LEQSF(2007-12)-ENH-PKSFI-PES-06

"Leveraging Louisiana's Industrial and Human Resources for Post-Katrina Recovery"

PI: David Norwood

Lead Institution: Southeastern Louisiana University

Contents:

Proposal Narrative (without appendices)

COVER PAGE FOR POST-KATRINA SUPPORT FUND INITIATIVE **008PKSFI-E-07**
PRIMARILY EDUCATION SUBPROGRAM PROPOSALS
BOARD OF REGENTS SUPPORT FUND, FY 2006-07

1. Primary Submission Discipline: ☐ Biological Sciences ☐ Information Technology ■ Materials Science (check only one)	(For BoR Use Only) Application Number:
2. Name of Lead Institution of Higher Education: Southeastern Louisiana University (Include Branch/Campus/Other Components)	
3. Address of Lead Institution of Higher Education: Dept of Chemistry and Physics, SLU 10878, 500 Western Avenue, Hammond LA 70804-0878 (Include Dept/Unit, Street Address/P.O. Box Number, City, State, Zip Code)	
4. Title of Proposed Project: APTEC/SEAL: Leveraging Louisiana's Industrial and Human Resources for Post-Katrina Recovery	

5. Funds Requested:	P-KSFI Year 1: $ 58,400	ESIP (Year 1 only): $ -0-	Total Project Request: $ 496400	6. Proposed Duration: (Circle # of Yrs.) 1 2 3 4 (5)

7. Name(s) of Partnering Institution(s):

8. Does This Proposal Contain Confidential or Proprietary Information Which Falls Into a Category Described in R.S. 44:4(16)?
☐ YES ■ NO (NOTE: If YES, the proposal MUST be appropriately marked.)

By signing and submitting this proposal, the signators are certifying that: (1) the proposed project has not already been funded/is not currently being funded/has not been promised funding; (2) this proposal has been reviewed and approved by an Institutional Screening Committee; and (3) the institution and the proposed project are in compliance with all applicable Federal and State laws and regulations, including, but not limited to, the required certifications set forth in: (a) Grants for Research and Education in Science and Engineering, NSF Grant Proposals Guide (GPG), NSF 03-2, effective 10/1/02, and (b) 45CFR 620, Subpart F (Requirements for a Drug-Free Workplace).

Name/Title Institution (if different from Item #2 above)	Dept./E-mail/Telephone No.	Signature
PI/PD David Norwood	Chemistry and Physics, dnorwood@selu.edu / 985/549-3938	
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Co-PI		

Campus Head or Authorized Institutional Representative	**Dean**	**Authorized Fiscal Agent**
Name/Title: (type or print) Emily O. Bond, Director Sponsored Research	Name/Title: (type or print) Daniel McCarthy Dean College of Science & Tech.	Name/Title: (type or print) Nettie Burchfield, Controller
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Date: 3/12/07 Telephone Number: 985.549.5312	Date: 3/9/07 Telephone Number: 985 549-2153	Date: 3/12/07 Telephone Number: 985.549.2088

(Form 1-PKSFI-PES, 1-2007)

PROJECT SUMMARY

Name(s) of Lead Institution (Include Branch/Campus and School or Division) and Partnering Institution(s):

Southeastern Louisiana University

Address of Lead Institution:
Dept of Chemistry and Physics, SLU 10878, 500 Western Avenue, Hammond LA 70804-0878

Principal Investigators: David Norwood, Debra Dolliver, Mike Doughty, Sanichiro Yoshida

Title of Project: APTEC/SEAL:
Leveraging Louisiana's Industrial and Human Resources for Post-Katrina Recovery

Abstract (DO NOT EXCEED 250 WORDS):

The Applied Polymer Technology Extension Consortium (APTEC) is an umbrella organization of the polymer research and teaching efforts in the state of Louisiana, established by La. House Bill 1548 of the 2003 Regular Session, intended to make these resources more accessible to industrial partners in Louisiana. Southeastern Louisiana University is one of many Louisiana universities included in the APTEC collaboration (others include LSU, SUBR, UNO, Xavier, Tulane, McNeese, UL-Lafayette, LaTech and Grambling). The PI and co-PIs are directly involved in the APTEC structure.
SEAL (Student Entrepreneurs as Active Leaders) is a proposed Louisiana version of an innovative program called ChemEngine, which integrates education, leadership training and economic development. ChemEngine is a non-profit, student-managed, faculty-supervised corporation that provides engineering services to industrial clients (116 projects in aggregate over 8 years involving 64 students) while engaging *undergraduates* in problem solving and management.

