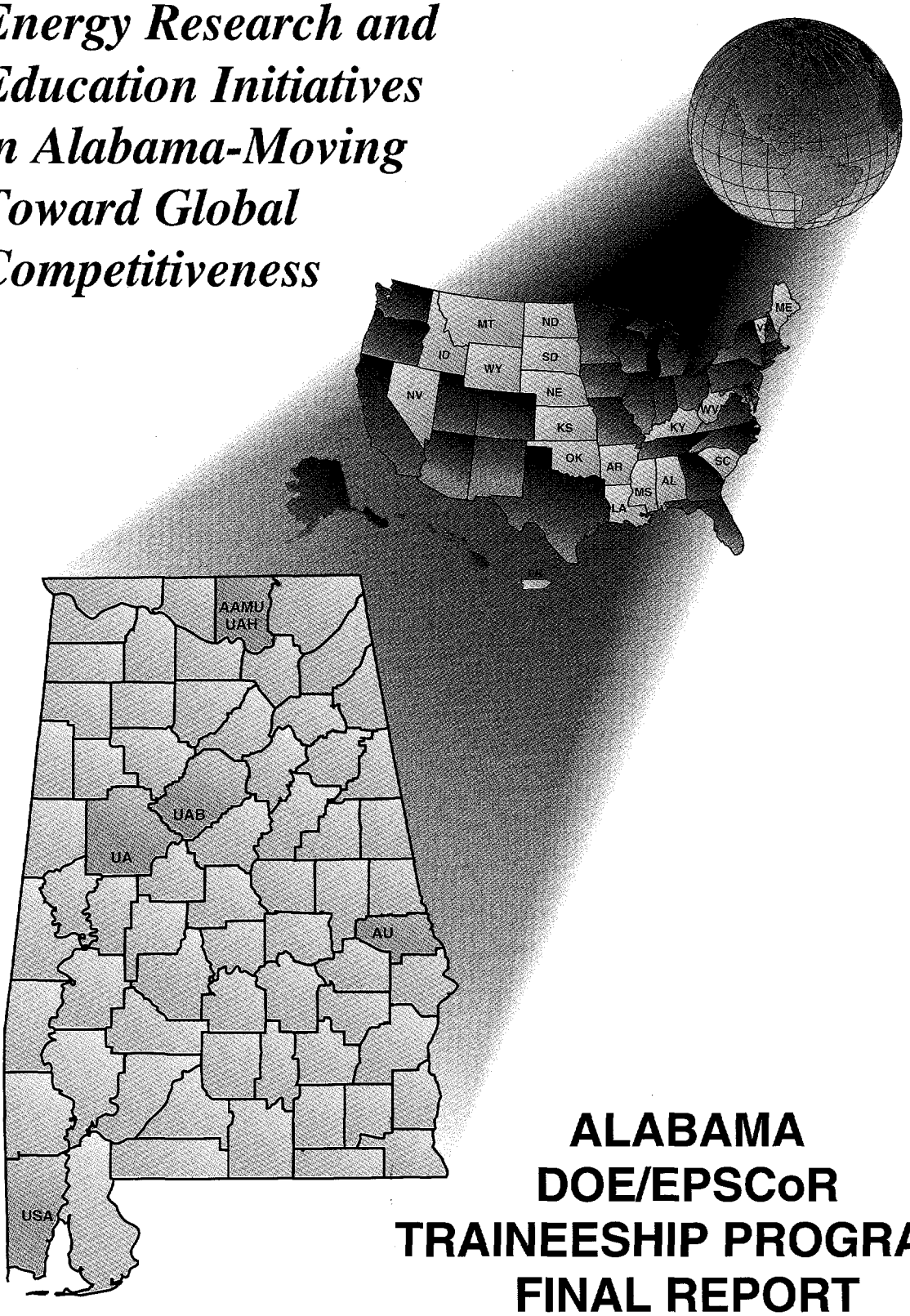
DOE/ER/75658--T1

Energy Research and Education Initiatives in Alabama-Moving Toward Global Competitiveness



ALABAMA DOE/EPSCoR TRAINEESHIP PROGRAM FINAL REPORT

DECEMBER 1995

ALABAMA DOE/EPSCoR TRAINEESHIP PROGRAM

Final Report

Prepared by

KENNETH M. PRUITT
Director
ALABAMA EPSCoR PROGRAM

and

GARY C. APRIL
Associate Director
ALABAMA DOE/EPSCoR PROGRAM

Box 870203
Tuscaloosa, AL 35487-0203
[205] 348-1734

Prepared For

DONNA J. PROKOP
United States Department of Energy
Washington, D.C.

DOE Grant No. DE-FG02-91ER75658

December 1995

DISCLAIMER

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

ALABAMA DOE/EPSCoR TRAINEESHIP PROGRAM

FINAL REPORT

SUMMARY

This report covers programmatic accomplishments of the Alabama DOE/EPSCoR Traineeship Program for the period September 28, 1991 to September 29, 1995.

The Alabama DOE/EPSCoR Traineeship Program is an integral part of this state's efforts to address barriers that inhibit the full development and substantial growth of energy-related research at the six major research institutions and at Alabama's Historically Black Colleges and Universities (HBCUs). To overcome these barriers it was determined that the following actions were needed:

Area 1: Strengthening the Research Faculty Base

Area 2: Increasing the Number of Outstanding Graduate Students

Area 3: Improving the Research Environment

Area 4: Developing the Human Resources Base

Area 5. Improving the Energy-related Infrastructure, Collaborations and Communications

Although the DOE/EPSCoR Traineeship Grant complements each of the areas listed above, its primary emphasis is the enhancement of opportunities for graduate students. The extent to which this program has met this challenge during the three year funding period constitutes the substance of this report.

PROGRAM BACKGROUND

In 1991, the State of Alabama EPSCoR Program was awarded DOE/EPSCoR Planning and Traineeship Grants to begin the processes needed to identify, then develop, a strong energy-related research and education consortium involving industry, State and Federal government, and the six EPSCoR universities in the state (See Appendix A -- DOE/EPSCoR Organizational Structure). Broad-based interests derived from faculty surveys were used to direct recruitment activities identifying highly qualified students. Likewise, these broadly-defined research areas were targeted with campus visitation programs to begin the task of measuring institutional strength and commitment for energy-related research and education.

The results derived from these initiating steps produced a sound foundation upon which future energy-related programs could be built (See Appendix B -- Alabama DOE/EPSCoR Program Elements). The outcomes assessment study conducted as part of the DOE/EPSCoR Planning Grant process identified four critical elements:

[1]. There exists a broad-based interest among faculty and a corresponding diversity of energy-related research at the six EPSCoR universities.

[2]. There are outstanding and highly qualified faculty and students capable of conducting meaningful energy-related research activities.

[3]. There is recognized institutional commitment and support for energy-related research based on the individual records of achievement at each institution.

[4]. There is a willingness and the enthusiasm to develop interdisciplinary and intercampus collaboration where it makes good sense and where it enhances the quality and the opportunity for conducting energy-related research.

These initial studies also indicated the areas that Alabama should address to achieve its goals and objectives within the context of energy-related research and educational missions. The specific role of the DOE/EPSCoR Traineeship Grant Program contributed to the state-wide plan in the following significant areas:

[1]. To build lasting linkages with State and Federal entities for sustaining the programmatic themes in energy-related research and education.

[2]. To identify and recruit outstanding, highly qualified students and faculty in sufficient numbers to maintain competitive research programs.

[3]. To improve opportunities for under-represented groups, at all levels, for the purpose of launching them into meaningful and rewarding energy-related educational careers.

These missions continue to be the focal point of the Alabama DOE/EPSCoR Program and this report provides information describing the degree to which success has been achieved under the Traineeship Grant.

PROGRAM ACCOMPLISHMENTS

The Alabama DOE/EPSCoR Traineeship Grant ended on September 30, 1995. During its 3-year history 26 students participated in energy-related M.S. and Ph.D. research at all six EPSCoR institutions. This included 10 M.S. and 16 Ph.D. recipients. Additionally, 10 were female students and 4 were minorities of color. To date, 13 have completed degrees and 12 are continuing with expected graduation dates in 1996-1998; one student transferred to an NIH-directed program.

During the third year of competition, trainees were selected to complement the research activities that were targeted for DOE funding in the Implementation Cooperative Agreement. Thus, seven students are directly involved with Research Cluster projects. Two have graduated and five continue with support of their work from other sources.

A breakdown of the funding received over the 3-year period is shown below.

PROGRAM FUNDING, $				
Traineeship Program	**DOE**	**State Cash**	**In-Kind**	**Total**
Year 1 (FY92)	250,000	20,000	120,000	390,000
Year 2 (FY93)	250,000	70,000	85,000	405,000
Year 3 (FY94)	250,000	70,000	100,000	420,000
Total	**750,000**	**160,000**	**305,000**	**1,215,000**

An overview of the students supported, by institution, is shown in Figure 1. A profile of Applicants and Trainees participating in the DOE/EPSCoR Program since its inception is provided in Appendix C.

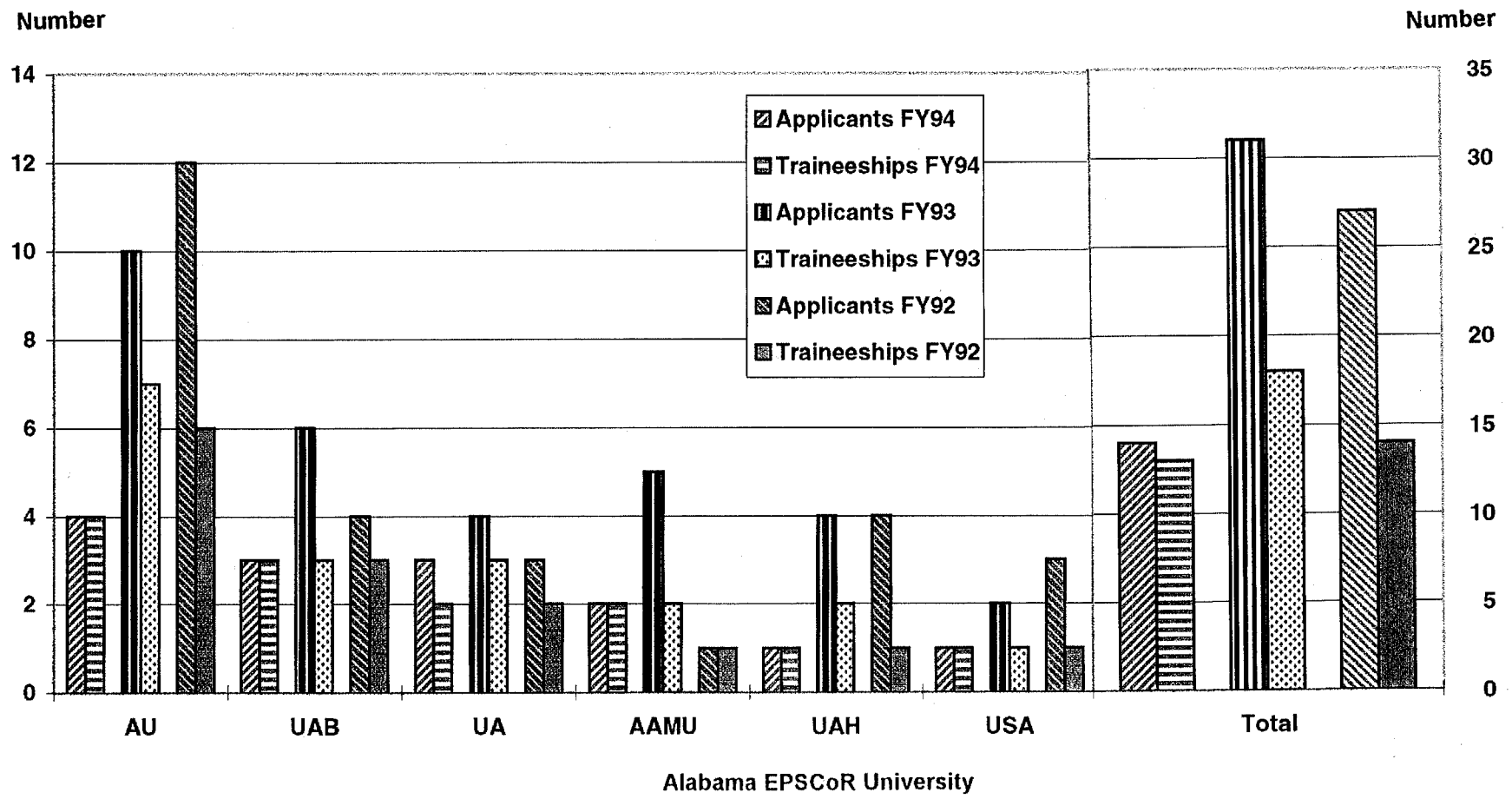


Figure 1. No. of Applicants and Trainees by EPSCoR University

Note: No. of Applications are lower in FY94 reflecting a change in DOE funding policy and a more focused direction involving Alabama DOE/EPSCoR Implementation Grant Research Clusters.

Identifying and Recruiting Outstanding, Highly Qualified Students

One of the major barriers identified during the DOE/EPSCoR Planning Grant study was Alabama's inability to attract into and keep within its institutions, at the graduate level, highly motivated and qualified students. A review of recent enrollment figures shows that the ratio of PhD-to-MS students within EPSCoR universities is 1 to 4. These figures are generally perceived to be caused by the inability of the institutions to offer nationally competitive assistantships (current Alabama average: $8,000) due in part to limitations on state budgeted support for graduate programs and from line item support in research contract and grant funding that falls short of national levels (Note: In terms of DOE funding for FY91, Alabama averaged $0.69/person compared with $2.25/person in non-EPSCoR states with similar populations. The State is consistently low in nationally competitive research funding among most Federal agencies.)

The DOE/EPSCoR Traineeship Program offers the opportunity to break the above cycle by creating competitive stipends and program support at levels between $12,000 (MS) and $19,000 (PhD). The effect of this program has been a shift in the PhD-to-MS ratio among DOE/EPSCoR Trainees from 2 to 3 during its initial funding period (FY92) to a ratio of 4 to 1 among current Trainees (FY95); exceeding the projected three year target of 1 to 1 funding by the end of FY94 (See Figure 2).

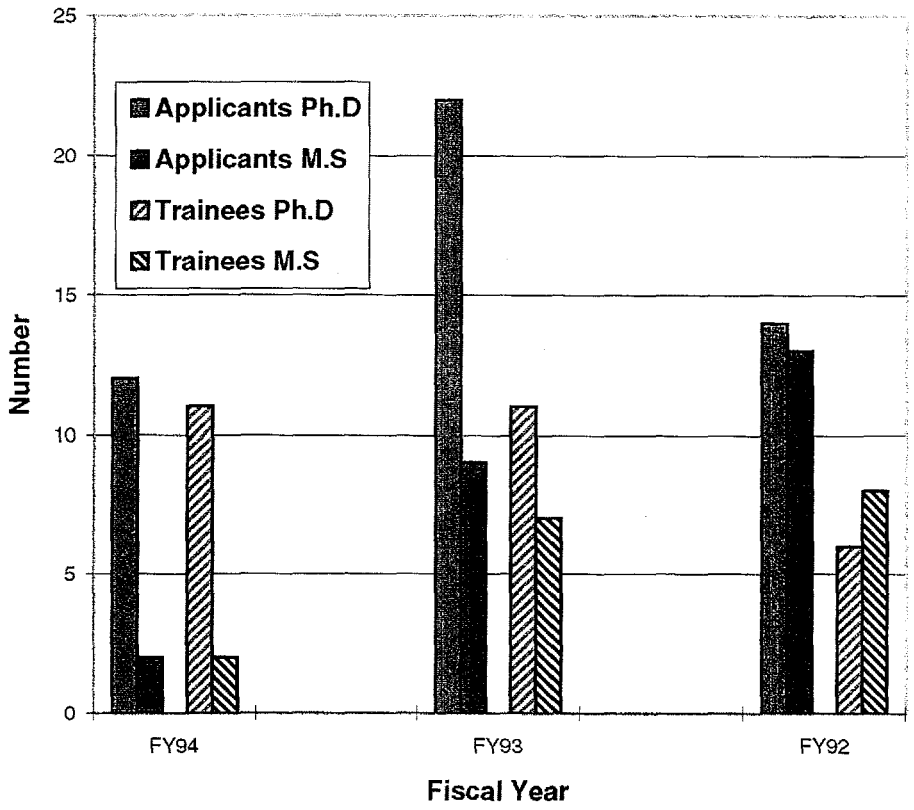


Figure 2. Number of Applicants and Trainees by Degree

Note: No. of Applications are lower in FY94 reflecting a change in DOE funding policy and a more focused direction involving Alabama DOE/EPSCoR Implementation Grant Research Clusters.

In part, these changes reflect a concerted effort to selectively recruit PhD qualified students. However, it is also in part due to the continuation by many MS students into a PhD study program at one of the EPSCoR institutions. The latter speaks well for the need to maintain a balanced approach to funding entry level students with interest in both MS and PhD degree programs.

One measure of the quality of the Trainees selected is their performance scores on the Graduate Record Examination (GRE). The minimum requirement at most Alabama EPSCoR universities is a composite score (Verbal, Quantitative and Analytical) of 1500. Over the last three years, DOE/EPSCoR applicants have averaged 1830 (FY92), 1850 (FY93) and 1790 (FY94). Correspondingly, Trainees have averaged 1880 (FY92), 1950 (FY93) and 1960 (FY94). This is illustrated in Figure 3.

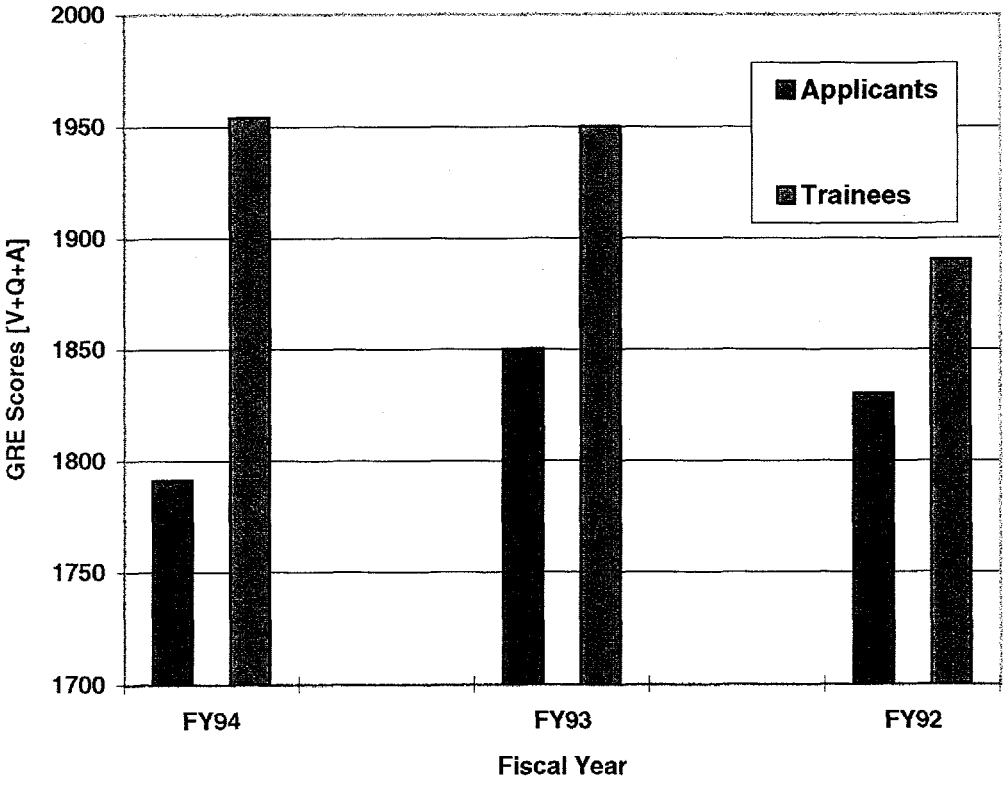


Figure 3. Applicant and Trainee Performance Scores - GRE [V+Q+A]

Note: No. of Applications are lower in FY94 reflecting a change in DOE funding policy and a more focused direction involving Alabama DOE/EPSCoR Implementation Grant Research Clusters.

During the three years of support under the Alabama DOE/EPSCoR program 85% of the Trainees participated in extramural research activities at DOE national laboratories and the remaining 15% participated in industrial facilities with energy-related research functions (See Figure 4). Aside from the very positive impact that these collaborations have for the student, his/her advisor and the research program, they also serve to enhance the understanding of and opportunities in energy-related careers.

While there was some initial resistance to this aspect of the program, most students and advisors had favorable reactions when the program was completed; reflected by either more efficient performance in the research project or greater knowledge and skill within the field. In some cases, extensions of the extramural activity are being pursued as complementary activities. These arrangements are made between the laboratory and the individual Trainee or his/her advisor, further enhancing the cooperative benefits accruing to each participant. One Trainee is now a DOE Fellow at the Oak Ridge National Laboratory; a position derived through contact within the Alabama DOE/EPSCoR program.