We propose the creation of research assistantships at Southeastern for undergraduate students doing research under the APTEC/SEAL umbrella, to serve as the core of a SEAL effort to be developed state-wide. Five students would be trained by the coPIs of this proposal in tandem with the establishment of the APTEC/SEAL research structure. As the APTEC/SEAL collaboration takes hold, these students would recruit, train and administer students who enter the program later. In this way, a self-supporting and directing student effort can be established.

(Form 2, rev.2006)

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Goals and Objectives

At the end of the five-year grant period, we propose to have a self-sustaining program in which undergraduate students at Southeastern Louisiana University perform research on problems posed by local businesses. This program, termed Student Entrepreneurs as Active Leaders (SEAL), is modeled on a successful program at Virginia Commonwealth University called ChemEngine. Years One and Two will be spent establishing the program. That is, the PI's will recruit students into the program and cultivate contacts with industrial clients. These tasks will be a natural extension of current activities of the PI's in the context of the academic research they already perform. The PI's already recruit students into existing research programs, and two of the PI's (Norwood and Dolliver) have existing projects in collaboration with local industry. *What's new is that the new recruits will be groomed as entrepreneurs by being permitted to practice running a business.* We envision that some of the student time in the beginning will be spent visiting local industries to ensure that the students are an integral part of all activities. By Year Three, we have two intermediate goals: to begin securing paid contracts from industry clients on the way to full self-sufficiency and to begin establishing SEAL teams at other universities. We will initially target universities in the APTEC community, as it is our plan to leverage the PI's existing APTEC collaborations to secure industry contacts and contracts. It is thus natural to extend the program to universities with whom the PI's are already in contact. By Year Five, we propose to have a fully self sufficient SEAL program at Southeastern Louisiana University, to have SEAL Teams in place at Louisiana universities outside the APTEC collaboration, and to leverage the reputation and expertise developed by the PI's in building Southeastern's SEAL program to aid other universities in securing sufficient industry funding to themselves be self sufficient.

Narrative and Bibliography

Project Rationale and Structure

Context for Project

Southeastern Louisiana University (SLU) is a large regional university located geographically between New Orleans and Baton Rouge in the town of Hammond, LA. The university has experienced dramatic growth of its student body over the past seventeen years, swelling from 8,176 students in 1987 to 15,118 students in 2006. The number of minority students has nearly quadrupled in this same time, jumping from only 751 students in 1987 to almost 3500 students today. The strategic mission of the University "is to lead the educational, economic and cultural development of Southeast Louisiana." This mission is well-reflected by the geographic origin of our student body, 97% from Louisiana, and 80% from the surrounding six parishes. Not only do nearly all of the students come from Louisiana, but nearly all choose to live here. *This proposal is about helping them remain here at a higher standard of living.* Southeastern is in every sense a "regional" university. While Southeastern was essentially unaffected by Hurricane Katrina, it serves many areas that were significantly affected. This was shown clearly when Southeastern served as a staging area for rescue and recovery personnel dispatched immediately after Katrina, and again when students driven from their schools were admitted to Southeastern to continue their studies while their Universities recovered. Thus, Southeastern Louisiana University is well positioned to serve as an anchor in enhancing the economic recovery of surrounding areas that were severely affected by Hurricane Katrina, just as it served as a key center in recovering from the immediate aftermath.

Like the University, the Department of Chemistry and Physics has also experienced strong growth over the past two decades, expanding from 11 full time faculty members in 1985 to 27 full time faculty members today (includes 18 tenured or tenure-track faculty). There has been a concurrent growth in the number of majors as well. The prime objective of all faculty members is quality teaching. This fact is substantiated by the large class load carried by each faculty member (12 contact hours per week) and the large number of hours outside of class time that each faculty member reserves to assist students (10 office hours a week). A testament to the success of these efforts is the success of our graduates and the large number of undergraduate students actively involved in research projects with chemistry and physics faculty.

Within the past ten years, the department of chemistry and physics has developed very active research programs, supported both by the Board of Regents and other grant agencies, including the National Science Foundation and the National Institutes of Health. Ten faculty members have supervised the research of ~90 undergraduate students, ~50 of whom have made ~135 presentations of that research at meetings of regional, national and international scope. One limitation to the effectiveness of this training is that the majority (76%) of Southeastern students work, about two-thirds (63%) off campus, and (anecdotally) many of them are required to do so to support themselves or their families. Additionally, much of this research is performed in the professor's lab solving primarily academic problems. While the value of fundamental research is unquestioned, the application to economic recovery can be quite indirect and delayed.

The current proposal seeks to remedy these limitations while simultaneously leveraging the advantages present at a regional university with scientists of the caliber present at

Southeastern. We propose the creation of research positions for undergraduates at Southeastern that will be devoted SPECIFICALLY to research of direct and immediate benefit to current and future businesses in this region, including both tiny startups and local offices of global corporations. That is, the research problems addressed will be problems PROPOSED by local industry. Representatives of such businesses have made clear their interest in such a proposal (letters of support and outlines of proposed research activities are in the appendix). The creation of the research positions for undergraduates would provide greater opportunities to students at Southeastern to avail themselves of the educational benefits inherent in performing undergraduate research (problem solving, mentorship, written and oral presentations). Additionally, supporting research of direct and immediate value to local industry will enhance the economic competitiveness of those businesses. Finally, giving experience in working with local industry to undergraduate students who have a clear tendency to remain in this area provides a clear enhancement to the workforce issues facing local industry.

The Applied Polymer Technology Extension Consortium (APTEC) is an umbrella organization of the polymer, biopolymer and plastics research and teaching efforts in the state of Louisiana. A principal goal of this organization is to make these resources, essential to development in the Materials Science & Engineering and Nanotechnology sectors, more accessible to industrial partners both in Louisiana and those considering relocating here. APTEC is also to be a model of how our universities can work together. House Bill 1548 of the 2003 Regular Session, defines APTEC's mission:

> *"The purpose of the consortium shall be to promote the development of interdisciplinary, diversified polymer research at various universities located in this state; provide basic and applied research, education, workforce training, and consulting that will retain the state's existing polymer industries, induce such industries to expand and attract new firms and manufacturing or research divisions to the state; and to establish a model of cooperation among the various universities who shall participate in the consortium."*

Southeastern Louisiana University is one of ten Louisiana universities included in the APTEC collaboration (others include LSU, SUBR, UNO, Xavier, Tulane, McNeese, UL-Lafayette, LaTech and Grambling).

SEAL (Student Entrepreneurs as Active Leaders) is the tentative name for a Louisiana version of an innovative program called ChemEngine. ChemEngine is a creative, active, problem-solving approach to education, leadership training and economic development. Based at Virginia Commonwealth University, ChemEngine is a not-for-profit, student-managed, faculty-supervised corporation that operates in the style of a for-profit company. It provides engineering services to industrial clients (>$250 K in sales for 2005, 116 projects in aggregate over 8 years involving 64 students) while engaging *undergraduates* in serious problem solving and management. Many of these undergraduates go on to graduate school, leadership positions in startup companies or traditional technical careers. SEAL is an important part of the NSF Partnership for Innovation (PFI) proposal being prepared by LSU, Tulane, Southern, UL-Lafayette, Louisiana Tech and Southeastern Louisiana University.

Project Focus

The project design enhances the quality of undergraduate science, technology, engineering and mathematics (STEM) education by broadening student access to undergraduate research opportunities. There are a number of educational benefits a student derives by performing undergraduate research. First, the essence of research is experiential learning and problem solving of a type not seen (perhaps not possible) in standard coursework – the solving of problems for which the answer is not known. In fact, to solve a problem the first step is to fully define and understand the problem. Research complements the traditional lecture by providing the opportunity to apply knowledge from the classroom to a problem from another context and by providing strong motivation for further study as research helps students to see the applicability of academic knowledge. In addition, research tends to break down the artificial barriers constructed between disciplines. These lines are reinforced by the separation of a student's education into discrete departments and courses. By requiring a student to draw upon knowledge gained from whatever source, undergraduate research reveals the inherently interdisciplinary nature of science and technology.

Further, another educational opportunity derived from undergraduate research arises from the presentation of results, whether orally before an audience or in the form of a written report. By tying these educational benefits to a dedication of those research efforts to problems proposed by industry, we propose to amplify the benefits accrued. Industry wins by having academia dedicate its efforts to problems of immediate benefit to local industry. Undergraduate students win by acquiring experience solving problems of interest to industry and gaining familiarity with the industrial culture prior to graduation. The state of Louisiana wins in any case, especially if some high school students who are inclined to be active problem solvers (and who might not, therefore, be bound for the halls of academia) find SEAL appealing enough to enroll for college. Our goal is to establish a self-sustaining and scalable research program. It is therefore imperative that students be drawn from the freshman and sophomore populations. This ensures that we establish continuity of the SEAL program as freshmen and sophomores progress through their college career. The Principle investigators all have a history of involving students at all levels in their research activities and have a proven history of successfully mentoring and guiding students to successful undergraduate and post graduation careers. In addition to the mentoring and support provided by the faculty members, students in the program will enhance their skills as they train and mentor students entering the program; they learn not just by doing but also by teaching.