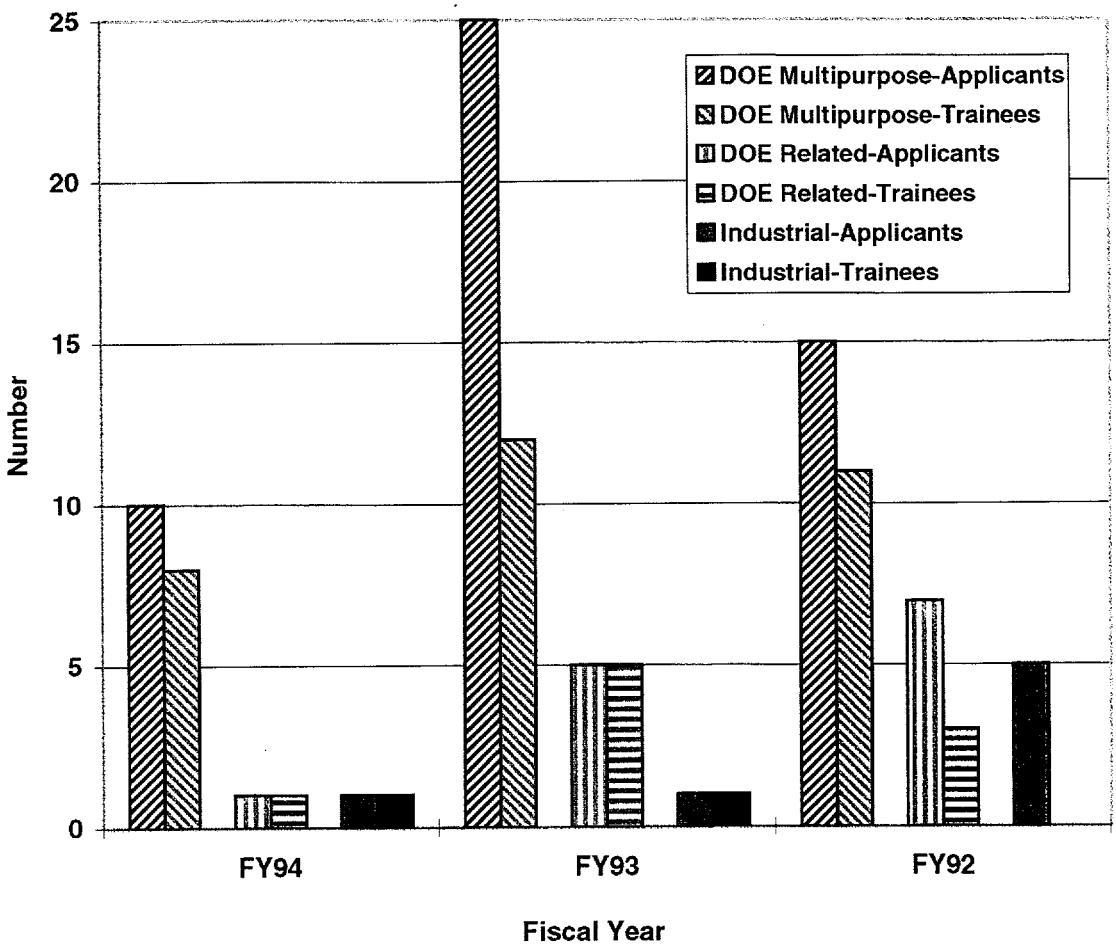


Figure 4. Types of Laboratories Selected for Extramural Activity

Note: No. of Applications are lower in FY94 reflecting a change in DOE funding policy and a more focused direction involving Alabama DOE/EPSCoR Implementation Grant Research Clusters.

Improving Opportunities for Under-Represented Groups

Good progress has been made by the Alabama DOE/EPSCoR Program in attracting women into energy-related advanced study programs. The composition of women students within all energy-related fields of study in the six EPSCoR universities is 19%. During the first three years of the Alabama DOE/EPSCoR Traineeship Program, approximately 30% (4 of 14 in FY92, 5 of 18 in FY93 and 5 of 13 in FY94) of the Trainees have been women. (See Figure 5).

These data represent a special program of emphasis since the number of women applicants during the three year funding period made up only 20% of the applicant pool. Clearly, progress has been made.

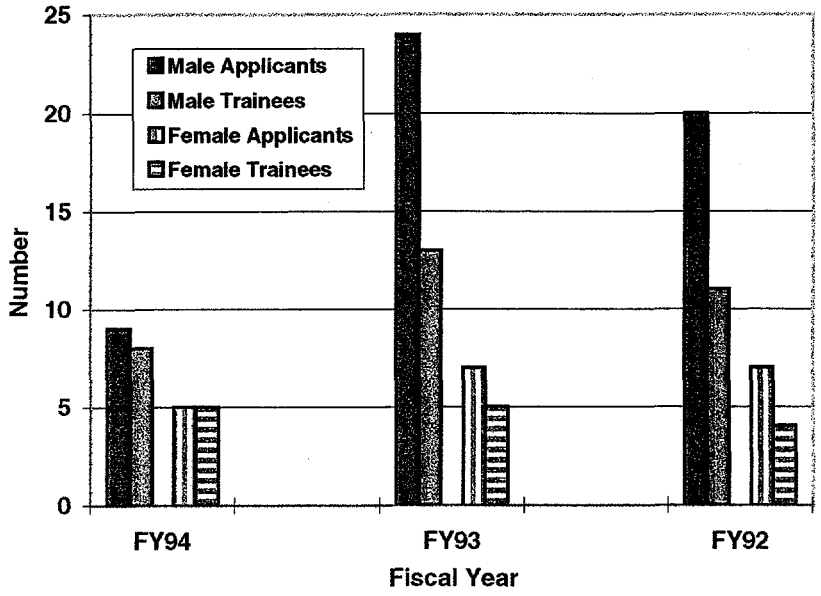


Figure 5. Number of Applicants and Trainees by Gender

Note: No. of Applications are lower in FY94 reflecting a change in DOE funding policy and a more focused direction involving Alabama DOE/EPSCoR Implementation Grant Research Clusters.

The success among minorities of color has been slower in developing (See Figure 6). It appears that the support available in Alabama for black students to pursue graduate study exceeds the number of qualified applicants in all programs. Clearly, in the short term, a more active recruitment posture is needed. However, in the longer term, overall improvement of and selected enhancement opportunities for minorities are needed to increase the number reaching the applicant pool. This continues to be an emphasis in the DOE/EPSCoR - Alabama Alliance for Minority Participation (NSF) program under the Implementation Cooperative Agreement (See Appendix E). Four of the six traineeships designated in the proposal will provide students from HBCU's in Alabama the opportunity to do graduate work in one of the targeted Research Cluster Areas (Petroleum Reservoir Characterization, Fusion Energy and Novel Organic Semiconducting Materials).

Currently, statewide figures for black student enrollment in the six EPSCoR universities, with one being an HBCU, indicate an energy-related graduate school population of 5%. During the three year funding period under the DOE/EPSCoR Program, the number of black Trainees correspond to 7% (1 in 14 during FY92), 6% (1 in 18 during FY93) and 17% (3 in 17 during FY94). In addition, there are two Asian-American trainees funded; one male and one female.

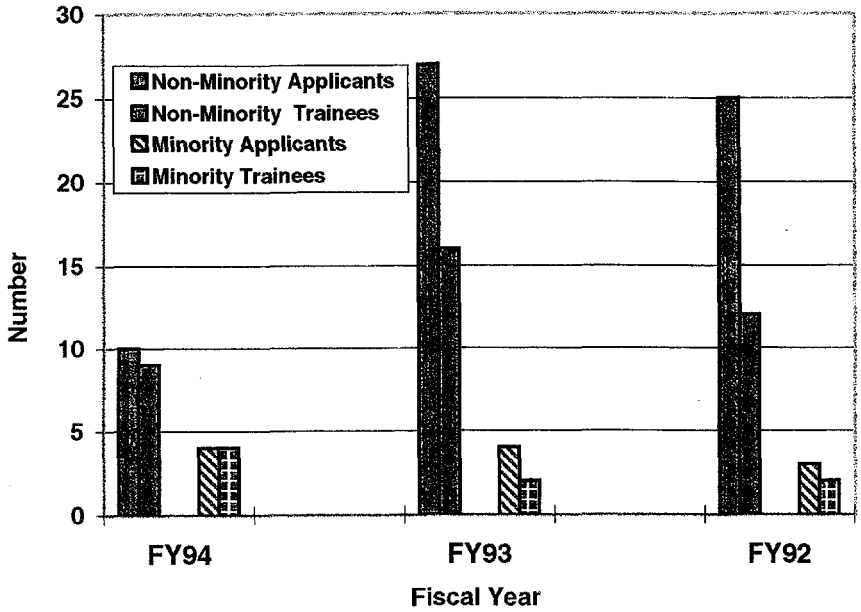


Figure 6. Number of Minority Applicants and Trainees

Note: No. of Applications are lower in FY94 reflecting a change in DOE funding policy and a more focused direction involving Alabama DOE/EPSCoR Implementation Grant Research Clusters.

PROGRAM MANAGEMENT

The program continues to be supported by the six EPSCoR institutions through their active participation in committees and in campus liaison roles (See Appendix B). The recommending body of the Alabama DOE/EPSCoR Program continues to be the DOE/EPSCoR Internal Advisory Committee (IAC) who help with recruiting, screening and evaluating applicants. Three Research Cluster Directors (corresponding to those funded in the Implementation Cooperative Agreement continue to look at the quality of each applicant within the specific energy field (Petroleum Reservoir Characterization, Fusion Energy and Novel Organic Semiconducting Materials). This provides statewide evaluation of applicants independent of the institutional affiliation through which they apply for consideration.

In addition to these activities, the Traineeship Management Team was instrumental in developing and implementing two guidelines to insure equitable administration of the program consistent with its goals and missions established in FY92-93. One guideline defined the support categories in the Alabama DOE/EPSCoR Traineeship Packets (See Appendix D) in terms of course hours completed. This guideline is stated as follows:

TABLE 1

GUIDELINE DEFINING SUPPORT CATEGORY ELIGIBILITY IN TERMS OF COURSE HOURS COMPLETED

DEGREE	COURSE HOURS SEMESTER	COMPLETED QUARTER	LEVEL OF DOE/EPSCoR SUPPORT
MS	0-24	0-36	$17,000
PhD [I]	0-24	0-36	$21,000
PhD [II]	24-48	37-72	$23,000
PhD [III]	>48	>72	$25,000

The second guideline dealt with the number of months for which a Trainee was eligible to receive full and partial DOE/EPSCoR support. This guideline is stated below:

TABLE 2

GUIDELINE DEFINING TERMS FOR FULL AND PARTIAL SUPPORT USING CUMULATIVE MONTHS OF GRADUATE SCHOOL ENROLLMENT

	MONTHS AT DOE SUPPORT LEVEL		
DEGREE	FULL	HALF	QUARTER
MS	0-18	19-27	27-31.5
PhD	0-36	37-54	55-63

Specifically, during FY93, an institutional commitment at half and three quarters support was required for those students who exceed the period established for full DOE support. Also, in the case of transfer students, an equivalent number of months needed to complete the course hours accepted for transfer credit were assigned to calculate eligibility under this guideline. Twelve semester (18 quarter) hours were set equivalent to 12 months of study.

While the application of these guidelines helped in the recruitment of new students and enabled the program to obtain EPSCoR university funding to supplement the support of those trainees, a critical concern

was expressed for those students who reasonably needed long periods of time to complete degree requirements. Therefore, during round two in FY94, prompted by new DOE Traineeship Award funding guidelines (a reduction in support for $250K to $125K per year, and, a stipulation that only states receiving an Implementation Cooperative Agreement were eligible for Traineeship Awards), Alabama DOE/EPSCoR approved modifications to these state guidelines.

The first lowered the state matching requirement to 1/4 for all active Trainees in the program at the start of FY94. This helped many of the Trainees fund extended periods needed to complete requirements. The second specified that only new applicants with research interests in one of the Research Cluster Areas would be eligible for funding using the remaining FY94 resources.

While the impact of these modifications, lowered the number and variety of applications received (see Figures 1-6), it was felt that the second modification was necessary to provide a transition strategy under the new DOE restrictions on funding. The Implementation Cooperative Agreement extends this transition strategy, and further specifies that two thirds of the new Traineeship Awards be designated for qualified minority students identified in the DOE/EPSCoR-AAMP Bridge Program - a program which aggressively targets qualified women and minority students at most of Alabama's (and two of Mississippi's) HBCUs. This refocusing of Traineeship support strengthened the energy-related research thrusts in the state, although the impact in the short term was a reduction in graduate students supported in broad energy-related fields.

PROGRAM FINANCIAL COMMITMENT

The amount of institutional support from the member EPSCoR universities has grown in size over the last two periods as shown in Figure 7. Generally, matching funds are provided to the Associate Director

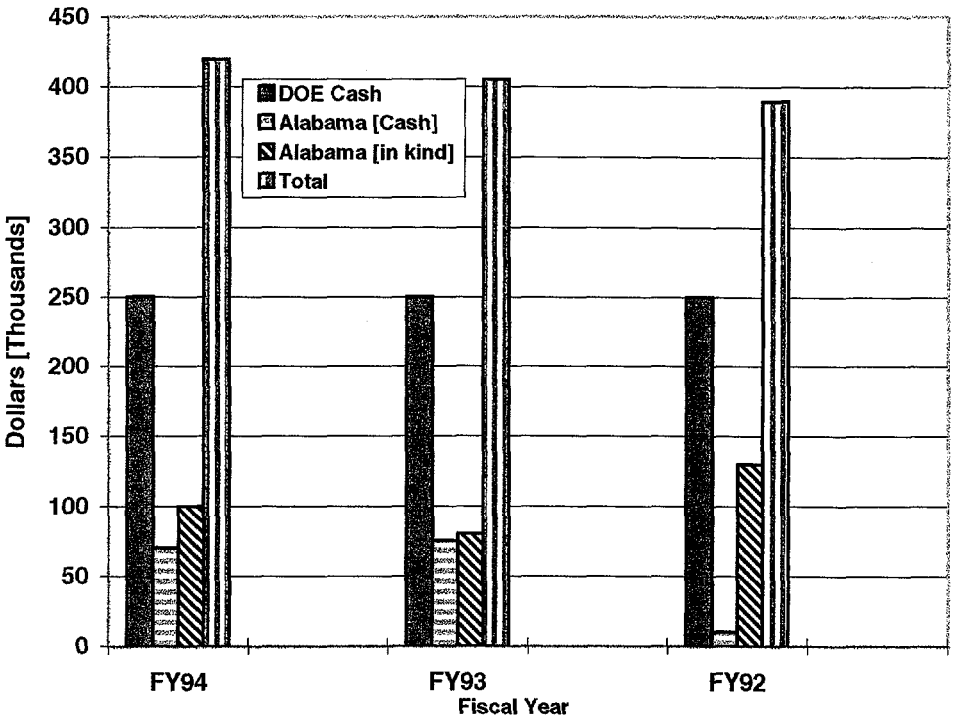


Figure 7. Alabama DOE/EPSCoR Traineeship Grant Budget

Note: No. of Applications are lower in FY94 reflecting a change in DOE funding policy and a more focused direction involving Alabama DOE/EPSCoR Implementation Grant Research Clusters.

in two categories; cash matching funds for the day-to-day operation of the program and for the supplemental support of Trainees, and cost sharing funds which are derived from committed time allocations for Campus and Program Representatives, Traineeship Management Team Members and Research Area Directors.

In FY92 $390K was invested in the Alabama DOE/EPSCoR Program including the $250K DOE Traineeship funds. The corresponding values for FY93 and FY94 were $405K and $420K, respectively. A no-cost extension during FY95 was needed to expend Traineeship funds that carried over as a result of recruitment initiated to implement the program in FY92.

TRAINEESHIP SUMMARIES

Following the FY92 and FY93 broad-based DOE rules, the breadth and depth of the energy-related research undertaken by the Alabama Trainees ran the full range of topics identified as critical in the DOE/EPSCoR Planning Grant Study. To illustrate these attributes, the following one page summaries for each Trainee in the Alabama DOE/EPSCoR Program are provided outlining their programs of study. Those Trainees appointed under the more restrictive DOE rules are indicated by an asterisk (*). These summaries are listed in alphabetical order.

TRAINEESHIP SUMMARY

TITLE: The Effect of Boron and Stoichiometry on the Mechanical Properties of FeAl at Elevated Temperatures

TRAINEE: Robin Carleton	**PERIOD:** 01/01/93 - 06/30/94
UNIVERSITY: AU	**DEGREE PROGRAM:** M.S. (06/94)
TOTAL FUNDING: $25,494	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: To determine the effects of boron and stoichiometry on the strength and ductility of FeAl at elevated temperatures.

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory (ORNL)
June 1993 - March 1994

TECHNICAL PERSPECTIVE: FeAl intermetallics have intrinsically weak grain boundaries resulting in brittle intergranular fracture. A maximum yield strength and ductility occur as the temperature is raised. Boron has been shown to improve ductility and strength in other ordered intermetallics. Also, stoichiometry influences the properties of intermetallics. Thus, effects of both boron and stoichiometry at elevated temperatures will be determined.

RESULTS: Fe-40 and 43 at% Al + B showed a maximum in yield strength and ductility at 873 K. Fe-45 and 48 Al + B displayed a peak in yield strength at 923 K and 573 K, respectively. A study of the fracture surfaces of these alloys indicated a transition in the fracture mode (transgranular to intergranular) around the peak temperature of ductility. A peak in yield strength was absent in tensile tests of boron-free Fe-43, 45, and 48 Al at elevated temperatures. The low temperature strength of the boron-free alloys was higher than the boron-doped alloys, whereas the boron-doped alloys displayed a larger yield strength at elevated temperatures. The ductility of the boron-doped alloys decreased after reaching a maximum. The boron-free alloys displayed an increase in ductility as the temperature increased. Grain boundary cavitation was present in the boron-doped alloys at elevated temperatures but was absent in the voron-free alloys. Grain size control was a problem in the boron-free alloys; thus, further testing is required of these alloys to confirm the results.

TECHNICAL APPROACH: Four sets of alloys were fabricated: Fe-40, 43, 45, and 48 at% Al, each with and without 300 wppm B. Heat treatments resulting in 200 micron grain size (to eliminate grain size strengthening) were determined. Tensile tests were conducted on the alloys at elevated temperatures in vacuum. Yield strength, ultimate tensile strength, and % elongation were calculated for each test. Scanning electron microscopy was employed to determine fracture modes.

PROJECT IMPLICATIONS: FeAl has many desirable mechanical properties (good creep and fatigue resistance and high modulus and strength-to-weight ratio). The enhancement of its ductility would make this alloy an attractive candidate for high temperature applications.

KEYWORD INDEX: ductility, FeAl, intermetallics, stoichiometry

TRAINEESHIP SUMMARY

TITLE: Localization of an Origin of Plasmid Replication in Frankia

TRAINEE: Scott T. Chancey	**PERIOD:** 01/01/92 - 12/31/93
UNIVERSITY: AU	**DEGREE PROGRAM:** M.S. (03/94)
TOTAL FUNDING: $32,934	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: To locate and determine the nucleotide sequence of an endogenous Frankia plasmid

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory
October 1992 - December 1992

TECHNICAL PERSPECTIVE: A portion of Frankia plasmid pFQ31 which contains the origin of plasmid replication was cloned into pUC18. This segment was then used to generate a set of nested deletions for sequencing. Selected nested deletion clones were transformed into Frankia and the transformants are to be assayed for plasmid replication.

RESULTS: A 700 base KpnI to EcoRI fragment has been identified as the location of the putative origin of plasmid replication through transformation studies. Thus far, sequence analysis of this fragment has revealed a region which is more than 60% A-T rich. This is highly significant because Frankia is typically 75% G-C rich and because high A-T regions are characteristic of origins of plasmid replication. This region also contains several possible stem-loop structures which is another characteristic of plasmid origins.

TECHNICAL APPROACH: Nested deletions were generated using Exonuclease III (ExoIII). This allows for the determination of the nucleotide sequence of different regions of the plasmid from the same primer binding site. A set of nested deletions was generated for both strands. Sequencing has been performed using the Sequenase 2.0 Dideoxynucleotide. Sequencing Kit from USB. Transformation of Frankia was done by electroporation and putative transformants were assayed for plasmid replication by recovering the plasmids into E. coli.

PROJECT IMPLICATIONS: Frankia is a filamentous bacteria that fixes nitrogen in symbiosis with many commercially and environmentally important species of trees. This project will help develop a system for transforming, and therefore studying the molecular biology of Frankia. As more is learned about this important symbiont, it will become increasingly more valuable for reforestation of the rain forests, waste land reclamation and as a means of biological fertilization of forest plantation crops.

KEYWORD INDEX: endogenous, Frankia bacteria, plasmid replication

TRAINEESHIP SUMMARY

TITLE: Molecular Biology of Early Responses of Oil-Rich Crucifers to Bacterial Infection

TRAINEE: Kelle M. Dodson	**PERIOD:** 01/01/92 - 12/31/93
UNIVERSITY: AU	**DEGREE PROGRAM:** M.S. (12/93)
TOTAL FUNDING: $32,868	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: To purify chitinase/lysozyme isozyme (CHL-2) for N-terminal animo acid sequencing and antibody production.

EXTRAMURAL ACTIVITY: MSU/DOE Plant Research Lab
August 1993 - September 1993

TECHNICAL PERSPECTIVE: Chitinaslysozymes (CHL's) are antimicrobial enzymes that degrade fungal cell walls and bacterial membranes. CHL-2 is specifically associated with the development of resistance to bacterial infection in cabbage. My project involves further characterization of the role of this isozyme. Last quarter I was purifying this enzyme for sequence determination and antibody production.

RESULTS: My earlier research indicated a positive correlation between the timing of the development of resistance and the accumulation of CHL-2 and an increased enzyme activity. What remains is the purification of the enzyme and cloning of the gene for further characterization. Winter quarter I partially purified this enzyme and provided enough protein for microsequencing at the Univ. of Kentucky. CHL-2 has a pI of 4.0 and a molecular weight of approx. 30 kd. Unfortunately, the N-terminal end of this protein was "blocked" and will have to be repurified to provide more sample for sequencing.

TECHNICAL APPROACH: A 2-dimensional protein purification procedure was utilized. This involves the precipitation of proteins in high salt and dialysis of the sample, loading the preparation on the Rotofor device (which separates proteins according to the pI), and further purification on a native gel (Prep Cell). Purified protein is identified according to their immunological characteristics.

PROJECT IMPLICATIONS: This is the first report of the involvement of constitutive expression of a hydrolytic enzyme in plant defenses. Transgenic expression of this protein may be very useful in protecting plants against bacterial and fungal diseases which, in turn improves energy utilization of plants. Understanding the regulation of the gene encoding CHL-2 also has practical implications which could lead to modifications of the gene expression for resistance.

KEYWORD INDEX: Chitinase/lysozymes, Pathogenesis-related proteins, hycholytic enzymes.

TRAINEESHIP SUMMARY

TITLE: Isolation and Characterization of Aluminum Tolerant Protein(s) in Four Soybean Cultivars

TRAINEE: Shirlean Goodwin	**PERIOD:** 09/30/93 - 08/31/95
UNIVERSITY: AAMU	**DEGREE PROGRAM:** Ph.D. (01/96 est.)
TOTAL FUNDING: $39,750	**INSTITUTIONAL MATCH:** $6,250

RESEARCH OBJECTIVE: To isolate, purify, and characterize the unique proteins elicited during aluminum stress and to sequence the amino acids of the isolated proteins.

EXTRAMURAL ACTIVITY: Battelle (PNL) Lab, Richland, WA
May 1994 - July 1994.

TECHNICAL PERSPECTIVE: Aluminum toxicity is a serious problem in the southeastern U.S. Soybean roots are susceptible to acid soil and associated aluminum toxicity. Additionally, cultivars that are resistant to high levels of aluminum differ in their degree of tolerance to aluminum toxicity. To better understand the molecular basis for plant resistance to aluminum stress the identity and sequencing of stress-induced proteins is essential.

RESULTS: Preliminary results indicate aluminum stress induced altered protein production in the cytoplasmic region. Significant protein peaks have been observed from both tolerant and sensitive aluminum treated cultivars. Unique proteins have been isolated from tolerant cultivars and are now being further purified. Concentrations of Al were significantly higher in roots than in the shoots of all cultivars. Results have also showed that of the Al detected in the partitions, cyclopasmic and cell wall, had the greatest accumulation.

TECHNICAL APPROACH: Four soybean cultivars (differing in aluminum tolerance) will be hydroponically aluminum stress-induced. Total protein extract will be partitioned and cytoplasmic fraction purified using High pressure liquid chromatography (HPLC). Aluminum accumulation in partitions and tissue absorption will be measured by inductively coupling plasma spectrophotometry (ICP).

PROJECT IMPLICATIONS: An understanding of the molecular differences between tolerant soybean genotypes when exposed to aluminum stress would help in the selection and development of plant cultivars with greater tolerance to excess available aluminum in acid soils.

KEYWORD INDEX: Plants, Soybean, proteins, Environmental stress

TRAINEESHIP SUMMARY	
TITLE: Enhancing NMR Images for Studying Fluid Distribution in Porous Media	
TRAINEE: Kathrine Henson-Mack*	**PERIOD:** 06/01/93 - 05/30/94
UNIVERSITY: UA	**DEGREE PROGRAM:** Ph.D. (12/94)
TOTAL FUNDING: $17,250	**INSTITUTIONAL MATCH:** $12,938
RESEARCH OBJECTIVE: To clarify and possible segment NMR and CT images of core samples through the use of fuzzy logic.	
EXTRAMURAL ACTIVITY: BDM, DOE Laboratory (formerly National Institute for Petroleum and Energy Research), Bartlesville, OK May 1993 - August 1993	
TECHNICAL PERSPECTIVE: By applying fuzzy set theory to "traditional" image processing techniques, I hope to provide clearer images and more accurate information about fluid distribution, saturation, and porosity of the core sample.	
RESULTS: After attempting to develop more image merging algorithms, I found that they did not improve upon the algorithms developed earlier. As to gaining more information about porosity, I was able to determine the number of pores in 20 consecutive slices of a sandstone plug, as well as the volume of each pore.	
TECHNICAL APPROACH: Three more merging algorithms were written and tested on both NMR images of core samples (magnified and unmagnified) and "standard" images (images of cars, clocks, etc.). Although two of these produced good results, they did not improve upon the results obtained from the previous algorithms (see last report). While at the DOE lab in Bartlesville, OK, we wrote a Fortran program to determine the porosity of a sandstone core plug. The program found each pore, in three dimensions, calculated its volume, and provided statistics (min/max/avg pore volume, standard deviation, etc.). Originally the 20 consecutive slices used for these calculations were thresholded, meaning that pixel values $>x$ were considered "pore" and those $<=x$ were "rock". The next step would be to fuzzify this threshold.	
PROJECT IMPLICATIONS: with more accurate information available from NMR images of core samples, petroleum exploration will have another tool to help determine the feasibility of drilling. The implications of this are reflected in both the economy and the environment.	
KEYWORD INDEX: NMR (nuclear magnetic resonance), CT (computed tomography), image processing, fuzzy logic, porosity, fluid distribution, image merging.	

*Alabama DOE/EPSCoR Research Cluster Trainee

TRAINEESHIP SUMMARY

TITLE: Effect of Particle Characteristics and Surface Chemistry on Rheology of Ceramic and Composite Slurries

TRAINEE: Jeffrey A. Horn	**PERIOD:** 01/01/92 - 12/31/94
UNIVERSITY: UAB	**DEGREE PROGRAM:** Ph.D. (12/95)
TOTAL FUNDING: $66,106	**INSTITUTIONAL MATCH:** $6,250

RESEARCH OBJECTIVE: To understand the effects of processing variables on the interparticle interaction and viscosity of powder slurries.

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory
June 1993 - August 1993
June 1994 - August 1994

TECHNICAL PERSPECTIVE: Better understanding of the energy dissipation processes in flowing powder slurries will aid in the prediction and control of suspension rheology.

RESULTS: A model of relative viscosity for powder slurries has been developed based upon fundamental energy dissipation processes (kinetic and potential). Rheological data for powder slurries of metal oxides in aqueous and polymeric liquids demonstrate trends in interparticle interaction with changes in particle size and surface chemistry and temperature to be interpreted by the model.

TECHNICAL APPROACH: Slurry samples are prepared for a range of powder volume fractions (solids loadings). The powders are dispersed in either aqueous solutions or polymer fluids, then the mature of interparticle interaction is adjusted by salt concentration (in aqueous solutions) or by temperature (in polymer fluids). Rheological measurements are made on a controlled-strain rheometer to characterize the nature of the slurry microstructures, i.e. well-dispersed or coagulated, and the viscosities for a range of shear rates.

PROJECT IMPLICATIONS: The rheology of particle suspensions is important in any field where such systems are shaped or transported. Ceramics, metals, plastics, petroleum and paper industries all will benefit from improved understanding of suspension/slurry flow.

KEYWORD INDEX: Slurries, Suspensions, Ceramics, Powder, Rheology, Viscosity

TRAINEESHIP SUMMARY

TITLE: Finite Element Modeling of the Double Ligament Tension Test for Particulate Metal Matrix Composite Materials

TRAINEE: Chesley R. Johnson	**PERIOD:** 06/01/92 - 05/31/93
UNIVERSITY: UA	**DEGREE PROGRAM:** Ph.D. (12/94)
TOTAL FUNDING: $18,008	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: To verify the applicability of the DLT applied to MMCs

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory
April 1993 - May 1993

TECHNICAL PERSPECTIVE: The DLT has been shown to provide reliable conventional metals such as steels. However, the actual results differ from those of a uniaxial tensile test. An understanding of the stress state is essential in order to use the DLT in characterizing materials such as MMCs. This is being accomplished by FEM. With consistency established and an understanding of the stress state, the DLT can be used to characterize energy saving materials such as MMCs in thin sections.

RESULTS: Physical testing of steel and MMC samples has shown that the DLT is as consistent in regard to result as is conventional uniaxial tension testing. MMC test results showed variation depending on material orientation, an expected and desired result. Computer resource limitations have so far precluded the development of a satisfactory 3D model, however physical experiments and 2D models indicate that a plane strain assumption is a good approximation. Additional boundary condition experimentation is needed to improve the model.

TECHNICAL APPROACH: DLT samples of steel and Al-SiC particulate MMC have been tested and the results compared with various finite element models. The materials have been characterized by optical and scanning electron microscopy. Nanoindentation hardness and stress-strain data have been obtained of the phases and microstructural components and will be incorporated into micromechanical models as they are developed.

PROJECT IMPLICATIONS: Successful application of the DLT to non conventional materials such as particulate MMCs and brittle intermetallics will permit mechanical characterization of the properties of new energy saving materials in thin sections that cannot otherwise be easily tested.

KEYWORD INDEX: Double Ligament Tension Test (DLT), Finite Element Modeling (FEM)

TRAINEESHIP SUMMARY

TITLE: Laser Patterning of Selected Organic Semiconducting Materials

TRAINEE: David L. Kjendal*	**PERIOD:** 09/01/94 - 08/31/94
UNIVERSITY: USA	**DEGREE PROGRAM:** M.S. (12/95 est.)
TOTAL FUNDING: $17,000	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: To investigate some novel processes to pattern organic semiconducting thin films on commercially useful substrates using the pulsed laser technique.

EXTRAMURAL ACTIVITY: Los Alamos National Laboratory
June 1995 - August 1995

TECHNICAL PERSPECTIVE: Optical absorption spectra will be used for the evaluation of semiconductor properties.

RESULTS: The Laser Processing Lab at the University of South Alabama is operational. A multi-target carrousel has been designed and manufactured to facilitate working with more than one material without breaking vacuum. Over one hundred and forty films of various materials have been deposited. Polymeric thin films of poly(tetrafluoroethylene) and poly(phenylene sulfide) have been deposited and are being analyzed for mechanical and electrical properties.

TECHNICAL APPROACH: Work is currently underway in depositing various polymeric materials using the PLD system. The feasibility of laser-patterning of various thin films is currently being studied. Patterning masks and imaging optics are in the process of being purchased.

PROJECT IMPLICATIONS: Novel processing of organic semiconductors. Better understanding of the laser-solid interaction in poly(phenylene vinylene).

KEYWORD INDEX: Pulsed Laser Deposition, organic semiconductors.

*Alabama DOE/EPSCoR Research Cluster Trainee

TRAINEESHIP SUMMARY

TITLE: Effect of Dispersion in Coal Liquefaction Systems and Simulation of Particulate Control Systems: Electrostatic Precipitator and Fabric Filter

TRAINEE: Chad L. Marks	**PERIOD:** 01/01/92 - 06/30/93
UNIVERSITY: AU	**DEGREE PROGRAM:** M. S. (06/93)
TOTAL FUNDING: $23,830	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: To study the effect of surfactants in waste oil on the dispersion of coal

EXTRAMURAL ACTIVITY: Southern Company Services
June 1992 - August 1992

TECHNICAL PERSPECTIVE: Due to the abundance of waste oil, the coprocessing of coal with waste oil has the possibility of enhancing the economics of coal liquefaction.

RESULTS: Certain factors such as agitation speed increase the overall conversion of coal. When certain surfactants were added to a paraffinic oil the overall conversion of coal also increased.

TECHNICAL APPROACH: From previous studies, a paraffinic oil has little effect on the liquefaction of coal with waste oil is a feasible process. With competition increasing in the public utility industry, there is a trend to shift from coal liquefaction to coal gasification. The coprocessing of coal with waste oil carries the possibility of preventing the need to make this change.

PROJECT IMPLICATIONS: The results obtained in this study shows that the coprocessing of coal with waste oil is a feasible process. With competition increasing in the public utility industry, there is a trend to shift from coal liquefaction to coal gasification. The coprocessing of coal with waste oil carries the possibility of preventing the need to make this change.

KEYWORD INDEX: Dispersion, coal liquefaction, simulation and particulate control

TRAINEESHIP SUMMARY

TITLE: Process Controls for a Coal and Waste Oil Coprocessing System and Process Simulation of an Advanced Pressurized Fluidized-Bed Combustor

TRAINEE: Rebecca A. Maxson	**PERIOD:** 01/01/92 - 06/30/93
UNIVERSITY: AU	**DEGREE PROGRAM:** M.S. (06/93)
TOTAL FUNDING: $23,830	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: Produce a simulation of an APFBC that accurately predicts the mass and energy balance from a test facility. Develop control systems for coprocessing system.

EXTRAMURAL ACTIVITY: Southern Company Services. Wilsonville
June 1992 - August 1992

TECHNICAL PERSPECTIVE: In light of the dwindling petroleum market, and waste oil coprocessing system, are being developed to lessen the US dependence on foreign oil. The process simulation of the APFBC will aid in testing the new coal gasification technology. The controls for the coprocessing system will help operators run the system in a cost effective manner with less safety and environmental hazards.

RESULTS: The process simulation was finished and presented to Southern Company Services in August, 1992. The simulation accurately predicts the given data. Also, work was begun to make the simulation more rigorous. All of the controls needed for the coal and waste oil coprocessing system have been designed, programmed, installed, and tested.

TECHNICAL APPROACH: The APFBC simulation was developed using Aspen Plus with Model Manager. Several simulations were developed using different reactor types for simulating the carbonizer section of the module. The controls for the coprocessing systems were programmed using the Allen Bradley SLC 502 and the Texas Instruments Series 545 PLC. The TI CVU10000 was configured for operator interface with the TI 545. Rosemount differential pressure cells are used to measure height and flow.

PROJECT IMPLICATIONS: The APFBC simulation will be used to predict output for various operating conditions when the APFBC is built at the Power Systems Development Facility in Wilsonville, AL. The PSDF is a joint project with Southern Company Services, DOE, and others. The PSDF will be used to test new coal gasification technologies. The controls for the coprocessing system will aid in running the system more economically. The system will also help in gaining energy from coal and recycling used oil, which greatly helps the environment.

KEYWORD INDEX: Coal gasification, process simulation, process controls, oil recycling, coal and waste oil coprocessing

TRAINEESHIP SUMMARY

TITLE: Carbon Fixation Characteristics of Emiliania huxleyi, a Unicellular Marine Calcifying Alga

TRAINEE: Carol A. Melton	**PERIOD:** 01/01/92 - 12/31/92
UNIVERSITY: USA	**DEGREE PROGRAM:** M.S. (12/93)
TOTAL FUNDING: $14,227	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: The purpose of this proposal is to identify and characterize the photosynthetic carbon fixation pathway of E. huxleyi.

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory
June 1992 - August 1992

TECHNICAL PERSPECTIVE: Information obtained from this study will aid in understanding how future fossil-fuel energy demands may impact CO_2 levels and primary production in the marine environment.

RESULTS: The rate at which E. Huxleyi fixes CO_2 and removes it from the environment was measured and the photosynthetic pathway, major CO_2 fixing enzyme activities along with the carbon compensation point of E. huxleyi will be determined. This will allow the potential exchange rate of inorganic carbon between the organism and its environment to be calculated. With this information the potential for E. huxleyi to remove dissolved inorganic carbon from the ocean and ultimately from the atmosphere will become clearer.

TECHNICAL APPROACH: An enclosed gas exchange measuring system for algae has been built. The following parameters were measured on E. huxleyi, using the enclosed system: dark respiration, carbon dioxide fixation rates, carbon compensation point, and hydrogen evolution. Research will continue on the first fixation products of E. huxleyi.

PROJECT IMPLICATIONS: NOTE: Trainee informed associate director on October 28, 1992 of successful employment with the Florida Department of Environmental Regulation. Traineeship was terminated effective November 9, 1992. Her thesis is in 2nd draft review by her committee. She should be allowed to defend by mid-August. A copy of her thesis will be forwarded.

KEYWORD INDEX: Fossil-fuel, E. Huxleyi, photosynthetic pathway

TRAINEESHIP SUMMARY

TITLE: Covalently Attached Hydrophilic Polymer Coatings for Biofilm Inhibition

TRAINEE: Steven A. Orr	**PERIOD:** 01/01/93 - 12/31/94
UNIVERSITY: UAH	**DEGREE PROGRAM:** Ph.D. (12/95 est.)
TOTAL FUNDING: $42,563	**INSTITUTIONAL MATCH:** $2,875

RESEARCH OBJECTIVE: Hydrophobic polymer coatings will be covalently bonded to the surfaces of stainless steel and titanium to inhibit biofouling in industrial water systems.

EXTRAMURAL ACTIVITY: Idaho National Engineering Laboratory
August 1993 - September 1993

TECHNICAL PERSPECTIVE: Metal surfaces exposed to a nonsterile aqueous environment are susceptible to fouling by formation of a complex film composed of various molecules and organisms (a biofilm). Biofilms often increase corrosion rates as well as restrict the flow of mass or energy within a system. Significant energy and economic penalties arise from this fouling. A method of eliminating this biofilm formation is required. One approach is to covalently bond a hydrophilic polymer to the metal surface that will inhibit biofilm formation.

RESULTS: Studies of the activation of metal surfaces (primarily 304 stainless steel and titanium) with silanes continues. We have coated many metal samples with PEG, and have determined that it is stable under distilled water for more than 4 months. Stability testing under a variety of conditions and environments in nearing completion using the x-ray photoelectron spectrometer. A triethoxy-silane surface activation coating has been chosen. Bacterial rejection capability (thiobacillus ferrooxidase) testing of coated metal surfaces is being initiated. The project is nearing completion.

TECHNICAL APPROACH: Coatings on metal surfaces are applied with bench scale equipment in three steps. Step one is polishing and cleaning of the metal surface. The metal is polished to a mirror-like surface which is necessary for the previously mentioned FTIR characterization. Then it is cleaned by a three step process. Step two, after cleaning, the dried metal surface is activated by precoating with an activated triethylsilane or other activating compound. Step three, a functionalized polyethylene glycol is bonded to the silanated metal. Work will continue on finding the optimum silane-functionalized polymer combination, as well as optimizing a precoating cleaning process.

PROJECT IMPLICATIONS: Inhibition of biofouling in industrial water systems is critical to the energy industry. Billions of dollars are wasted annually to clean, repair and replace equipment damaged by biocorrosion. Many more dollars are lost due to energy loss and safety concerns directly related to biofilm formation. A large portion of these costs would be saved by the development of a coating that prevents biofilm formation in industrial water systems. A variety of other applications including transportation and medical implants would benefit from this technology.

KEYWORD INDEX: Biofilm, Self-assembled Monolayer, Hydrophilic Polymer, Biocorrosion, Biofouling, Metal Silanation

TRAINEESHIP SUMMARY

TITLE: The Interfacial Microstructure of Sapphire-Toughened Aluminosilicate

TRAINEE: Ronald Ott	**PERIOD:** 06/01/92 - 05/31/94
UNIVERSITY: UAB	**DEGREE PROGRAM:** Ph.D. (06/96 est.)
TOTAL FUNDING: $29,760	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: To study the reaction zone (bonding) between the fibers and the matrix in a ceramic matrix composite (CMC's). The degree of bonding will determine the toughness of the composite material.

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory
August 1993 - September 1993

TECHNICAL PERSPECTIVE: CMC's have the potential to replace components conventionally made from metals in high temperature and stress applications (aircraft jet engines). There must be minimal bonding between the matrix and the fiber reinforcement in order to achieve fracture toughness.

RESULTS: General Electric, the supplier of the CMC's, is in the process of altering the matrix components. A new plan of study is taking shape which will allow the analysis of the bonding between the matrix and the fiber reinforcement to be carried out progressively. The CMC's will undergo heat treatments so that the progress of the reaction zone (degree of bonding) can be studied as it proceeds from providing minimal bonding (good toughness) to excessive bonding (causing the toughness to decrease).

TECHNICAL APPROACH: In order to study the interface between the matrix and the fiber reinforcement, transmission electron microscopy (TEM) and scanning electron microscopy (SEM) are being utilized. Also, energy dispersive spectroscopy (EDS) is being used to study the chemical composition of the matrix and the reaction zone between the matrix and the fiber reinforcement.

PROJECT IMPLICATIONS: By determining the composition of the reaction zone, the component(s) in the matrix that is causing the reaction zone to form can be identified. Either these components can be altered or the processing of the CMC's can be modified to reduce or halt the formation of the reaction zone. Once this has been done, these CMC's can be used to replace components in jet aircraft engines as well as land based engines. These materials will be able to reduce the weight of the engine thus increasing performance and efficiency.