Personnel

The Principle Investigator for this proposal is Dr. David Norwood, Associate Professor of Physics in the Department of Chemistry and Physics at Southeastern Louisiana University. While Dr. Norwood accepts primary responsibility for the activities proposed, the work will be a joint and interdisciplinary effort. The investigators are named in the table below (two page biographical sketches are presented in the Biographical Sketches section), which also indicates their primary areas of expertise. These faculty members not only provide expertise in areas most likely to be useful in solving problems posed by clients from local industry, they also have a history of mentoring undergraduates in research. They have mentored 71 undergraduate students in research which resulted in 65 presentations at regional, national and international meetings and 17 papers. Finally, all have been successful in interdisciplinary and collaborative research. Thus, when industrial clients' problems call for expertise other than that possessed by the PI's,

these faculty members have a proven ability to seek out and avail this program of that expertise.

Name	Title	Research Area
Dr. Debra Dolliver	Asst. Professor of Chemistry	Organic synthesis, w/ medical applications
Dr. Michael Doughty	Assoc. Professor of Chemistry	Biochemistry, with emphasis on molecular biology
Dr. David Norwood	Assoc. Professor of Physics	Polymer characterization
Dr. Sanichiro Yoshida	Asst. Professor of Physics	Materials science, using laser interferometry

The commitment of the administration to the proposed activities takes two concrete forms. First, each of the principle investigators will serve for one year as the director of the consulting activities (specific duties are described in the section on Project Structure). The administration has committed to provide the director with two hours of release time from their academic workload to allow them to perform these duties. This constitutes a cash match of almost $70,000 (details are in the section on Budget and Budget Justification). Second, the University will provide access to extremely well equipped laboratory space for the research activities proposed (some of the equipment provided by previous Board of Regents support). This access includes a Materials Characterization Lab (Pursley Hall Room 106); a Polymer Characterization Lab (PH Room 129) including triple detection HPLC and dynamic light scattering apparatus; an organic synthesis lab (PH 202); and a biochemistry laboratory (PH 120). This commitment of resources, as well as administrative support to administer the grant and manage payroll for the student researchers and others, is represented by the unrecovered indirect costs, totaling over $180,000 over the entire five-year period. We finally comment that the proposed work fits well with the University's mission statement: "*to lead the educational, economic and cultural development of Southeast Louisiana.*"

Work Plan

Proposed Work

The enhancement of education in science, technology, engineering and mathematics (STEM) by the proposed activities is expected to be significant. By involving freshman and sophomore students in undergraduate research, we encourage students who might otherwise be lost to remain in the STEM pipeline. Additionally, by showing the direct and concrete value of scientific research to local business, we will attract additional students who might not have considered careers in science. We recognize that the few positions created will not remake the practice of STEM education. This limitation will be ameliorated by the natural scalability of the program: other departments in other universities can benefit from our experience, and we will keep an open book. We do not envision the program as limited to the student research positions funded under our proposal but rather see those positions as the nucleus of a larger research effort, throughout the University and at other campuses throughout the state, funded by revenues from local industry contracted through the APTEC collaboration. These positions would come with greater participation by faculty throughout the University, to include not only other departments in the College of Science and Technology, but also the College of Business and, in fact, wherever the requisite expertise can be found. Therefore, a natural metric for success will be the

extent to which this vision is realized. This is discussed further in the section on Performance Measures and Milestones.

Project Structure

Here we describe in detail the proposed SEAL/APTEC research structure, including a definition of the roles of all personnel. The primary activity to be supported by Board funds is the creation of paid positions for student researchers, members of Student Entrepreneurs Acting as Leaders: SEALs. We note again that the SEAL structure is based upon the very successful ChemEngine program at Virginia Commonwealth University. Many of the program elements are borrowed from that program. Where we hope to dramatically improve the concept is to make the structure more modular and scalable, so that it is not dependent upon the drive, expertise and contacts of a single faculty member (a limitation of the ChemEngine structure). The student positions come in three levels, advancing in responsibility and pay as students gain the requisite skills and show the required level of responsibility.

The SEAL fellows will begin as Student Researchers, whose primary responsibility is to actually perform the daily research activities of the industry projects. In addition, they will prepare research proposals for industrial clients in which they will describe how they propose to solve the problem posed by the industrial client and they will report the results in both written and oral form. In the first year of the program, the effort of training and mentoring of these students will fall to the PI and coPI's. Later, as the program develops, more senior students will play an increasing role in mentoring and training Student Researchers as they enter the program (but always with the active participation of the faculty).

As they gain expertise and are prepared to assume greater responsibility, students can assume the position of Senior Student Researcher. Early in the program, it may be appropriate for a student to enter directly a position of higher responsibility. These students will not only perform research, but will have responsibility for delegating research activities and coordinating the activities of other SEAL personnel. They would play an active role in the preparation of proposals and reports, whether writing or supervising them.

The final level of SEAL members is the Student Manager. Again, these students will perform active research in the lab. In addition, they will have greater responsibility to supervise and direct the activities of other SEAL members, participating in the preparation of proposals and reports and attending meetings with industry clients. They will also have responsibilities regarding the purchase of supplies to support the research of other students. While financial responsibility will remain with the faculty advisors, these students will be charged with securing pricing and bids where necessary and preparing the necessary paperwork. Finally, in concert with the Faculty Director, the Student Managers will supervise the activities of the other SEAL members to ensure that their activities under industry contracts (which provide immediate gratification in the form of a paycheck) do not interfere with their other academic activities (which provide a much delayed gratification).

The last formal position created by this proposal is that of Faculty Director. The Faculty Director will have responsibilities similar to other faculty advisors – to provide scientific expertise relevant to the needs of industrial clients and to mentor and train all student SEAL members. In addition, the Faculty Director bears responsibility for building the program, both within and without. That is, he or she is responsible for recruiting students into the program to serve as SEAL researchers and developing industrial contacts to provide problems for the students to address. Each of the coPI's will serve one year as Faculty Director (although the PI,

Dr. David Norwood will always assume primary responsibility for the success of the program, and for reporting). Finally, the Faculty Director is charged with ensuring that the activities of the SEAL members under industry projects do not interfere with their other academic responsibilities.

In addition to these formal positions, there will be more informal activities driven by the specific needs of the industrial contracts. In some cases, this will be activity similar to that of the faculty coPI's, providing scientific expertise and mentoring for the SEAL members. In some cases, this effort might be financed by industrial contracts, but in many cases, the faculty effort would be voluntary. While possibly counterintuitive, this attitude on the part of Southeastern faculty stems from the unique mission of Southeastern Louisiana University as a primarily undergraduate institution. The faculty at Southeastern, like the coPI's, are dedicated to the education of undergraduates. In other cases, there will be other SEAL members hired and financed by funds provided by industrial contractors. The PI's conversations with representatives of local industry make clear that they are prepared to fund such problem solving research to be performed by undergraduates. The limitation on the part of local industry is neither problems to be solved nor the resources to solve them, but the scientific expertise and, above all, the time for industry staff to work on problems that are not of immediate and vital interest. The PI is assured by his contacts that there exist sufficient problems that are not mission critical and so could be trusted to undergraduate students and the financial resources to solve them. Thus, Board funds used in the current proposal should be seen as "loss leaders," money spent to establish the structure and reputation of Southeastern researchers with local industry.

Finally, the APTEC collaboration will provide a ready source of other expertise and effort, in the form of faculty at APTEC universities and the research activities of post-docs at APTEC Universities. While most post-doctoral researchers envision an academic career and so have as their primary responsibility the generation of academic research and peer-reviewed papers, a few months spent on industrially relevant research will always serve as a resume builder (the PI is a perfect example, having spent three months of his post-doctoral period at Tulane on a successful research collaboration with USBI, Inc., of New Orleans, LA.). Furthermore, a post-doc who wishes to maximize his options or even seriously considers a career in industry (again, the PI is an example) would be eager to work on problems seen to be of industrial interest. The PI has discussed this with faculty at other APTEC schools and finds them receptive. In fact, such activities are explicitly included in a PKSFI PRS grant being prepared with Tulane University as the lead institution [contact: Wayne F. Reed, Professor of Physics]. That proposal, on which the PI of this proposal (Dr. David Norwood) is a co-PI, provides explicitly for the support of the expansion of the SEAL program to other APTEC schools and for the participation of post-docs with an entrepreneurial bent. We point out that funding of both proposals provides the maximum opportunity for synergies in the two programs to be realized, but also that the benefits of either program obtain even in the absence of the other.