KEYWORD INDEX: Ceramic matrix composite, ceramic fiber reinforcement, advanced materials, aluminosilicate, toughness

TRAINEESHIP SUMMARY

TITLE: The Electronic Structure of Point Defects

TRAINEE: David C. Patton	**PERIOD:** 09/01/92 - 08/31/95
UNIVERSITY: UAB	**DEGREE PROGRAM:** Ph.D. (06/96 est.)
TOTAL FUNDING: $54,713	**INSTITUTIONAL MATCH:** $5,571

RESEARCH OBJECTIVE: The development of an improved Embedded Cluster Algorithm for the study of point defects in ionic crystals. The improved method will be applied to calculations on wide band-gap semiconductor materials.

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory Ceramics and Metals Division
Materials Science Section, Theory Group
June 1994 - August 1994

TECHNICAL PERSPECTIVE: Point defects in crystals are of interest due to their effects on the properties of crystals. Currently there is an interest in wide band-gap semiconducts (such as AIN, BN, diamond, SiC, etc) due to better their performance at high temperatures and frequencies as compared to Si. The ability to fabricate devices is dependent on the capability of doping the semiconductors correctly. This capability is directly dependent on the local electronic structure of the material in the vicinity of defects.

RESULTS: An Embedded Cluster Method has been developed which achieves the objectives of this study. It has been benchmarked with several calculations: including, F-centers in LiF, MgO, NaF, and CaO. This has led to significant improvement in calculation of relaxation effects on the energy levels and structure. Extensive studies of the effect of dopants(Be, Si, S) in cubic Boron Nitride have begun.

TECHNICAL APPROACH: Density Functional Theory within the Local Spin Density Approximation is the premier technique for the study of defects in solids. Previous methods have been deficient at allowing lattice relaxation and at including in crystal field effects. With this in mind, the present work is aimed at correcting the above deficiencies by combining a Finite Cluster approach with an embedding technique.

PROJECT IMPLICATIONS: This project will develop a set of codes that will be the Density Functional equivalent of the Hartree Fock ICECAP program. This will allow calculation of lattice relaxation around defects in crystals with inclusion of crystal field effects. Thereby making it possible to accurately calculate the effect of dopants in semiconductors and other important materials.

KEYWORD INDEX: point defects, electronic structure, density functional theory, wide band-gap semiconductors

TRAINEESHIP SUMMARY

TITLE: Magnetic Island Rotation on the Compact Auburn Torsatron

TRAINEE: David A. Pritchard *	**PERIOD:** 09/01/94 - 08/31/95
UNIVERSITY: AU	**DEGREE PROGRAM:** Ph.D. (12/96 est.)
TOTAL FUNDING: $20,600	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: To study the effects of controlled magnetic island rotation on a plasma in the Compact Auburn Torsatron (CAT) and to provide experimental evidence that the velocity profile of the plasma inside the island can be optimized using the rotating islands as applied to torsatrons.

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory
June 1995 - August 1995

TECHNICAL PERSPECTIVE: This study focusses on experimentally proving that the velocity profile of plasma can be optimized using rotating islands as applied to torsatrons.

RESULTS: Initial tests for rotating magnetic islands has been make with electron and ion beam vacuum magnetic field mapping techniques. The high current amplifiers are fully functioning and high power has been achieved. To date, we have demonstrated the basic physical phenomina of ion drift surface broadening and the effects of varying the perturbation amplitude, frequency and frequency direction.

TECHNICAL APPROACH: Compact Auburn Torsatron (CAT) was built as a test bed to study magnetic fragility and control. Various magnetic configurations can be achieved on CAT by changing the various parameters. These will be studied in this experiment.

PROJECT IMPLICATIONS: Successful completion of this project will lead to a better understanding of the plasma velocity profile in the torsatron model for the production of Nuclear Fusion Energy.

KEYWORD INDEX: Controlled Fusion, Torsatron, Compact Auburn Torsatron

*Alabama DOE/EPSCoR Research Cluster Trainee

TRAINEESHIP SUMMARY

TITLE: Synthesis of Methyl Tertiary Butyl Ether from Synthesis Gas

TRAINEE: David Omavowan Raine	**PERIOD:** 09/15/92 - 08/30/94
UNIVERSITY: UA	**DEGREE PROGRAM:** M.S. (06/94)
TOTAL FUNDING: $28,094	**INSTITUTIONAL MATCH:** $4,250

RESEARCH OBJECTIVE: To test a ZSM-5 zeolite, bearing Fischer-Tropsch catalysts, for the synthesis of methyl tertiary-butyl ether ('MTBE') from carbon monoxide/hydrogen mixtures at near atmospheric pressure.

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory
May 1993 - August 1993

TECHNICAL PERSPECTIVE: High performance transportation fuels that meet the nation's emission standards are obtained by blending oxygenated hydrocarbons with gasoline. The raw materials for the production of these hydrocarbons are petroleum derivatives, a significant amount of which is imported. The production of oxygenates from local non-petroleum precursors will be an important contribution to the effort to reduce the nation's dependence on imported petroleum.

RESULTS: Catalysts were prepared by ion exchange of ZSM-5 ziolite with saturated nitrate solutions of cobalt, copper, zinc and potassium. Carbon monoxidehydrogen gas mixtures were passed over the catalysts in a glass tube in once-through flow at temperatures of 110 - 275° C and at near atmospheric pressure. Analysis of the effluent gases show o MTBE is produced under the conditions of this investigation.

TECHNICAL APPROACH: Thermodynamic considerations predict the formation of a wide range hydrocarbons, including oxygenates, from syngas at low pressures and temperatures. It is postulated that the selectivity to a particular specie can be enhanced by proper choice of the environment in which the reactions take place. In this work, shape selectivity is to be obtained by the use of a porous catalyst from whose pores species of van der Waals diameters greater than MTBE are not expected to exit.

PROJECT IMPLICATIONS: Successful demonstration that product selectivities in hydrocarbon synthesis from syngas can be controlled by this approach will be a major boost to efforts to convert the nation's abundant coal supply into higher-valued products, especially motive fuels. The State of Alabama is in a vantage position to benefit directly from an industry based on the technology that may result from this work.

KEYWORD INDEX: ZSM-5 zeolite, catalysts, methyl tertiary-butyl ether (MTBE)

TRAINEESHIP SUMMARY

TITLE: Ion Orbit Studies on the Compact Auburn Torsatron

TRAINEE: Gerald Sasser *	**PERIOD:** 09/01/92 - 08/31/95
UNIVERSITY: AU	**DEGREE PROGRAM:** Ph.D. (09/95 est.)
TOTAL FUNDING: $64,328	**INSTITUTIONAL MATCH:** $6,200

RESEARCH OBJECTIVE: Ion orbits will be studied for various energies and magnetic configurations on CAT.

EXTRAMURAL ACTIVITY: Torsatron-Stellarator Laboratory
University of Wisconsin-Madison
June 10-August 7, 1993

TECHNICAL PERSPECTIVE: One of the criteria for sustained magnetically confined fusion is a high confinement time of the energetic alpha particles produced during fusion. In order to improve these times it is necessary to study the ion loss rates and ion trajectories and the factors which affect them. The flexibility of the magnetic configurations on CAT make it an ideal machine for these studies.

RESULTS: An ion gun was designed and built for use in CAT. Time-of-flight measurements were made in the ion energy range of 0 to 20 eV and for various launch positions and field settings. A code has been developed to model the very complicated trajectories of the particles in the magnetic geometry of CAT. Rotational transform profiles were measured for the drift surfaces and agreed well with code simulations. Resonant magnetic perturbations were applied and were shown to couple with the rational drift surfaces of the energetic ions. An analytical theory was also developed to describe the orbits.

TECHNICAL APPROACH: Lithium-6 and Magnesium ion sources have been used in the ion gun. The gun drive is capable of 2 degrees of freedom (linear and rotational). The ion currents, of typical magnitude 20 nA, are measured with a small paddle probe which is coaxially shielded to minimize electrical noise. The signal is amplified with a Keithly 424 current amplifier and recorded with a LeCroy 6810 digital recorder. The ion gun is pulsed with a Kepco bipolar power supply and the measured currents are filtered with a box car averaging technique.

PROJECT IMPLICATIONS: The understanding of ion orbits is critical to the improvement of confinement times of energetic alpha particles in toroidal confinement devices. An improvement of these confinement times is necessary for the success of controlled plasma fusion.

KEYWORD INDEX: Ion Gun, Controlled Fusion, Torsatron, Drift Surfaces, Drift Islands

*Alabama DOE/EPSCoR Research Cluster Trainee

TRAINEESHIP SUMMARY

TITLE: In-Situ Vitrification Interface Exploration Using Inverse Techniques

TRAINEE: Jerard T. Smith	**PERIOD:** 06/01/92 - 05/31/94
UNIVERSITY: AU	**DEGREE PROGRAM:** M.S. (09/94)
TOTAL FUNDING: $29,600	**INSTITUTIONAL MATCH:** $4,000

RESEARCH OBJECTIVE: To explore the melting interface of an in-situ vitrification process using numerical tools.

EXTRAMURAL ACTIVITY: Battelle, Pacific Northwest Laboratory
June 1993 - August 1993

TECHNICAL PERSPECTIVE: In-situ Vitrification is a waste remediation process specifically designed to reduce cost and energy consumption. This new process shows great promise, but an increased understanding of the process in general and the melting interface inspecific is necessary if advancements are to be made. Efforts of this research are directed towards characterizing the properties on the melting interface.

RESULTS: The 1-D and 2-D heat transfer codes have been completed. Using the commercial optimization code DOT, the 2-D heat transfer code, and the experimental data from NASA Lewis, the thermal conductivity of the melt zone has been estimated at steady state. This has been possible because of the high temperature dependance of the thermal conductivity. Efforts are underway to expand to optimization method to the transient realm.

TECHNICAL APPROACH: In order to better understand the phase change phenomena found in an ISV process, numerical techniques will be used. Thermocouple measurements from soil melting experiments will be used as input to a 2-D optimization code. The melting zone will be modeled using an effective thermal conductivity which the optimization code will determine.

PROJECT IMPLICATIONS: Successful completion of this project will lead to a numerical tool to assist in the exploration of ISV. A better understanding of the ISV process will assist in waste cleanup around the country.

KEYWORD INDEX: In-Situ Vitrification, Inverse Heat Conduction, Thermal Destruction, Waste Clean Up.

TRAINEESHIP SUMMARY

TITLE: Mapping Three Dimensional Fault Geometry Using Data from Logs of Coalbed-Methane Wells

TRAINEE: Julia K. Smith *	**PERIOD:** 06/01/94 - 05/31/95
UNIVERSITY: UA	**DEGREE PROGRAM:** M.S. (05/95)
TOTAL FUNDING: $17,000	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: This research focusses on understanding the fault geometry of the Black Warrior Basin and to see if the fault geometry affects the methane production in the basin.

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory
June 1994 - August 1994

TECHNICAL PERSPECTIVE: The 3-D geometry of horsts and grabens in foreland basins is not yet well documented. The Pennsylvanian rocks of the Black Warrior basin have abundant NE-trending normal faults in a horst and garben system. The Pennsylvania Pottsville formation is formed by repeating cycles of coal, sandstone, and shale. Subsurface data from coalbed-methane well logs are available to accurately map these faults in detail within the Pottsville. This study will focus on mapping shallow fault geometry in parts of the Holt and Peterson Fields of the Black Warrior basin, Tuscaloosa County, Alabama.

RESULTS: It is expected that the Holt and Peterson fields will have fault patterns comparable to the adjacent field, thus shallow normal faults which flatten out downward to a detachment within the sedimentary sequence. Work completed so far shows a series of northwest trending faults defining a set of half grabens. Fault offsets do not exceed 200 feet. There are also faults with smaller offsets, around 50 feet, in different orientations. Even with the density of wells in the research area, there is not absolute control on the fault and fold geometry. Faults with offfsets greater than fifty feet are considered.

TECHNICAL APPROACH: Faults were identified in the well logs based on missing stratigraphic sections in each log when compared to the standard log. The Alabama State Geological Survey holds gamma ray and density logs for coal sandstone and mudstone lithologies which were used as references. Maps and cross sections were made using the subsurface data and are now being drafted on a Macintosh. Area in each section can then be measured on the computer.

PROJECT IMPLICATIONS: Normal faults in the Black Warrior Basin appear to detach at a shallow level, according to calculations make using the lost area method. Faults die out into folds. There ins not an obvious correlation between fault geometry and coal or gas production.

KEYWORD INDEX: Coal Bed Methane, Black Warrior Basin, balanced cross sections, lost area, foreland basin.

*Alabama DOE/EPSCoR Research Cluster Trainee

TRAINEESHIP SUMMARY

TITLE: The Design and Optimization of the Holographic Solar Concentrator

TRAINEE: William (Bill) Tang	**PERIOD:** 09/01/92 - 08/31/94
UNIVERSITY: AAMU	**DEGREE PROGRAM:** M.S. (05/95)
TOTAL FUNDING: $31,256	**INSTITUTIONAL MATCH:** $8,350

RESEARCH OBJECTIVE: In this phase of the research, I have contributed innovative ideas to improve the performance of the most successful traditional photovoltaic panels.

EXTRAMURAL ACTIVITY: Sandia National Laboratory
June 1994 - August 1994
National Energy Laboratory, Golden, Colorado
June 1993 - August 1993

TECHNICAL PERSPECTIVE: I worked with experts at the Sandia Labs and came up with a new design that will reduce the cost of photovoltaic panels. By placing ridge-shaped aluminum reflectors on top of a traditional solar cell panel, I concentrated light into a smaller area, and reduced by half the number of cell strings needed to generate almost the same amount of electric power.

RESULTS: With reduced cell area and cheap aluminum reflectors, we are able to bring down the cost per unit of energy generated by the traditional module by an additional 20%.

TECHNICAL APPROACH: As I pointed out in my last quarterly report, the solar energy community must follow a rational and phased plan to develop advanced concept systems. It logically follows that we must improve the marketability of existing systems in order to acquire the capital needed to develop more advanced systems. This is exactly what we are doing. We have used the best performing traditional PV module, manufactured by Mobil Solar, and combined it with our last ridge-shaped reflectors.

PROJECT IMPLICATIONS: Several private distributors in the Midwest have agreed to purchase this new concept. We are convinced that this new proprietary system, owned by the Solardyno Corporation, will act as an important link between existing PV technology and the more advanced concepts.

KEYWORD INDEX: Solar, Photovoltaic, Concentrator, Solar cells

TRAINEESHIP SUMMARY

TITLE: Confinement of Energetic Particles in the Compact Auburn Torsatron

TRAINEE: Edward Thomas, Jr. *	**PERIOD:** 06/01/94 - 05/31/95
UNIVERSITY: AU	**DEGREE PROGRAM:** Ph.D. (12/96 est.)
TOTAL FUNDING: $20,800	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: Accurately model loss mechanisms of alpha particles in larger toroidal devices. Experimental measurements of energetic ion trajectories will be compared with theoretical predictions.

EXTRAMURAL ACTIVITY: Torsatron/Stellarator Laboratory
University of Wisconsin
June 1995 - August 1995

TECHNICAL PERSPECTIVE: An important aspect for sustained magnetically confined fusion is a high time of confinement of the alpha particles produced during fusion. In order to improve these times, it is necessary to study the loss mechanism of alpha particles.

RESULTS: The toroidal harmonics have been successfully incorporated into the Integrable Field Torsatron (IFT) Code. The code is currently being optimized to make efficient use of the harmoics. This will greatly reduce the amount of time needed to make simulations of particle orbits in the Compact Auburn Torsatron (CAT) and allow a more accurate model of the CAT magnetic fields to be made.

TECHNICAL APPROACH: The research will be conducted in the Fusion Energy Research Cluster of Auburn University. An investigation of helically trapped charged particle orbits in the Compact Auburn Torsatron will be made using an array of collector plates designed to collect particles that have been launched into a plasma from an ion source.

PROJECT IMPLICATIONS: The results of this study will be used to compared with theoretical predictions make with the improved IFT code. This comparison with theory will allow the experimental results to be extrapolated to larger torsatron devices.

KEYWORD INDEX: Torsatron, Nuclear Fusion, Helically Trapped Particles

*Alabama DOE/EPSCoR Research Cluster Trainee

TRAINEESHIP SUMMARY

TITLE: Micro-Raman Photoluminescence Spectroscopy of Novel Organic Semi-Conductors

TRAINEE: Kristie M. Thomas	**PERIOD:** 09/01/94 - 08/31/95
UNIVERSITY: UAB	**DEGREE PROGRAM:** Ph.D. (06/99 est.)
TOTAL FUNDING: $18,000	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: To provide a non-destructive tool for characterization of organic semi-conductors and devices with spectroscopic techniques like Micro-Ramen/ Photoluminesence.

EXTRAMURAL ACTIVITY: Lawrence Livermore National Laboratory
October 1994

TECHNICAL PERSPECTIVE: Micro-Raman and photoluminescence studies provide a rapid and non-destructive evaluation of crystalline quality of the advanced optical devices and interfaces. New characterization techniques will be developed for films below 50 nm.

RESULTS: Comparison of the electronic and vibrance levels of time resolved photoluminescence in organic semiconductors will be compared with theoretical calculations.

TECHNICAL APPROACH: Micro-Raman and photoluminescence techniques will be used to characterize thin films below 50 nm. The results will be used for comparison with theoretical calculations, on bonding defects in those materials.

PROJECT IMPLICATIONS: Successful implementation of this project will provide a rapid and non destructive evaluation of the crystalline quality of optical devices and interfaces.

KEYWORD INDEX: Micro-Raman photoluminesence, organic semi-conductors

TRAINEESHIP SUMMARY

TITLE: Scintillation Fiber Calorimeter

TRAINEE: Michael Tocci	**PERIOD:** 6/01/92 - 5/31/93
UNIVERSITY: UAH	**DEGREE PROGRAM:** Ph.D. (06/95)
TOTAL FUNDING: $21,470	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: Study Scintillation Fiber Calorimeter

EXTRAMURAL ACTIVITY: Brookhaven National Laboratory
August 1992; January 1993

TECHNICAL PERSPECTIVE: Presently studying alteration lengths of different types of scintillating optical fibers.

RESULTS: Built an apparatus and complete housing for testing scintillation fibers. Mounted and prepared fibers for testing.

TECHNICAL APPROACH: First, and most importantly finish all classwork. Then research all aspects of the project. See what has been done already, and formulate new methods of experimentation. Third, conduct experiments as carefully, quickly, and accurately as possible. Fourth, analyze all data and fit to a theory (write dissertation).

PROJECT IMPLICATIONS: Presently, the most limiting factor in the size of scintillation fiber colorimeter is the alternation length of the individual fibers. By investigating scintillating fiber alternation lengths, I hope to discover a method for producing longer alternation length fibers.

KEYWORD INDEX: Scintillating optical fibers, alternation length fibers

TRAINEESHIP SUMMARY

TITLE: Formation and Characterization of Deep Implanted Ti Waveguides in Lithium Niobate

TRAINEE: Eric K. Williams	**PERIOD:** 06/01/93 - 05/31/95
UNIVERSITY: AAMU	**DEGREE PROGRAM:** Ph.D. (01/96)
TOTAL FUNDING: $35,520	**INSTITUTIONAL MATCH:** $11,000

RESEARCH OBJECTIVE: Fabrication and characterization of deeply buried optical waveguides created by stoichiometric implantation of Ti and O, multiple high energy He implants and optimization of the processes.

EXTRAMURAL ACTIVITY: Oak Ridge National Laboratory
June 1993 - July 1993
July 1994 - September 1994
March 1995 - April 1995

TECHNICAL PERSPECTIVE: Stoichiometric implantation of Ti and O at 500°C allows for dynamic recrystallization which inhibits the amorphization usually associated with high dose ion implantation. Annealing at 1000°C in flowing oxygen completes the recrystallization process. The implantation of the oxygen inhibits diffusion of the implanted titanium to the surface so that the waveguide region defined by the titanium doped region remains well defined and below the crystal surface. Implantation of 1.5 and 4 MeV He ions will create a surface waveguide and a deeply buried multimode waveguide (~ 5 micrometers below the surface).

RESULTS: All lithium niobate crystals implanted at low energy have exhibited wave-guiding. Loss measurements indicate losses below 2 dB/cm but with great uncertainties. Prism coupling indicates that the ion dose may need to be increased. High energy Ti implantation (5.5 MeV) was attempted in July 94 but was rescheduled to the last week of August due to a source failure.

TECHNICAL APPROACH: Ion implantation followed by optical characterization by end fire coupling methods. Refractive index change induced by implantation will be measured by angular reflectivity measurements. TEM, XRD and RBS will be used to characterize crystal structure and implantation.

PROJECT IMPLICATIONS: Higher energy Ti implantation in lithium niobate could facilitate fabrication of novel opto-electronic devices. Very deep waveguides could form a part of new 3D devices.

KEYWORD INDEX: optical waveguides, lithium niobate, ion implantation

TRAINEESHIP SUMMARY

TITLE: Molecular Conductors & Unimolecular Rectifiers

TRAINEE: Xiang-Li Wu *	**PERIOD:** 06/01/94-05/31/95
UNIVERSITY: UA	**DEGREE PROGRAM:** Ph.D. (05/95)
TOTAL FUNDING: $25,000	**INSTITUTIONAL MATCH:** -0-

RESEARCH OBJECTIVE: Research has concluded. Dissertation was defended successfully on April 19, 1995. Further corrections have been made accordingly.

EXTRAMURAL ACTIVITY: Argonne National Lab
January 1995 - April 1995
Indiana University, Department of Chemistry
May 1995

TECHNICAL PERSPECTIVE: There are four chapters in this dissertation.
Chapter 1 Introduction to Molecular Electronics
Chapter 2 Introduction to Langmuir-Blodgett Films and to the Principal Analytical Techniques Used to Study Them.
Chapter 3 Organic Complexes and Thin Films as Conducting and Semiconducting Materials.
Chapter 4 C16H33Q3CNQ Monolayer as a Unimolecular Rectifier.

RESULTS: With the continuing miniaturization of electronic devices, a new challenge has arisen, to produce even smaller molecular electronic devices (Chapter 1). Some of the techniques used for studying molecular properties are discussed in Chapter 2: Langmuir-Blodgett (LB) films, attenuated total reflection (ATR) and grazing-angle (GA) Fourier transformed infrared (FTIR), scanning tunneling microscopy (STM), and ellipsometry. Three classes of organic semiconducting materials are discusses in Chapter 3: (1) Two new thiophene-derived annulenes were found to be good electron donors: their complexes with the electron acceptor $TCNQF_4$ were studied by conductivity measurements, FTIR, FTNIR (Fourier transformed near-infrared), and temperature-dependent EPR (electron paramagnetic resonance) spectroscopy. Both complexes are semiconductors at room temperature. (2) Bifunctional TTF derivatives were studied using the Langmuir-Blodgett technique, FTIR, UV-Vis (Ultraviolet-Visible) and conductivity measurements: Semiconducting LB films were obtained from iodine-doped multilayer films. (3) A record low band gap of 0.65 eV of a novel conducting polymer was determined by in situ spectroelectrochemistry combined with FTNIR.

A D-π-A type molecule of $C_{16}H_{33}$-Q3CNQ is discussed in Chapter 4: $C_{16}H_{33}$-Q3CNQ was studied by the LB technique, and monolayer films were transferred onto single crystal Au(111) and HOPG (highly oriented pyrolytic graphite). The orientation of the LB monolayers was characterized by grazing-angle FTIR, ellipsometry, and STM. The Electron transfer (rectification) through the monolayers was studied by STS (scanning tunneling spectroscopy), and cyclic voltammetry (CV). Asymmetrical current-voltage response (I-V curves) through the monolayers were observed both in STS and CV. The direction of electron transfer through the molecules was in agreement with the Aviram-Ratner molecular rectifier model.

KEYWORD INDEX: attenuated total reflection (ATR); cyclic voltammetry; ellipsometry; Fourier transformed infrared (FTIR); grazing-angle (GA); Langmuir-Blodgett film (LA);molecular electronics, molecular rectifier, organic conductors, organic semiconductors, scanning tunneling microscopy (STM)

*Alabama DOE/EPSCoR Research Cluster Trainee

OUTCOMES

Outcomes of the positive impact that the Traineeship Program has had on the energy-research infrastructure in Alabama are publications, presentations, and extramural programs. Each of these are presented in the following section.

PUBLICATIONS AND PRESENTATIONS

Collectively, the Alabama DOE/EPSCoR Trainees have contributed to the State-of-the-Knowledge in their respective energy-related fields by completing 12 technical journal publications, and 48 presentations. Additionally, 25 theses/dissertations have been completed or are in progress. The following sections summarize these technical accomplishments.

THESES/DISSERTATIONS BY ALABAMA DOE/EPSCoR TRAINEES

Carleton, R., *The Effect of Boron and Deviations from Stoichiometry on the Mechanical Properties of FeAl at Elevated Temperatures*, MS Thesis, Auburn University, June 1995.

Chancey, S., *Localization of an Origin of Plasmid Replication in Frankia*, MS Thesis, Auburn University, December 1993.

Dodson, K., *Molecular Biology of Early Responses of Oil-Rich Crucifers to Bacterial Infection*, MS Thesis, Auburn University, June 1995.

Goodwin, S., *Isolation and Characterization of Aluminum Tolerant Proteins in Four Soybean Cultivars*, Alabama A&M University, in progress.

Henson-Mack, K., *Enhancing NMR Images for Studying Fluid Distribution in Porous Media*, The University of Alabama, December 1994.

Horn, Jeffrey A., *Effect of Particle Characteristics and Surface Chemistry on Rheology of Ceramic and Composite Slurries*, University of Alabama at Birmingham, in progress.

Johnson, C., *Finite Element Modeling of the Double Ligament Tension Test for Particulate Metal Matrix Composite Materials*, The University of Alabama, December 1994.

Kjendal, D., *Laser Patterning of Selected Organic Semiconducting Materials*, University of South Alabama, in progress.

Marks, C., *Effect of Dispersion in Coal Liquefaction Systems and Simulation of Particulate Control Systems: Electrostatic Precipitator and Fabric Filter*, MS Thesis, Auburn University, August 1993.

Maxson, R., *Process Controls for a Coal and Waste Oil Coprocessing System and Process Simulation of an Advanced Pressurized Fluidized-Bed Combustor*, MS Thesis, Auburn University, June 1993.

Melton, C., *Carbon Fixation Characteristics of Emiliania huxleyi, a Unicellular Marine Calcifying Alga*, MS Thesis, The University of South Alabama, December 1993.

Orr, S., *Covalently Attached Hydrophilic Polymer Coatings for Biofilm Inhibition*, University of Alabama in Huntsville, in progress.

Ott, R., *The Interfacial Microstructure of Sapphire-Toughened Aluminosilicate*, University of Alabama at Birmingham, in progress.

Patton, D., *The Electronic Structure of Proto-typical Substitutional Dopants in cubic Boron Nitride*, University of Alabama at Birmingham, in progress.

Pritchard, D., *Magnetic Island Rotation on the Compact Auburn Torsatron*, Auburn University, in progress.

Raine, D., *The Direct Synthesis of Methyl Tertiary-Butyl Ether from Synthesis Gas*, MS Thesis, The University of Alabama, August 1994.

Sasser, G., *Experimental Research on the Compact Auburn Torsatron (CAT)*, Auburn University, September 1995.

Smith, J., *In-Situ Vitrification Interface Exploration Using Inverse Techniques*, Auburn University, December 1994.

Smith, J. K., *Mapping Three Dimensional Fault Geometry Using Data from Logs of Coalbed-Methane Wells*, MS Thesis, The University of Alabama, September 1995.

Tang, W., *An Innovative Holographic Solar Concentrator and its Figure of Merit*, MS Thesis, Alabama A&M University, May 1995.

Thomas, E., *Confinement of Energetic Particles in the Compact Auburn Torsatron*, Auburn University, in progress.

Thomas, K., *Micro-Raman Photoluminescence Spectroscopy of Novel Organic Semiconductors*, University of Alabama at Birmingham, in progress.

Tocci, M., *Scintillation Fiber Calorimeter*, University of Alabama in Huntsville, in progress.

Williams, E., *Formation and Characterization of Deep Implanted Ti Waveguides in Lithium Niobate*, Alabama A&M University, in progress.

Wu, X., *Studies of Organic Thin Films and Complexes as Materials for Molecular Electronics*, The University of Alabama, May 1995.

PUBLICATIONS BY ALABAMA DOE/EPSCoR TRAINEES

Gandy, R., H. Lin, G. Hartwell, S. Knowlton, S. Morimoto, **D. Pritchard,** *Drift surface axis position and transform measurements in the Compact Auburn Torsatron,* Phys. Plasmas, Vol. 2, No. 4, p. 1270, April 1995.

Gandy, R., H. Lin, G. Gartwell, S. Knowlton, **D. Pritchard,** J. Hanson, *Observation and analysis of particle drift islands in a torsatron,* Phys. Plasmas, Vol. 2, No. 8, p. 2877, August 1995.

Horn, J. and B. Patterson, *Effects of Particle Size, Density and Surface Chemistry on the Rheology of AL_2O_3 and ZrO_2 Slurries*, Conference Proceedings of the 1994 Annual ACerS Meeting, Indianapolis IN, May 1994.

Jenkins, G, D. Ila, N. Kukhtarev and **E. Williams**, *Oxygen Bombardment Induced Activation of Glassy Carbon*, Materials Research Society, Pittsburgh PA, 1993, pp. 173-7.

Kukhtarev, N., D. Ila, **E. Williams**, et al., *Material Synthesis and Processing Using Ion Beams*, Materials Research Society, Pittsburgh PA, 1994, pp. 661-6.

Lin, H., R. Gandy, S. Knowlton, G. Hartwell, **D. Pritchard,** G. Sasser, E. Thomas Jr., *Electron transport studies in stochastic magnetic fields on the Compact Auburn Torsatron,* Phys. Plasmas, Vol. 2, No. 6, p. 2026, June, 1995.

Marks, C., H. Sanjay and R. Tarrer, *Iron Based Catalysts for Coal/Waste Oil Coprocessing*, Energy & Fuels, Vol. 1, No. 8, p.99, Washington DC, 1994.

Sasser, G., S. Knowlton, et al., *An Ion Gun and Detector System for Ion Drift Surface Studies on Toroidal Devices*, Review of Scientific Instruments, Argonne IL, January 1995.

Thomas, E., Jr., G. Sasser, S. Knowlton, J.D. Hanson, R. Gandy, *A new technique for calculating toroidal harmonic coefficients for curl-free magnetic fields in helical toroidal devices,* submitted to Computer Physics Communications, October 1995.

Wu, X., Z. Hu, A.S. Jeevarajan, M.P. Cava, R.M. Metzger, *Studied of New Organic Conductors Based on Thiophene Derived Annulene Complexes with $TCNQF_4$,* **Synthetic Metals,** Vol. 70, p. 1169-1170, 1995.

Wu, X., J.P. Parakka, M.P. Cava, Y. Kim, R.M. Metzger, *Scanning Tunneling Micrographs of Ordered Layers of Two Thiophene-Alkylpyrrole Oligomers on Graphite,* Synthetic Metals, Vol. 71, p. 2105-2106, 1995.

Zimmermann, R., D. Ila, N. Kukhtarev and **E. Williams**, *Electrical Field Induced Dechanneling*, Materials Research Society, Pittsburgh PA, 1994, pp. 667-70.

PRESENTATIONS BY ALABAMA DOE/EPSCoR TRAINEES

Carleton, R. and R. Zee, *The Effect of Boron and Deviations from Stoichiometry on the Mechanical Properties of FeAl as a Function of Temperature,* 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Chancey, S., B. Nielson and J. Shaw, *DNA Sequence of a Frankia Plasmid: Analysis and Identification of Regions for Replication*, 93rd Regional Meeting of the American Society of Microbiology, Atlanta GA, May 1993.

Dodson, K., *Bacteria Genetically Engineered to Bioluminesce Provides Evidence of Constitutive and Regulated Expression of an Antibacterial Protein Correlated with Plant Disease Resistance*, 1993 Auburn University Graduate Research Forum (First Place Award-Science Division), Spring 1993.

Dodson, K. and S. Tuzun, *Molecular Biology of Early Responses of Oil-Rich Crucifers to Bacterial Infection*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Gandy, R., S. Knowlton, H. Lin, **D. Pritchard,** M. Owens, *Electron Drift Surface Mapping on the Compact Auburn Torsatron.* Electron Drift Surface Mapping on the Compact Auburn Torsatron, November 1994.

Goodwin, S. and K. Soliman, *Isolation and Characterization of Aluminum Tolerant Protein(s) in Four Soybean Cultivars*, American Society of Agronomy, Nashville TN, November 1993.

Goodwin, S. and K. Soliman, *Detection of Aluminum Levels in Tolerant and Sensitive Soybean Root Partitions*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Henson-Mack, K., *Enhancing NMF Images for Studying Distribution in Porous Media*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Henson-Mack, K. (Attendee), IEEE Workshop on Biomedical Image Analysis, Seattle WA, June 1994.

Henson-Mack, K. (Volunteer Worker), 32nd Annual ACM Southeast Conference, Tuscaloosa AL, March 1994.

Horn, J., *Rheology of Ceramic Powder Slurries*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Horn, J., *Viscosity of Powder Suspensions*, Annual Meeting of the American Ceramic Society, Indianapolis IN, April 1994.

Horn, J., *Viscosity of Powder Suspensions*, MPIF Annual Meeting, Nashville TN, May 1993.

Horn, J., *Rheology of Highly Loaded Slurries*, PIM Symposium, Boulder CO, March 1993.

Horn, J., *Modeling the Viscosity of Ceramic Powder Suspensions*, ASM/TMS Fall Meeting, Pittsburgh PA, August 1993.

Horn, J., *Viscosity of Powder Suspensions*, Annual Meeting of the American Ceramic Society, Minneapolis MN, April 1992.

Ila, D., **E. Williams** and M. Jenkins, *Irradiation Induced Carbonization of Phenolic Resin Films*, 21st Biennial Conference on Carbon, Buffalo NY, June 1993, pp.320-1.

Johnson, C., *Developing an Understanding of the Double-Ligament Tension Test*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Kjendal, D., A. Kumar, R.B. Inturi, J.A. Barnard, *Pulsed Laser Deposition of Poly(tetrafluoroethylene),* Materials Research Society Fall 1995 Meeting, November 1995.

Kjendal, D., A. Kumar, Spall, M. Thakur, *A Model of Laser Ablation in Semiconducting Polymers,* submitted to Materials Research Society 1995 Spring Meeting, February 1995.

Kukhtarev, N., D. Ila, **E. Williams**, et al., *Particle Channeling in $LiNbO_3$:Fe Modulated by Holographic Electric Field Superlattice*, Fall 1993 Meeting of the MRS, Boston MA, November 1993.

Orr, S. and K. Chittur, *Adsorption Rate Monitoring of IR Labeled Protein Using FTIR/ATR*, International Biomaterials Symposium, Birmingham AL, April 1993.

Orr, S., *Inhibition of Biofouling on Metal Surfaces by Coating with Hydrophilic Polymers*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Ott, R., *Transmission Electron Microscopy (TEM) Sample Preparation and Preliminary Examination of Sapphire Toughened Aluminosilicate Composite Materials*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Patton, D., *Improved Embedded Cluster Algorithm for Defect Calculation in Ionic Clusters*, Seventh Annual Alabama Materials Research Conference, Normal AL, September 1993

Patton, D., *Electronic Structure of Si and Be Substitutional Defects in Cubic Boron NItride*, 1994 March Meeting of the American Physical Society, Pittsburgh PA, March 1994.

Patton, D., *Embedded Cluster Studies of Defects in Ionic Crystals*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Patton, D., *An Improved Embedded-Cluster Algorithm for Defect Calculations in Partially Ionic Crystals*, Electronic Properties of Solids Using Cluster Methods Workshop, Michigan State University, East Lansing MI, July 1994.

Raine, D., *The Direct Synthesis of Methyl Tertiary-Butyl Ether from Synthesis Gas*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April1 1994.

Sasser, G., S. Knowlton, et al., *Energetic Ion Trajectories in the Vacuum Magnetic Field of the Compact Auburn Torsatron*, APD Division of Plasma Physics Meeting, St. Louis MO, November 1993.

Sasser, G., S. Knowlton, et al., *Ion Orbit Studies on the Compact Auburn Torsatron*, 1994 Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Sasser, G., S. Knowlton, et al., *An Ion Gun and Detector System for Ion Drift Surface Studies on Toroidal Devices*, 10th Topical Conference on High-Temperature Plasma Diagonostics, Rochester NY, May 1994.

Smith, J., *Melting Dirt*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Tang, W. and H. Caufield, *Holographic Solar Concentration*, 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Tuzun, S. and **K. Dodson**, *Utilization of Plant and Bacterial Chitinases for Disease Control*, USDA/ARS Louisiana Invited Presentation, Spring 1993.

Thomas, E., Jr., G. Sasser, S. Knowlton, R. Gandy, J.D. Hanson, J. Cary, *Use of Toroidal Harmonics to Medel Magnetic Fields in the Compact Auburn Torsatron*, 36th Annual Meeting - APS Division of Plasma Physics, November 1994.

Thomas, E., Jr., S. Knowlton, R. Gandy, G. Sasser, D. Pritchard, *An investigation of helically trapped ion orbits in the Compact Auburn Torsatron*, 37th Annual Meeting - APS Division of Plasma Physics, November 1995.

Thomas, E., Jr., S. Knowlton, G. Sasser, R. Gandy, J.D. Hanson, *A new technique for computing toroidal harmonic coefficients to model vacuum magnetic fields in the Compact Auburn Torsatron,* 37th Annual Meeting - APS Division of Plasma Physics, November 1995.

Williams, E., *Formation and Characterization of Deep Implanted Ti Waveguides in Lithium Niobate,* 1st Annual Alabama EPSCoR Colloquium, Tuscaloosa AL, April 1994.

Williams, E, D. Ila, et al., *Simultaneous Application of Channeling to the Detection of Light Elements in Crystals*, Nuclear Instrumentation & Methods, B85, pp. 537-40, Amsterdam, The Netherlands, 1994.

Williams, E., D. Ila, S. Sarkisov, P. Venkateswarlu, D. Poker, *Application of NRA/Channeling to Study He^+ Implanted Waveguides, 12th International Conference on Ion Beam Analysis (IBA12),* Tempe, AZ, May 22-26, 1995.

Williams, E., D. Ila, S. Sarkisov, D. Poker, *Optical Characterization of Buried Waveguides Created in LiNb03 by Ion Implantation,* 12th International Conference on the Application of Accelerators in Research and Industry, Denton, TX, November 6-10, 1994

Williams, E., D. Ila, S. Sarkisov, P. Venkateswarlu, D. Poker, *Formation of Multilayer Waveguides in Lithium Niogate by MeV Light Ion Bombardment, Ion Beam Modification of Materials '95,* Canberra, ACT, Australia, February, 5-10, 1995.

Wu, X., *Studies of Organic Thin Films and Complexes as Materials for Molecular Electronics,* Graduate Student Seminar Series, Department of Chemistry, The University of Alabama, October 1994.

Wu, X., *Studies of Unimolecular Rectifiers and Organic Semiconductors, Institute of Chemistry,* Chinese Academy of Sciences, Beijing, China, December, 1994.

Wu., X., Z. Hu, A.S. Jeevarajan, M.P. Cava, R.M. Metzger, *Studies of New Organic Conductors Based on Thiophene Derived Annulene Complexes with $TCNQF_4$,* International Conference of Synthetic Metals '94, Seoul, South Korea, July, 1994.

Wu, X., J.P. Parakka, M.P. Cava, Y. Kim, R.M. Metzger, *Scanning Tunneling Micrographs of Ordered Layers of Two Thiophene-Alkylpyrrole Oligomers on Graphite,* International Conference of Synthetic Metals,'94, Seoul, South Korea, July 1994.

Zimmerman, R.L., D. Ila, N. Kukhtarev, **E.K. Williams**, *Electrical field induced dechanneling,* Fall Meeting of the MRS, Boston, Mass., December 1993.

EXTRAMURAL ACTIVITIES BY ALABAMA DOE/EPSCoR TRAINEES

In addition to the exemplary record of publications and presentations previously listed, Alabama DOE/EPSCoR Trainees participated in an extramural activity which is specifically designed to enhance their course and research plans of study. These extramural activities are listed by the laboratory/organization hosting the trainees.

Oak Ridge National Laboratory (ORNL)

Carleton, R.	June 1993 - March 1994
Chancey, S.	October 1992 - December 1992
Horn, J.	June 1993 - August 1993 June 1994 - August 1994
Johnson, C.	April 1993 - May 1993
Melton, C.	June 1992 - August 1992
Ott, R.	August 1993 - September 1993
Patton, D.	June 1994 - August 1994
Pritchard, D.	June 1995 August 1995
Raine, D.	May 1993 - August 1993
Smith, Ju.	June 1994 - August 1994
Williams, E.	June 1993 - July 1993 July 1994 - September 1994 March - April 1995

Pacific Northwest Laboratory (PNL)

Goodwin, S.	May 1994 - July 1994
Smith, Je.	June 1993 - August 1993

Lawrence Livermore National Laboratory (LLNL)

Thomas, K.	October 1994

Sandia National Laboratory

Tang, W.	June 1994 - August 1994

National Energy Laboratory

Tang, W.	June 1993 - August 1993

Brookhaven National Laboratory

Tocci, M.	August 1992 - January 1993

Indiana University, Department of Chemistry

Wu, X.	May 1995

Idaho National Engineering Laboratory

Orr, S.	August 1993 - September 1993

Los Alamos National Laboratory

Kjendal, D.	June 1995 - August 1995

Argonne National Laboratory (ANL)

Wu, X-L	January 1995 April 1995

Torsatron-Stellarator Lab (DOE/U. of Wisconsin)

Sasser, G.	June 1993 - August 1993
Thomas, E.	June 1995 - August 1995

Plant Research Laboratory (DOE/Michigan State U.)

Dodson, K.	August 1993 - September 1993

BDM Laboratory (formerly National Institute for Petroleum & Energy Research)

Henson-Mack, K.	May 1993 - August 1993

Southern Company Services

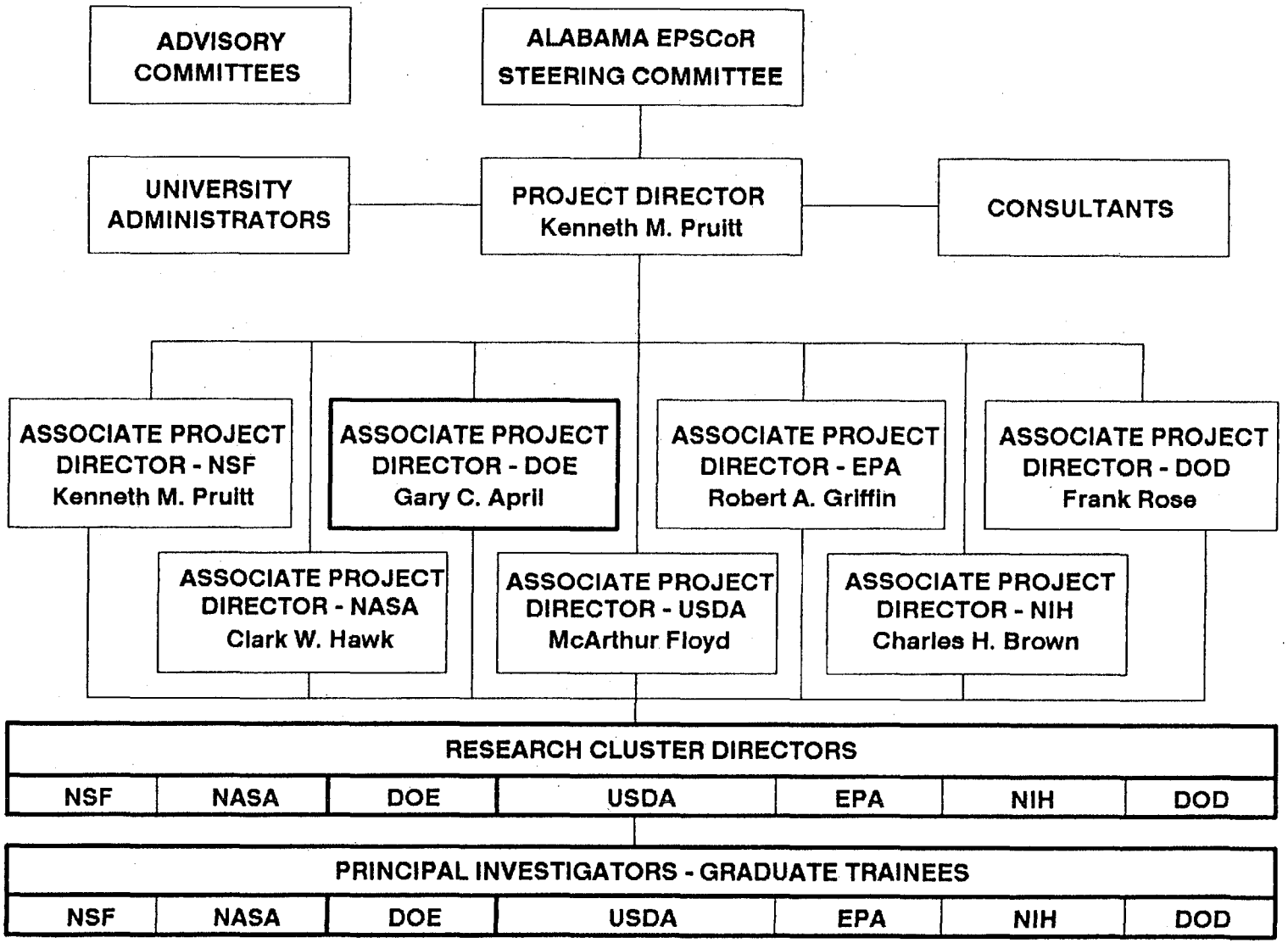
Marks, C.	June 1992 - August 1992
Maxson, R.	June 1992 - August 1992

LEGACY OF THE ALABAMA DOE/EPSCoR PROGRAM

As the DOE/EPSCoR Traineeship ends, its contribution to the infrastructure and to the ongoing energy-research programs under Phase I of the two year Cooperative Agreement is measurable and significant. Within the three Research Clusters and five HRD Partnerships there are currently ten post- doctorals, six PhD and eight MS students engaged in active programs. There are seven trainees who entered under the original Traineeship Program continuing in these Research Clusters. With continuation of support under Phase II-VI, the number of qualified post doctorals and graduate students needed to achieve a nationally competitive, critical mass level are projected to increase over the next five years. This legacy of Federal and State support for energy-related focus areas will have a lasting impact on Alabama's capability to reach its goals and to achieve self-sustained support for its energy programs. The State of Alabama will ultimately benefit from these increased activities through economic development and strengthening of the job market in high-tech, energy-related fields.

APPENDIX A

DOE/EPSCoR ORGANIZATIONAL STRUCTURE


ADVISORY COMMITTEES
ALABAMA EPSCoR STEERING COMMITTEE
UNIVERSITY ADMINISTRATORS
PROJECT DIRECTOR Kenneth M. Pruitt
CONSULTANTS
ASSOCIATE PROJECT DIRECTOR - NSF Kenneth M. Pruitt
ASSOCIATE PROJECT DIRECTOR - DOE Gary C. April
ASSOCIATE PROJECT DIRECTOR - EPA Robert A. Griffin
ASSOCIATE PROJECT DIRECTOR - DOD Frank Rose
ASSOCIATE PROJECT DIRECTOR - NASA Clark W. Hawk
ASSOCIATE PROJECT DIRECTOR - USDA McArthur Floyd
ASSOCIATE PROJECT DIRECTOR - NIH Charles H. Brown
RESEARCH CLUSTER DIRECTORS
NSF
NASA
DOE
USDA
EPA
NIH
DOD
PRINCIPAL INVESTIGATORS - GRADUATE TRAINEES
NSF
NASA
DOE
USDA
EPA
NIH
DOD

ALABAMA EPSCoR STEERING COMMITTEE MEMBERS

Dr. Robert L. Wells
Chairman, AL EPSCoR Steering Committee
Assistant Vice President for Research
The University of Alabama
Box 870104
Tuscaloosa, AL 35487-0104
Phone: (205) 348-8878
FAX: (205) 348-8882

Mr. William B. Brown
Executive Editor
The AL Journal/The Mont'g Adv.
200 Washington Avenue
P. O. Box 1000
Montgomery, AL 36101-1000
Phone: (334) 262-1611
FAX: (334) 261-1505

Dr. Kenneth Harwell
Vice Pres. for Res.& Assoc. Provost
Research Institute, Room M17
The University of Alabama in Huntsville
Huntsville, AL 35899
Phone: (205) 895-6100
FAX: (205) 895-6783

Dr. Henry J. Hector (Dr.Elizabeth French, Rep.)
Executive Director
Alabama Commission on Higher Education
P. O. Box 302000
Montgomery, AL 36130-2000
Phone: (334) 281-1921
FAX: (334) 281-6711

Dr. Jeanette Jones
Assoc. Vice Pres. for Res. & Dev.
Alabama A & M University
P. O. Box 411
Normal, AL 35762
Phone: (205) 851-5675
FAX: (205) 851-5030

Mr. Ronald L. Kuehn, Jr. (Eric Thomas, Rep.)
Chairman, President and Chief Executive Officer
SONAT Inc.
P. O. Box 2563
Birmingham, AL 35202-2563
Phone: (205) 325-7101
FAX: (205) 325-7444

Dr. Sven-Peter Mannsfeld
President
Degussa Corporation
P. O. Box 606
Theodore, AL 36590
Phone: (334) 443-4000
FAX: (334) 443-1609

Mr. Robert Lunsford
Director
Alabama Department of Economic and Community Affairs
401 Adams Ave.
Montgomery, AL 36103-5690
Phone: (334) 242-5100
FAX: (334) 242-5099

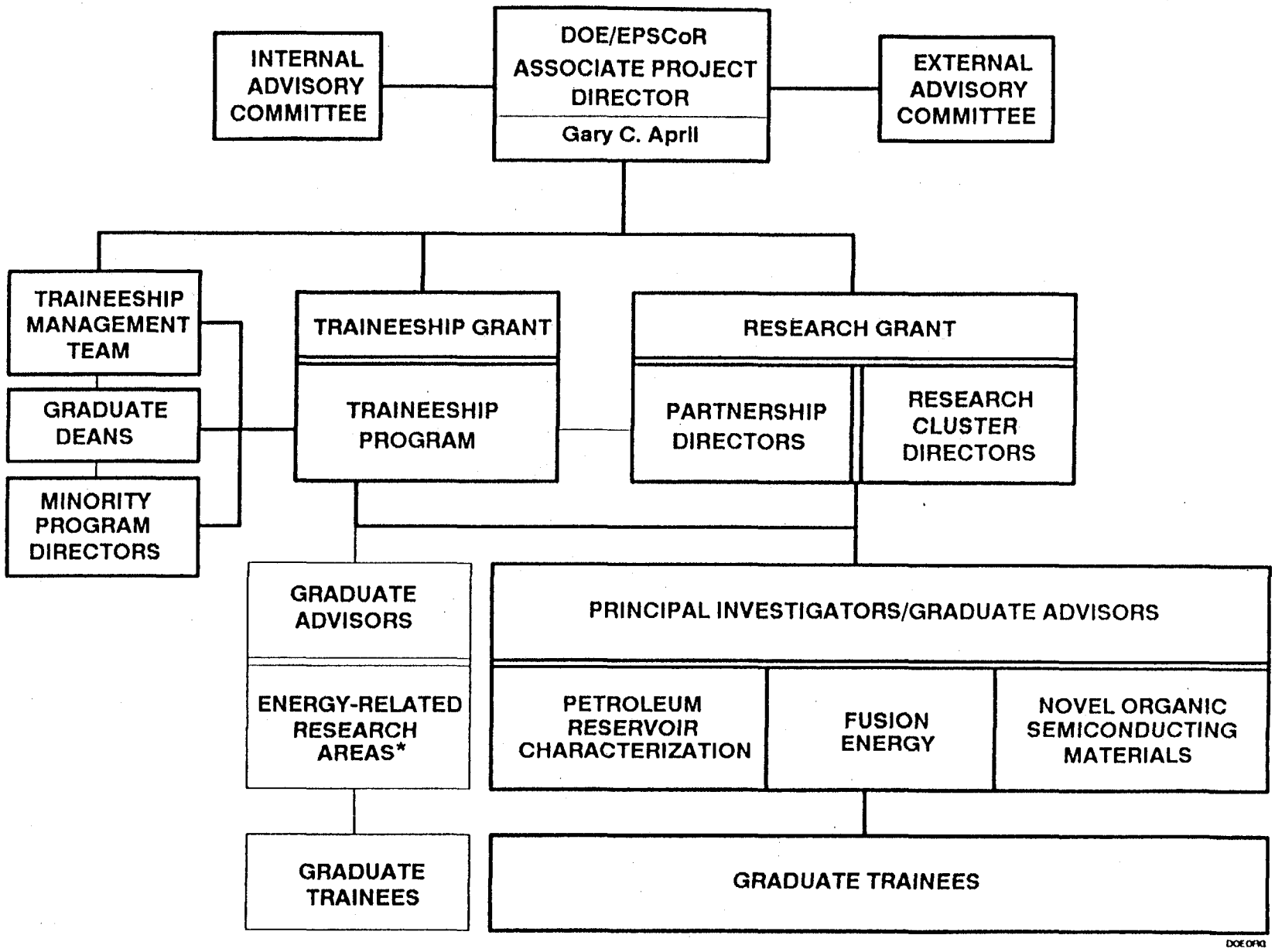
Dr. William A. Sibley
Vice President for Academic Affairs
The University of Alabama at Birmingham
217, Education Building
UAB Station
Birmingham, AL 35294
Phone: (205) 934-6133
FAX: (205) 934-1650

Dr. James L. Wolfe
Associate Vice President for Research
University of South Alabama
304 Administration Building
Mobile, AL 36688
Phone: (334) 460-6310
FAX: (334) 460-6575

Dr. Michael Moriarty (Dr. Bryan Chin, Rep.)
Acting Assoc. Provost and Vice Pres. for Research
202 Samford Hall
Auburn University, AL 36849-3501
Phone: (334) 844-4784
FAX: (334) 844-5971

APPENDIX B

ALABAMA DOE/EPSCoR ELEMENTS



*Prior to 1994 Traineeships were not restricted to Research Cluster areas.

EXTERNAL ADVISORY COMMITTEE

FUSION ENERGY

Dr. David Anderson
University of Wisconsin-Madison
Electrical and Computer Engineering
1415 Johnson Drive
Madision, Wisconsin 53706
Phone: (608) 262-0172
FAX: (608) 262-1267

Dr. Benjamin Carreras
Oak Ridge National Laboratory
Fusion Energy Division
P. O. Box 2009
Oak Ridge, TN 37831-8070
Phone: (615) 574-1292
FAX: (615) 576-7926

PETROLEUM RESERVOIR CHARACTERIZATION

Dr. Roger Slatt
Geological Engineering
Colorado School of Mines
Golden, CO 80401-1887
Phone: (303) 273-3800
FAX: (303) 273-3859

Dr. Stephen Stow
Oak Ridge National Laboratory
P. O. Box 2008
Oak Ridge, TN 37831-6038
Phone: (615) 574-7830
FAX: (423) 574-7287

NOVEL ORGANIC SEMICONDUCTING MATERIALS

Mr. Ray Baughman
AlliedSignal Company, Inc.
101 Columbia Road
Morristown, NJ 07962
Phone: (201) 455-2375
FAX: (201) 455-2936

Dr. George Hahn
Vanderbilt University
Department of Mechanical Engineering
P. O. Box 1592
Station B
Nashville, TN 37235
Phone: (615) 322-3594
FAX: (615) 343-6687

DOE/EPSCoR INTERNAL ADVISORY COMMITTEE

Dr. Sunnie A. Aburime
Alabama A & M University
Department of Plant & Soil Science
Box 1208
Normal, AL 35762
Phone: (205) 851-5462
FAX: (205) 851-5594 or (205) 851-9157

Dr. Jeff Weimer
The University of Alabama in Huntsville
Department of Chemistry
Department of Chemical & Materials Engineering
Materials Science Building 125,
South Loop Road
Huntsville, AL 35899
Phone: (205) 895-6954
FAX: (205) 895-6349

Dr. John Owens
Associate Dean
College of Engineering
Auburn University
Auburn, AL 36849
(334) 844-4326
FAX: (334) 844-2672

Dr. Wilford D. Raburn
University of South Alabama
College of Engineering
102 EGCB
University of South Alabama
Mobile, AL 36688-0002
Phone: (334) 460-6140
FAX: (334) 460-6343

Dr. Yogesh Vohra
University of AL at Birmingham
Department of Physics, Campbell Hall
1300 University Blvd.
Birmingham, Alabama 35294-4460
Phone: (205) 934-6662
FAX: (205) 934-8042

Dr. Richard Groshong
The University of Alabama
Professor, Geology
Box 870338
Tuscaloosa, AL 35487-0207
Phone: (205) 348-1882
FAX: (205) 348-7612

Government Representative:
Mr. Russell Moore
Science, Tech. & Energy Division
AL Dept. of Econ. & Community Affairs
PO Box 5690
Montgomery, AL 36103-5690
Phone: (334) 242-5294
FAX: (334) 242-5515

Industrial Representative:
Mr. Tom Saunders, Manager
Gov't Relations/Alabama Gas Co.
PO Box 1351
Montgomery, AL 36102
Phone: (334) 241-4245
FAX: (334) 241-4242

DOE/EPSCoR TRAINEESHIP MANAGEMENT TEAM
INTERNAL ADVISORY COMMITTEE

University (Campus) Representatives:

Dr. Sunnie Aburime
Alabama A & M University
Department of Plant & Soil Science
P.O. Box 1208
Normal, AL 35762
Phone: (205) 851-5462
FAX: (205) 851-5594 or 851-9157

Dr. Jeff Weimer
The University of Alabama in Huntsville
Department of Chemistry
Dept. of Chemical & Materials Engineering
Materials Science Building 125,
South Loop Road
Huntsville, AL 35899
Phone: (205) 895-6954
FAX: (205) 895-6349

Dr. Wilford D. Raburn
Associate Dean
College of Engineering
102 EGCB
University of South Alabama
Mobile, AL 36688-0002
Phone (334) 460-6140
FAX: (334) 460-6343

Dr. D. Gary Swanson
Auburn University
Department of Physics
206 Allison Lab
Auburn, AL 36849
Phone: (334) 844-4264
FAX: (334) 844-4613

Dr. Yogesh K. Vohra
The University of Alabama at Birmingham
Department of Physics
1300 University Blvd.
Birmingham, AL 35233
Phone: (205) 934-6662
FAX: (205) 934-8042

Dr. Richard Groshong
The University of Alabama
Professor, Geology
Box 870338
Tuscaloosa, AL 35487-0207
Phone: (205) 348-1882
FAX: (205) 348-7612

DOE/EPSCoR RESEARCH CLUSTER DIRECTORS & HRD PARTNERS

Dr. Jen-Ho Fang (PRC)
The University of Alabama
Department of Geology
Box 870338
202 Bevill Building
Tuscaloosa, AL 35487-0338
Phone: (205) 348-5097
FAX: (205) 348-0818

Dr. D. Gary Swanson (FE)
Auburn University
Department of Physics
206 Allison Lab
Auburn, AL 36849
Phone: (334) 844-4677
FAX: (334) 844-4613

Dr. M. Thakur (NOSM)
Auburn University
Department of Materials Engineering
201 Ross Hall
Auburn University, AL 36849
Phone: (334) 844-3326
FAX: (334) 844-3307

Dr. Dennis Sunal (PS4T)
The University of Alabama
Department of Curriculum and Instruction
Box 870231
Tuscaloosa, AL 35487-0231
Phone: (205) 348-7010
FAX: (205) 348-9863

Dr. Louis Dale (AAMP)
University of Alabama at Birmingham
Mathematics & Criminal Justice Bldg.
901 15th St. So.
Birmingham, AL 35294
Phone: (205) 934-6137
FAX: (205) 934-1650

Dr. Carl Davis (APS)
Department of Computer Science
University of Alabama in Huntsville
Huntsville, AL 35899
Phone: (205) 895-6088
FAX: (205) 895-6239

Dr. Greg Bennett (ATEC)
Bevill Center
1001 East Broad St.
Gadsden, AL 35901
Phone: (205) 547-5782

Dr. William L. Rainey (IS)
Project Director
Integrated Science Program
Center for Commun. & Ed. Technology
206 Temple Tutwiler
Box 870167
Tuscaloosa, AL 35487
Phone: (205) 348-2423

FE	**- Fusion Energy Research Cluster**
PRC	**- Petroleum Reservoir Characterization Cluster**
NOSM	**- Novel Organic Semiconducting Materials Cluster**
AAMP	**- Alabama Alliance for Minority Programs**
APS	**- Alabama Precollege Supercompeting Program**
ATEC	**- Alabama Technical Excellence Center**
IS	**- Alabama Integrated Science Program**
PS4T	**- Physical Science for Teachers Program**

APPENDIX C

A PROFILE OF PROGRAM APPLICANTS AND TRAINEES
FY 1992, FY 1993 & FY 1994

ALABAMA DOE/EPSCoR DEMOGRAPHIC DATA -- 1992-1994

UNIV	CODE	RD	ETHNIC STATUS	TARGET DEG-YR	FIELD	U/G GPA	GRAD GPA	GRE V+Q+A	GRE [V+Q]	LAB LINKAGE	AMOUNT REQUESTED	START DATE
AU	T1	2,4	WM	PhD-95	Phys	3.8/5	--	2040	1280	ORNL	$20,128	09/92
	T2	2,4	WM	PhD-94	ME	4.0/4	--	2170	1370	LLNL	$15,600	06/92
	T3	1,3	WF	MS -92	ChE	3.2/4	--	2010	1330	SCS-Wilsonville	$16,660	01/92
	T4	1,3	WM	MS -93	MiBiol	2.9/4	3.7/4	1810	1120	ORNL	$16,184	01/92
	T5	1,3	WF	MS -93	PPath	3.4/4	--	--	--	MichStU-DOE Lab	$16,128	01/92
	A1	1	WM	PhD-94	PChem	2.9/4	3.4/4	1880	1200	LANL	$21,000	03/92
	T6	1,3	WM	MS -93	ChE	2.9/4	4.0/4	1600	1030	SCS-Wilsonville	$16,660	01/92
	A2	1	WM	PhD-94	ChE	3.6/4	4.0/4	2140	1340	Union Camp	$20,078	06/92
	A3	1,2	WM	MS -94	ME	3.1/4	--	1930	1220	DOE-METC	$16,728	03/92
	T7	1,2	BF	PhD-95	MoBiol	2.7/4	3.9/4	1310	840	ANL	$19,750	03/92
	A4	1	WM	MS -92	ME	2.9/4	--	--	--	ORNL	$16,400	03/92
	A5	2	WM	PhD-95	PPath	2.9/4	3.6/4	1700	1130	MichStU-DOE Lab	$20,628	09/92
	T8	3	WF	PhD-95	MatE	3.9/4	--	1760	1080	ORNL	$20,994	09/92
	A6	4	WM	MS -95	ME	3.9/4	--	1850	1210	DOE-METC	$17,000	09/92
	A7	4	AM	PhD-95	ME	3.7/4	3.7/4	1460	780	ORNL	$25,000	09/92
	A8	4	WM	PhD-96	Phys	3.5/4	3.4/4	1920	1280	ORNL	$20,600	09/92
	T9	6	BM	PhD-96	Phys	3.8/4	3.9/4	1960	1280	Wisconsin-DOE Lab	$20,800	06/94
	T10	6	WM	PhD-96	Phys	3.0/4	3.8/4	2030	1310	ORNL	$20,600	09/94
UAB	T11	1,3	WM	PhD-94	MatE	3.2/4	3.7/4	2030	1350	ORNL	$21,000	01/92
	T12	1,2,4	WM	MS -93	MatE	3.6/4	4.0/4	1680	1070	ORNL	$17,000	03/92
	T13	2,4	WM	MS -93	Phys	3.5/4	--	2060	1310	ORNL	$17,000	09/92
	A9	1	WM	PhD-96	CE/Env	2.6/4	--	--	--	Taurus	$17,000	06/92
	A10	3,4	WM	PhD-95	MatE	3.7/4	--	2030	1320	HOWMET CORP, VA	$20,000	06/92
	A11	3,4	WM	PhD-96	MatE	3.1/4	--	1700	1220	ORNL	$20,000	06/92
	A12	4	WM	PhD-96	MatE	3.4/4	4.0/4	1820	1230	ORNL	$20,760	06/92
	T14	7	WF	PhD-99	Phys	3.5/4	--	1360	900	LLNL	$18,000	09/94
USA	T15	1	WF	MS -93	Biol	2.9/4	3.7/4	1730	1150	ORNL	$17,000	01/92
	A13	1,2	WM	MS -93	ChE	3.7/4	--	1940	1230	SCS-Wilsonville	$17,000	06/92
	A14	1	WM	MS -93	Biol	2.7/4	--	1380	1000	SoResInst	$17,000	01/92
	T16	7	WM	MS -96	EE	3.7/4	4.0/4	--	--	LANL	$17,000	09/94
UA	A15	1,2,4	WF	PhD-94	Chem	2.7/4	3.1/4	1480	1000	LANL	$19,000	01/92
	T17	1,3	WM	PhD-93	MtE	2.5/4	3.4/4	--	1480	ORNL	$18,500	06/92
	T18	2,4	BM	MS -94	ChE	--	3.3/4	1930	1290	TVA (Muscle Shoals)	$17,000	06/92
	A16	3,4	WM	PhD-96	Phys	3.5/4	3.6/4	1750	1110	SSC, BNL, LBL	$21,000	06/92
	T19	4	WF	PhD-94	CS	2.4/4	3.4/4	2000	1350	DOE-Bartlesville	$23,000	06/92
	T20	6	WF	MS -95	Geol	2.9/4	4.0/4	2070	1320	ORNL	$17,000	06/94
	A17	6	WM	PhD-98	Geol	3.2/4	3.8/4	1690	1110	LLNL	$21,000	06/94
	T21	7	AF	PhD-95	Chem	3.5/4	3.6/4	--	--	ANL	$25,000	06/94

ALABAMA DOE/EPSCoR DEMOGRAPHIC DATA -- 1992-1994

UNIV	CODE	RD	ETHNIC STATUS	TARGET DEG-YR	FIELD	U/G GPA	GRAD GPA	GRE V+Q+A	GRE [V+Q]	LAB LINKAGE	AMOUNT REQUESTED	START DATE
UAH	A18	2	WF	PhD-94	Chem	3.5/4	3.9/4	2030	1390	Martin Marietta-Huntsville	$21,000	06/92
	T22	2,3	WM	PhD-95	Chem	3.0/4	3.6/4	1930	1240	Idaho Nat. Engg. Laboratory	$20,970	06/92
	A19	2,3,4	WM	PhD-95	Atm Sci	2.9/4	3.5/4	1490	1030	ORNL	$21,000	09/92
	T23	2,4	WM	PhD-95	Optics	3.0/4	3.7/4	2180	1410	BNL	$21,000	06/92
	A20	4	WF	PhD-96	CE	2.5/4	--	--	--		$21,000	06/92
AAMU	T24	2,4	AM	PhD-96	Phys	3.3/4	3.8/4	1960	1380	LBL	$18,261	09/92
	T25	3,4	BF	PhD-94	Soil Scl	3.8/4	3.8/4	1120	780	Hanford Engg Dev Lab	$21,000	09/92
	A21	3,4	BM	PhD-93	Soil Scl	3.4/4	3.6/4	1530	1030	PNL	$25,000	09/92
	A22	4	BM	MS -95	Biol	3.3/4	--	--	--	ORNL	$17,000	09/92
	T26	4	WM	PhD-95	Phys	3.2/4	3.8/4	2030	1310	ORNL	$24,600	09/92

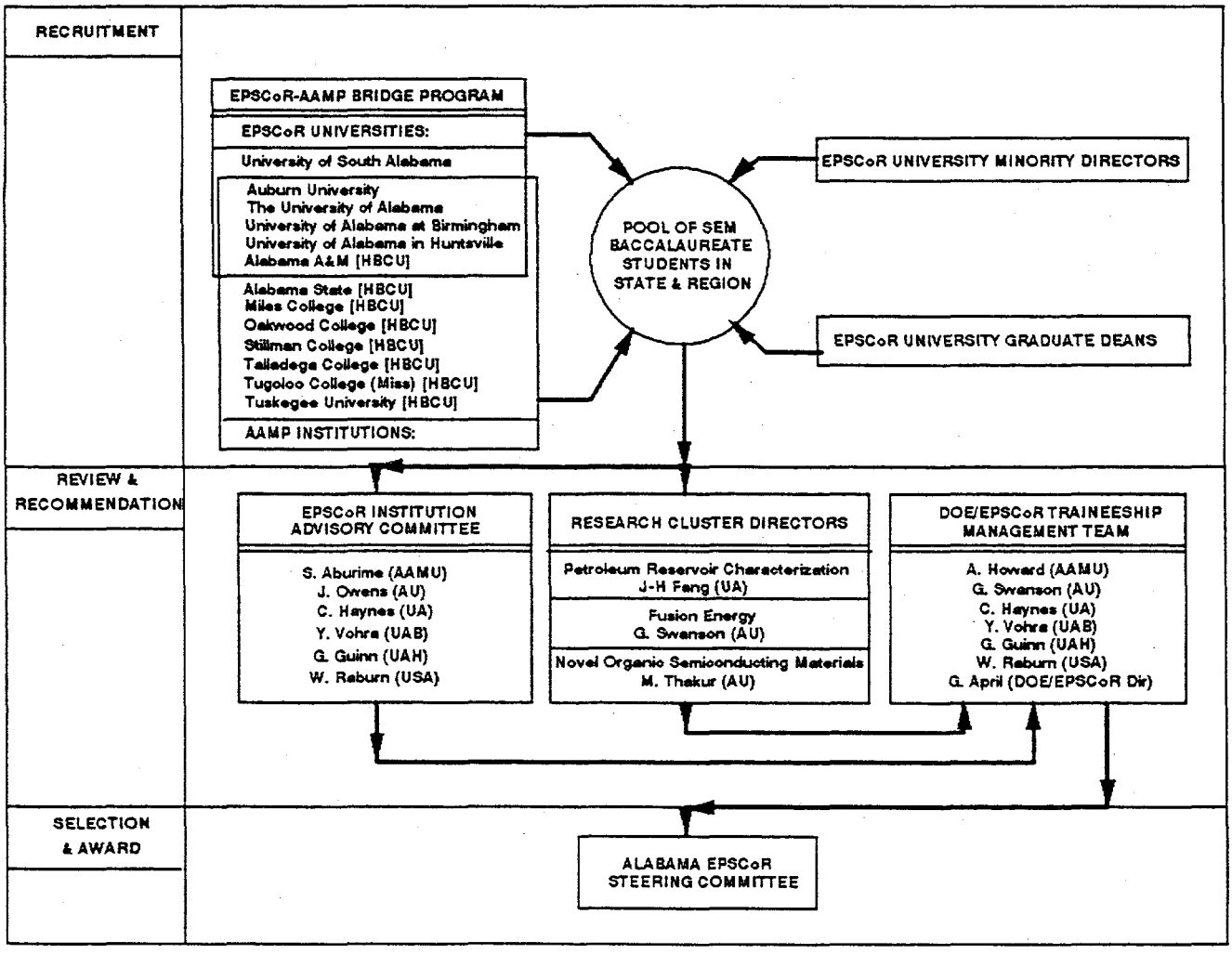
A-APPLICANT C 1-FY92 Round 1 2-FY92 Round 2
T-TRAINEE COD 3-FY93 Round 1 4-FY93 Round 2
5-FY94 Round 1 6-FY94 Round 2 7-FY94 Round 3

ALABAMA DOE/EPSCoR TRAINEESHIP PROGRAM DEMOGRAPHICS — 1992–1994

	APPLICANTS	%	RECIPIENTS	%	% SUCCESS
UNIVERSITY:					
AAMU	5	10.42%	3	11.54%	60.00%
AU	18	37.50%	10	38.46%	55.56%
UA	8	16.67%	5	19.23%	62.50%
UAB	8	16.67%	4	15.38%	50.00%
UAH	5	10.42%	2	7.69%	40.00%
USA	4	8.33%	2	7.69%	50.00%
TOTAL	48	100.00%	26	100.00%	54.17%
ETHNICITY:					
WHITE MALE	29	60.42%	13	50.00%	44.83%
WHITE FEMALE	10	20.83%	7	26.92%	70.00%
BLACK MALE	4	8.33%	2	7.69%	50.00%
BLACK FEMALE	2	4.17%	2	7.69%	100.00%
ASIAN MALE	2	4.17%	1	3.85%	50.00%
ASIAN FEMALE	1	2.08%	1	3.85%	100.00%
TOTAL	48	100.00%	26	100.00%	54.17%
DEGREES SOUGHT:					
PhD	32	66.67%	16	61.54%	50.00%
MS	16	33.33%	10	38.46%	62.50%
TOTAL	48	100.00%	26	100.00%	54.17%
AVERAGE SCORES:		RANGE:		RANGE:	
GRE [V+Q+A]	1850	1120–218	1870	310–218	
GRE [V+Q]	1220	780–148	1250	840–1480	
		RANGE:		RANGE:	
GPA [U/G]	3.2	2.4–4.0	3.3	2.4–4.0	
GPA [GRAD]	3.7	3.1–4.0	3.7	3.3–4.0	
EXTRAMURAL ACTIVITIE					
DOE NATIONAL LABS	30	62.50%	18	69.23%	
DOE RELATED LABS	9	18.75%	7	26.92%	
OTHER LABS	9	18.75%	1	3.85%	
TOTAL	48	100.00%	26	100.00%	

APPENDIX D

DOE/EPSCoR TRAINEESHIP APPLICATION PACKET
AND
DOE/EPSCoR TRAINEESHIP REPORT PACKET


RECRUITMENT
EPSCoR-AAMP BRIDGE PROGRAM
EPSCoR UNIVERSITIES:
University of South Alabama
Auburn University
The University of Alabama
University of Alabama at Birmingham
University of Alabama in Huntsville
Alabama A&M [HBCU]
Alabama State [HBCU]
Miles College [HBCU]
Oakwood College [HBCU]
Stillman College [HBCU]
Talladega College [HBCU]
Tugaloo College (Miss) [HBCU]
Tuskegee University [HBCU]
AAMP INSTITUTIONS:
POOL OF SEM BACCALAUREATE STUDENTS IN STATE & REGION
EPSCoR UNIVERSITY MINORITY DIRECTORS
EPSCoR UNIVERSITY GRADUATE DEANS
REVIEW & RECOMMENDATION
EPSCoR INSTITUTION ADVISORY COMMITTEE
S. Aburime (AAMU)
J. Owens (AU)
C. Haynes (UA)
Y. Vohra (UAB)
G. Guinn (UAH)
W. Raburn (USA)
RESEARCH CLUSTER DIRECTORS
Petroleum Reservoir Characterization
J-H Feng (UA)
Fusion Energy
G. Swanson (AU)
Novel Organic Semiconducting Materials
M. Thakur (AU)
DOE/EPSCoR TRAINEESHIP MANAGEMENT TEAM
A. Howard (AAMU)
G. Swanson (AU)
C. Haynes (UA)
Y. Vohra (UAB)
G. Guinn (UAH)
W. Raburn (USA)
G. April (DOE/EPSCoR Dir)
SELECTION & AWARD
ALABAMA EPSCoR STEERING COMMITTEE

DOETR93

APPLICATION PACKET

DOE/EPSCoR

APPLICATION PACKAGE

THE STATE OF ALABAMA
AND
THE UNITED STATE DEPARTMENT OF ENERGY

GRADUATE TRAINEESHIP PROGRAM

OF THE

EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH (EPSCoR)

The Alabama EPSCoR Member Universities

Alabama A & M University
Auburn University
The University of Alabama
The University of Alabama at Birmingham
The University of Alabama in Huntsville
The University of South Alabama

The Alabama Experimental Program to Stimulate Competitive Research

Traineeship Program Summary

The Alabama DOE/EPSCoR Consortium invites applicants for Traineeships to support and to enhance research studies in energy-related fields at one of its six member institutions.

"Energy related fields" means any academic discipline or field of study (including the physical, natural, and biological sciences; engineering, education, economics; business; sociology; behavioral sciences; computer science; communications; law; international affairs; and public administration) that is concerned with or likely to improve the understanding, assessment, development and utilization of this nation's energy resources and policies.

Awards will be based on academic excellence. Successful applicants will be individuals whose proposed research and career interests are coincident with the missions of DOE and the State of Alabama.

Selection Criteria

Individual graduate traineeships, up to $25,000 per year[1], will be awarded annually and are renewable (pending a favorable annual review). It is expected that the total award period will not exceed 36 months. Graduate applications may be submitted at any point during the applicant's graduate career or prior to completion of the undergraduate degree.

A significant goal of the national DOE/EPSCoR and Alabama's traineeship program is to encourage interdisciplinary training and research and to prepare professionals for energy-related careers in science, technology and allied fields. Successful applicants will be designated DOE/EPSCoR Trainees. Graduate student research plans must include an extramural experience at a DOE Multiprogram Laboratory or at an approved industrial laboratory.

All traineeship applicants must be U.S. citizens or permanent resident aliens and must be sponsored by a DOE/EPSCoR member institution. Individuals from under-represented groups, specifically Blacks, Hispanics, American Indians, Pacific Islander Americans, Asian Americans and women who have interest in energy-related fields, are especially encouraged to apply.

Application forms are available through the State DOE/EPSCoR Program office or individual participating campus offices.

---

[1] A schedule of awards based on level of graduate status is shown on page 5.

Management and Administration

The Alabama DOE/EPSCoR Consortium is composed of six major research universities in the state of Alabama. Alabama A&M University, Auburn University, The University of Alabama, The University of Alabama at Birmingham, The University of Alabama in Huntsville and The University of South Alabama. Dr. Gary C. April, University Research Professor, The University of Alabama, is the DOE/EPSCoR Associate Director and the Director of the Grant Program Office.

The Associate Director of the DOE/EPSCoR Program and a designated Campus Director on each of the six campuses constitute the Traineeship Management Team. The names, addresses and phone numbers of the Campus Directors are as follows:

Dr. Charles D. Haynes
The University of Alabama
Department of Mineral Engineering
Box 870207
Tuscaloosa, Alabama 35487-0207
Phone: (205) 348-2513 FAX: (205) 348-9455

Dr. Gwyn Morgan Jenkins
Alabama A & M University
Department of Physics
Huntsville, Alabama 35762
Phone: (205) 851-5308 FAX: (205) 851-7984

Dr. Gerald R. Guinn
The University of Alabama at Huntsville
Johnson Research Center
Huntsville, Alabama 35899
Phone: (205) 895-6707 FAX: (205) 895-6668

Dr. Steve Thomas
The University of South Alabama
HUMB 118
Mobile, Alabama 36688
Phone: (205) 460-6281 FAX: (205) 460-7928

Dr. D. Gary Swanson
Auburn University
Department of Physics
206 Allison Lab
Auburn, Alabama 36849
Phone: (205) 844-4264 FAX: 205)844-4613

Dr. Raymond G. Thompson
The University of Alabama at Birmingham
Department of Material Science & Engineering
360-F-BEC
Birmingham, Alabama 35294-4460
Phone: (205) 934-8450 FAX: (205) 934-8485

The Traineeships awarded by the Alabama DOE/EPSCoR Consortium will be administered by the DOE/EPSCoR Program Office through the Campus Director on whose campus the Trainee is working.

Names and Locations of DOE Multipgrogram Laboratories

Argonne National Laboratory
Division of Education Programs
9700 South Cass Avenue
Argonne, Illinois 60439
Dr. Dean Ettinger
1-708-972-2000

Brookhaven National Laboratory
Building 460
Upton, New York 19973
Mr. Nicholas Samios, Director
1-516-282-3427

Hanford Engineering Development Laboratory
P. O. Box 1970
Richland, Washington 99352
Ms. Jo Akita
1-509-376-8284

Idaho National Engineering Laboratory
DOE Operation
785 DOE Place
Idaho Falls, Idaho 83402
Dr. Rebecca Winston
1-208-526-9585

Los Alamos National Laboratory
HRD2 - Mail Stop P290
P. O. Box 1663
Los Alamos, New Mexico 87545
Ms. Marie Roman
1-505-667-0870

Lawrence Livermore National Laboratory
P. O. Box 808
7000 East Avenue
Livermore, California 94550
Mr. Manuel Perry
1-510-422-1100

Oak Ridge National Laboratory
U.S. Dept. of Energy
OR Operation Office
P. O. Box 2001
Oak Ridge, Tennessee 37830
Mr. Max Wilson
1-615-576-5454

Pacific Northwest Laboratories
902 Battelle
Richland, Washington 99352
Mr. Burt Vaughn
1-509-375-2121 (DOE Lab)

Sandia National Laboratory
1515 Eubanks SE
Albuquerque, New Mexico 87545
Mrs. Maureen Baca
1-505-844-1004

Savannah River Ecology Laboratory
P. O. Drawer E
Aiken, South Carolina 29801
Dr. Whitfield Gibbons
1-803-725-2472

Solar Energy Research Institute
1617 Cole Boulevard
Golden, Colorado 80401
Ms. Joan Miller, Director
1-303-231-1000

Submission of Applications

Initial Applications
Applicants for Traineeship awards under this program should submit an original and six copies of all materials to the Campus Director where the applicant expects to undertake studies for a degree program and carry out the research program or plan of study. The names and addresses of these individuals are listed at the beginning of this instruction packet. After preliminary screening by the Campus Director, applications for final consideration will be forwarded by the Campus Director to the DOE/EPSCoR Associate Director for distribution to and review by the appropriate Research Area Director(s) twice per year; in October for January to April enrollment and in March for May to September enrollment. Successful applications will be selected by the Traineeship Management Team and will be announced by the Associate Director. All applicants within the pool will receive a status report twice per year subsequent to each review meeting. Proposed starting dates for new awards will generally be expected to coincide with normal semester, quarter, or other accepted academic term starting dates.

Transcript
A certified copy of the most recent transcript should be attached to the application.

Submission for Renewal
Requests for renewal are to be submitted to the appropriate Campus Director at least one month before the Traineeship Management Team Review Meeting in October and March. Applicants should submit an original and six copies of all materials. The proposal for renewal should include a Cover Sheet, an Abstract, a Schedule of Target Dates, a Budget, and Approvals as specified in the section on Preparation of Application. Additionally, the renewal application should include a brief statement outlining the progress and status of the research program and plan of study, documentation of accomplishments, academic grades for the previous year and two current letters of recommendation from faculty personnel. Review and final selection will be carried out as described for Initial Applications. The starting date for renewals should be on the anniversary of the most recent award.

Final Administrative Report
A report on the student's research and academic accomplishments must be submitted by the faculty advisor within thirty days of completion of the student's study and research program. Information to be furnished in the report includes the degree granted, the employment or career plans of the student, and other important results of the student's experience, e.g., thesis or dissertation title, technical reports and papers published or written other than the thesis or dissertation, presentations made, awards and honors.

One copy of the report should be sent to the DOE/EPSCoR Associate Director (along with a bound copy of the thesis or dissertation) at the DOE/EPSCoR Program Office and one copy to the appropriate Campus Director.

Inquiries
Questions concerning the preparation and submission of applications and the administration of this program should be addressed to the appropriate Campus Director listed at the front of this instruction packet or to the DOE/EPSCoR Program Office at The University of Alabama.

Administrative Procedures

Selection of Proposals

DOE/EPSCoR Trainees will be selected for participation in the Program by the Traineeship Management Team and announced by the DOE EPSCoR Associate Director upon the recommendation of the specific Campus Director and the appropriate Research Area Director. Selection will be based on (1) the academic qualifications of the applicant, (2) the quality of the proposed research program or plan of study and its relevance to DOE/Alabama energy-related science and technology programs, (3) the quality of the research approach to achieving the objectives of the proposed program, (4) the merit of the proposed collaboration with a DOE Multiprogram Laboratory or an approved industrial laboratory[2] in carrying out the objectives of the program, (5) the prospects for completion of the project within the allotted time, and, (6) an assessment of the applicant's motivation toward an energy-related career. The extramural experience, usually planned for the summer, at a DOE Laboratory or an approved industrial laboratory, is a necessary condition for an award.

Awards

All graduate awards are made initially for a 12-month period and are eligible for renewal annually. It is expected that the total award period will not exceed 36 months. Renewals are based upon favorable annual reviews by the Campus and Area Directors and approvals by the faculty advisor and the DOE/EPSCoR Management Team. Trainees will be expected to devote full time to graduate study and research during the tenure of the award.

Eligibility

Applicants must be citizens of the United States of America or permanent resident aliens.

Applications may be submitted prior to completion of the senior undergraduate year or at any time during the applicant's graduate career. Beginning graduate students must show evidence of having met the entrance requirements of the institution in which they propose to enroll. Graduate students at a member institution may apply for an award at that institution or at another member institution. Full-time graduate students from a college or university that is not a member of the Consortium are eligible to apply for awards if they are able to meet the entrance requirements of the Consortium member university at which the applicant proposes to study. Graduate Trainees, in agreement with the Campus Director of their institution, may initiate their programs to coincide with normal semester, quarter, or other accepted academic term starting dates.

Each application must be sponsored by the involved department chair or a faculty advisor from the Consortium member institution where the student expects to do the research program and obtain the advanced degree. Individuals accepting graduate traineeship awards cannot receive concurrently other federal funds (including funds from other federal fellowships, traineeships, assistantships, or federal employment) or be otherwise employed. Supplemental funds may be assigned by the institution from non-federal sources.

Equal Opportunity

Applicants for the Graduate Traineeship Program will be considered for appointment as DOE/EPSCoR Trainees without regard to race, creed, color, age or handicap. Persons from under-represented groups will be especially encouraged to apply.

Obligation to the Government

While students who receive support through the National DOE/EPSCoR Traineeship Program do not incur any formal obligations to the government of the United States, the objectives of the program clearly will be best served if graduates from the program pursue further study or careers in energy-related science, technology or allied fields and support areas.

Funding

A schedule of available Traineeship Awards is shown below:

Degree & Year	Stipend Amount	Tuition Amount	Program Support
MS	$12,000	$3,000	$2,000
PhD (1st Yr.)	$15,000	$3,000	$3,000
PhD (2nd Yr.)	$17,000	$3,000	$3,000
PhD (3rd Yr.)	$19,000	$3,000	$3,000

These awards include support for a student stipend, student allowance, travel and living cost while at the DOE/Industrial Laboratory, tuition and other necessary costs. Specific details regarding the required extramural experience for graduate trainees will be discussed with the recipients and their faculty advisors prior to finalizing the traineeship awards.

---

[2]Sufficient details must be provided by the applicant to allow the Management Team to evaluate the extramural laboratory experience. A letter of agreement signed by the student, advisor and laboratory supervisor is a minimum requirement.

Preparation of Applications

Unsolicited Application Requirements

Proposals must be written by the students, should be specific in nature, and should be prepared in the following format.

Cover Sheet

This page must be completed and signed by the student, the faculty advisor, the chairman of the department in which the student plans to enroll, and the appropriate Campus Director. Cover sheet forms are included with these instructions. All graduate applications must also have the signature of the Graduate Dean. The appropriate Area Research Director will sign the copy after completing his/her review.

Abstract

The abstract, not to exceed 400 words, must describe the objectives of the proposed research program and/or plan of study and the methodology to be used.

Description of Proposed Research and Plan of Study

A full statement, prepared by the student in consultation with an advisor, that identifies and relates the key elements of the proposed research and/or plan of study, is required. The statement must include a course plan that will enrich the understanding of complex energy-related issues and should suggest an extramural, energy-related work study experience. Total description should not exceed the equivalent of five typed, single-spaced pages and must include a clear statement of how the award will help meet the objectives of the proposed research and study plan.

Schedule of Target Dates

The starting and completion dates for the proposed research program or plan of study, including the expected date for completion of the formal degree program, should be realistically identified. Any time expected to be spent at a DOE lab and/or approved industry facility, including the required extramural experience, should be taken into consideration in establishing the target dates.

Personnel

One page resumes of the applicant and of the faculty advisor must be included with the proposal. The student's resume should include a short summary of education, training and accomplishments.

References

The faculty advisor must provide a recommendation as to the acceptability of the student for the program, a clear statement of the advisor's willingness to supervise the student, and the nature of any past or present experience with the student. The identification of the source(s) of any supplemental research funds to support the student's project should also be provided. A second letter of recommendation must also be provided by someone who can address the student's qualifications and the soundness of the study plan.

Budget

A 12-month budget must be prepared and should include the following:

- The appropriate student stipend for twelve months
- Expenditure plan for up to $3,000 ($2,000 for MS students) of program support[3]
- Expenditure plan for up to $3,000 in tuition

An expense plan for the required extramural experience must be approved by the DOE/EPSCoR Program Office and the costs must not exceed the expenditure limits stated above.

In a request for renewal, include in the budget plan the amount of any unused funds remaining from previous awards.

Transcript

Attach a certified copy of the most recent transcript.

Approval

Signatures provided on the Proposal Cover Sheet will constitute approval by the campus representatives that the student meets all requirements and is qualified to pursue a course of study as an MS (or PhD)student at the EPSCoR Member University. Proposals cannot be processed without these approval signatures.

Disposition of Unused Funds

If a student terminates the Traineeship Program earlier than anticipated, the student stipend and other allowances are prorated and terminated. Any unused stipend and allowances are returned to the DOE/EPSCoR Program Office.

---

[3]Program support is provided primarily to assist the student with travel and residency expenses incurred while participating in the extramural laboratory program.

Alabama DOE/EPSCoR Consortium
Traineeship Program
Proposal Cover Sheet

Applications will be accepted at any time during the fiscal year. They will be reviewed for consideration of funding twice per year in October and in March.

For U.S. Citizens and Permanent Resident Aliens Only

Submit proposal to: *Appropriate Traineeship Campus Director*
(for address, see instructions)

Student's Name _____ Birth Date _____
Last First Middle Initial Mo/Day/Yr

Address _____ Home Phone _____
Street City State Zip

Proposed Faculty Advisor (if known) _____ Department _____ Phone _____

Target Degree _____ Discipline/Major _____ Expected Completion Date _____
Mo/Yr

High School _____ County/City/State/Zip _____

Undergraduate GPA _____ Scale _____ Earned Degree/Date: ____/____ Period of Enrollment: From _____ To _____

GRE:Analytical _____ Verbal _____ Quantitative _____ Total _____ Date of Exam _____

Graduate GPA _____ Scale _____ Earned Degree/Date: ____/____ Period of Enrollment: From _____ To _____

This is a new submission ☐ This is a renewal submission ☐

Proposed starting or renewal date _____ Funding requested _____

Area of study or proposed thesis/dissertation topic: _____

_____

Consortium campus to which this proposal is being submitted (check only one):

___ Alabama A & M University
___ Auburn University
___ The University of Alabama
___ The University of Alabama at Birmingham
___ The University of Alabama at Huntsville
___ The University of South Alabama

Proposed DOE Lab or Approved Industry Laboratory: _____

In order to determine the degree to which members of the diverse segments of the population are reached by this announcement, so that all persons are afforded an equal opportunity for consideration, DOE/EPSCoR requests that you fill in the appropriate block(s). Completion of this part of the application is voluntary. Whether or not the appropriate block(s) are completed, persons will be selected for participation in the program on merit and without regard to race, color, religion, national origin, sex or age.

Male ___ Female ___ Racial Minority: No ___ Yes ___ (Check one box below)

Black ___ Hispanic ___ American Indian ___ Asia (Chinese, Japanese, Korean, Vietnamese) ___ Other _____
(Please Specify)

I certify that I am a citizen of the United States ☐ *or a permanent resident alien* ☐ *and am or will be a full-time graduate student at a consortium* university during the period covered in the attached proposal.

_____ _____
Signature Date

_____ _____
DOE/EPSCoR Campus Director Department Advisor/Major Professor

_____ _____
DOE/EPSCoR Area Director Department Head/Program

_____ _____
DOE/EPSCOR Associate Director Graduate Dean

TERMS OF AGREEMENT

Name: _____
University: _____

DOE/EPSCoR TRAINEESHIP PROGRAM
TERMS OF AGREEMENT

(1). The amount covered in this DOE/EPSCoR Traineeship Subgrant Agreement is _____.

(2). The period of this grant is _____ months beginning on _____ and ending on _____.

Workloads and course/research schedules should be provided at the start of each term (quarter, semester, or any other period). The DOE/EPSCoR Trainee is expected to be assigned to only research and course commitments unless other duties are considered an integral part of every student's graduate educational experience.

(3). This Award is made for a ___ month period. There is a twelve month open submission of application policy. The DOE/EPSCoR Traineeship Program must be funded in an open, national competition each year. It is not a guaranteed multiyear program.

(4). A Course Study Plan and Research Plan, (Form B) including a description of the extramural activity(ies) (form C) should be provided to the Associate Director quarterly. This report of progress, updated periodically when changes occur, must also be included in any Renewal Application submitted.

(5). The Trainee and his/her major advisor agree to acknowledge the support of the Alabama DOE/EPSCoR Program on all publications, presentations, reports and other scholarly activities resulting in whole or in part from this support. A copy of each should be sent to the Associate Director. Use Form A to report all such activities and in any Renewal Application submitted.

(6). An annual report (Forms A through C and a general progress statement) must be sent to the Associate Director within thirty days of the grant termination date (or another date if different from the termination date). Invoices for payment may be submitted on a cost reimbursable basis no more often than monthly. Invoices should document required cost sharing. Any unused funds will revert back to the DOE/EPSCoR Traineeship program.

(7). Any changes in budget (which are reflected in the scope or magnitude of the project) must be approved by the Associated Director before funds are expended. Note: Changes in the study or research plan to a non-energy-related field will result in the loss of the Traineeship.

(8). A copy of the Trainee's thesis or dissertation, patent disclosure or invention must be sent to the Associate Director. Evidence of the Trainee's acceptance of a job in an energy-related field or any other field must be reported at the time the person leaves the university.

(9). All of the above applies to any person selected to receive a Traineeship under the DOE/EPSCoR Program whether the applicant receives a Renewal Award or not.

Recipient	Date	Advisor	Date
Department Head	Date	Dean	Date
Authorized Institutional Representative		Date	
University of Alabama Authorized Institutional Representative		Date	

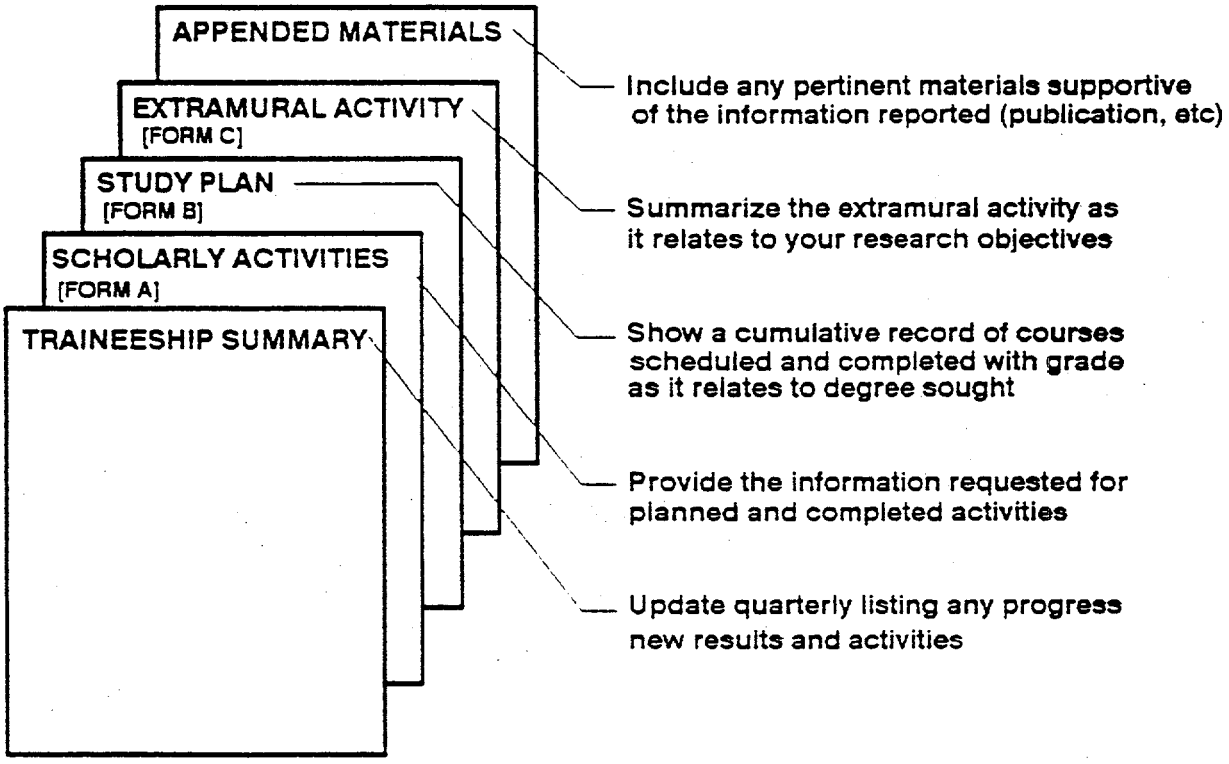
Please return this signed form, and any other materials requested in this document at the designated times, through your Campus Representative to:

Dr. Gary C. April, Associate Director
Alabama DOE/EPSCoR Program
Box 870203
Tuscaloosa, AL 35487-0203
(205) 348-1734 FAX: (205) 348-7558

REPORTING MATERIALS

ALABAMA DOE/EPSCoR TRAINEESHIP PROGRAM

QUARTERLY REPORTING MATERIALS



DOE/EPSCoR SCHEDULE OF DUE DATES

IF YOUR TRAINEESHIP START DATE IS:	YOUR QUARTERLY REPORTS ARE DUE:				FINAL REPORT DUE:	IF APPLICABLE, YOUR RENEWAL TARGET DATE IS:
	1st	2nd	3rd	4th		
DECEMBER	MARCH	JUNE	SEPTEMBER	DECEMBER	JANUARY	SEPTEMBER
MARCH	JUNE	SPETEMBER	DECEMBER	MARCH	APRIL	SEPTEMBER
JUNE	SEPTEMBER	DECEMBER	MARCH	JUNE	JULY	MARCH
SEPTEMBER	DECEMBER	MARCH	JUNE	SEPTEMBER	OCTOBER	MARCH

NOTE: DUE DATES ARE THE LAST DAY OF THE MONTH UNLESS OTHERWISE STATED

TRAINEESHIP SUMMARY	
TITLE:	
TRAINEE:	PERIOD:
UNIVERSITY:	DEGREE PROGRAM:
RESEARCH OBJECTIVE:	
TECHNICAL PERSPECTIVE:	
RESULTS:	
TECHNICAL APPROACH:	
PROJECT IMPLICATIONS:	
KEYWORD INDEX:	

ALABAMA DOE/EPSCoR TRAINEESHIP PROGRAM -- SCHOLARLY ACTIVITY REPORT [FORM A]

	AUTHOR(S)	TITLE(S)	JOURNAL(S)/MEETING(S)	DATE(S)
PUBLICATIONS				
PRESENTATIONS				
TECHNICAL REPORTS				
OTHER				

UNIVERSITY:	PROGRAM:

DOE/EPSCoR STUDY PLAN [FORM B]

NAME_____STUDENT NO._____DATE_____

DEGREE FOR WHICH THESE COURSES ARE PROPOSED: _____
FOR MS[ ] DEGREE, INDICATE OPTION: THESIS___NON-THESIS___

PREVIOUS DEGREES

DEGREE: _____ UNIVERSITY: _____ YEAR: ____
DEGREE: _____ UNIVERSITY: _____ YEAR: ____

COURSE NO.	COURSE NAME	UNIV	HRS	GRADE
	MAJOR IN: _____			
	TOTAL HRS [MAJOR]			

MINOR IN: _____

	TOTAL HRS [MINOR]			

[FORM B]
PAGE TWO

COURSE NO.	COURSE NAME	UNIV	HRS	GRADE
MINOR IN: _____				
	TOTAL HRS [MINOR]			

ADDITIONAL COURSES IN PROGRAM

	TOTAL HRS [FOR DEGREE]			

FOREIGN LANGUAGE REQUIREMENT:

RESEARCH TOPIC:

THESIS TITLE: _____

==========

STUDENT'S SIGNATURE: _____ DATE: _____

COMMITTEE'S SIGNATURES [INDICATING APPROVAL OF COURSE PLAN]:

ADVISOR: _____ DATE: _____
_____ DATE: _____
_____ DATE: _____
_____ DATE: _____
_____ DATE: _____
_____ DATE: _____

ALABAMA DOE/EPSCoR TRAINEESHIP PROGRAM -- EXTRAMURAL ACTIVITY REPORT [FORM C]

NAME AND LOCATION OF EXTRAMURAL ACTIVITY:

PERIOD AT EXTRAMURAL ACTIVITY SITE:

NATURE OF ACTIVITIES OR PROJECTS:

SUMMARY OF ITS IMPACT ON RESEARCH/DEGREE:

APPENDIX E

ALABAMA ALLIANCE FOR MINORITIES - DOE/EPSCoR BRIDGE PROGRAM

AAMP - DOE/EPSCoR Bridge Program

[YEAR 1 & YEAR 2]

AMP Goal
To provide enrichment and other experiences for science and engineering students enrolled in the Alabama Alliance for Minority Participation Program Institutions[1] to effect a smooth transition into DOE/EPSCoR Research Clusters.

EPSCoR Goal
To provide a pathway to energy-related research and advanced study programs at EPSCoR Universities[2] in areas critical to Alabama and national energy policies culminating in professional career opportunities that encompass the SEM disciplines.

Rationale
Currently the NSF-supported Alabama AMP Program is engaged in successful efforts to increase the quantity and quality of minority students receiving Bachelors degrees in science, engineering and mathematics (SEM) in Alabama and portions of Mississippi. These efforts include financial support for students and a Summer Research Internship Program at The University of Alabama at Birmingham and The University of Alabama in Huntsville (both EPSCoR Institutions). The Summer Research Internship Program involves students working on research projects with research faculty mentors. We expect this program to increase the number of minority students entering graduate programs in Alabama and elsewhere. We are nearing the time when our first group of interns will be graduating from AMP Institutions. To insure a successful transition into graduate programs, particularly those of the EPSCoR Institutions, an AMP - DOE/EPSCoR Transition Program is needed. What follows is our vision of that program.

Component I
Students must be identified and recruited to Research Clusters. Mentors must be identified at each Cluster Institution who will agree to work in their discipline and research area with students. Students and mentors must be paired. I envision visits to Research Clusters by interested students (8-12) and the development of a tracking system to monitor student interest and academic progress.

Estimated Cost $20,000

Component II
Students who are rising seniors with an interest in the area of research at EPSCoR Research Clusters will be eligible to spend a summer internship with a faculty mentor at the Cluster. Such students will also be required to spend a limited amount of time participating in the activities of the Summer Internship Program at either UAB or UAH.

---

1 AMP Institutions include the following: Alabama A&M (HBCU), Alabama State (HBCU), Miles College (HBCU), Oakwood College (HBCU), Stillman College (HBCU), Talladega College (HBCU), Tugaloo College (HBCU, Miss), Tuskegee University (HBCU), The University of Alabama at Birmingham and The University of Alabama in Huntsville.

NOTE: In 1994, Auburn University and The University of Alabama also joined as AMP Institutions in Alabama.

2 EPSCoR Institutions include the following: Alabama A&M (HBCU), Auburn University, The University of Alabama, The University of Alabama at Birmingham, The University of Alabama in Huntsville and The University of South Alabama.

AAMP - DOE/EPSCoR Bridge Program
(Continued)

Estimated Number of Students	4
Stipends	$2,000
Room and Board	$1,500
Other Expenses	$ 500
Total	$4,000 x (4) = $16,000

Component III

Students who are graduating seniors with an identified interest in the area of research at EPSCoR Cluster locations and who are admitted to the graduate school will participate in a Summer Graduate Bridge and EPSCoR Traineeship Program. This program will include:

(a). Assignment of a faculty mentor for orientation to the graduate program and requirements;

(b). Assignment of a graduate faculty mentor in the research area of interest;

(c). Enrollment in one elementary graduate course;

(d). Assignment to laboratory or field assignment for hands-on experience;

(e). Assignment to a graduate student "peer coach"; and

(f). Assistance with the DOE/EPSCoR Traineeship Application process to insure graduate and extramural support at a DOE National Laboratory or approved industrial laboratory.

Estimated Number of Students	4
DOE/EPSCoR Traineeship[3]	$19,000
Total	$76,000
Total Program Cost (Estimated)	$112,000

[3] Administered according to current DOE/EPSCoR Traineeship Program Guidelines

NOTE: Elements of this program in the Implementation Cooperative Agreement have been modified reflecting the termination of funding for the Traineeship Programs.