Project Impact

The impact of the proposed project will be most dramatic on undergraduate STEM education at the freshman and sophomore level, its primary target. A part of this recruiting effort would entail visits to local high schools to target students even before they enter college. Contacting high school counselors and teachers and advising them of the existence of the SEAL program provides them with more leverage to inform graduating high school seniors of the clear value of higher education. By recruiting explicitly from among the freshman and sophomore

student population, the SEAL program provides that group with the many obvious benefits of undergraduate research. This population is typically denied access to research activities, whether due to the false impression that they are not competent to do research (a conclusion the PI and coPI's have demonstrably rejected) or due to a lack of resources (requiring that the students work in the service industry to support themselves and their families). The educational and mentoring aspects of undergraduate research are clear: experiential learning in its purest form, problem solving of a type seldom seen in traditional coursework, the application of knowledge in a context other than that in which it was gained, and motivation of students to enter and remain in STEM disciplines. Further, the direct mentoring of SEAL members by SEAL faculty brings benefits other than those directly related to research: training in organizing and presenting one's work, guidance in the operational and ethical aspects of the scientific endeavor and ultimately preparation for a professional career in STEM disciplines.

This proposal addresses workforce issues in the most basic manner: providing training to undergraduate students in the skills most directly relevant to Louisiana businesses. It is self evident that if students are working on problems posed by Louisiana industry, they are developing and using skills relevant to Louisiana businesses. And since these students are primarily from the surrounding, largely rural parishes, they are most likely to provide a source of future labor. The SEAL model, however, does more than provide the promise of a source of skilled labor for the future; it provides a concrete way to leverage the existing scientific resources in Louisiana's Universities and businesses. Industry provides the problems to be solved; universities provide the equipment and scientific expertise in the form of existing research programs; and undergraduates provide the effort. The program is scalable to other Universities, beginning naturally with other campuses in the APTEC collaboration and spreading to others. The PKSFI-PRS proposal in preparation by Tulane University explicitly provides for this. But even absent funding under that proposal, extension of the SEAL program to other universities can be financed by funds we expect from industrial clients (see the following section, Performance Measures and Milestones).

Performance Measures and Milestones

A natural measure of the success of the program is straightforward: the number of contracts negotiated with local industries. While an important metric, it can be misleading: a large number of trivial problems might be of less overall significance than one long-term project (the DMSO project with Gaylord Chemical Corporation, Bogalusa, LA., described in the appendix is an example of an open ended project that is intended to last into the future). It is the PI's experience that industrial partners insist upon regular reporting to ensure that effort is being expended and progress made. Therefore, a natural metric of effort expended would be the regular reports made to industrial partners. These would be scheduled to satisfy the industrial clients, but a reasonable estimate of reports required would be at least monthly for long-term projects (many months to years) and even weekly for short-term projects (one or a few months).

Another metric is dollars committed to the program by industrial clients. While SEAL Teams are not intended (or even allowed!) to be a profit making enterprise, commitment of dollars by industry is, in fact, the sincerest form of flattery. Commitment of money by industry is clear evidence that the efforts of SEAL Teams are valued by local businesses. Furthermore, this commitment of funds will allow the program to grow beyond the limits allowed by BOR funding and ensure its survival beyond the Board's five year funding period. While it is not expected that such funding should materialize immediately, by year three, such funds should be

forthcoming and by year five, funds received by industrial clients should be comparable to the funds provided by the Board if the program is to be sustainable. Note that even these goals are modest. ChemEngine, with only one faculty advisor, handles over 100 projects a year, with receipts of over $200k per year. With four advisors in the SEAL program (and more envisioned), a realistic metric would be comparable numbers for the SEAL program.

Sustainability and Scalability

The plan for sustainability is to leverage the Board funds as a "loss leader," used to impress upon industry the actual value of academic research devoted to industrial problems. The PI's conversations with local industry people suggests that this will be an easy sell – industry representatives have already expressed an interest in providing problems suitable for undergraduate research and have stated that funds for such research are available. Ongoing collaborations between Southeastern faculty and local businesses (see the appendix) using the efforts of undergraduate researchers can only make this job easier. If, by year three, a commitment of funds by industrial clients is not seen, the sustainability plan becomes questionable.

The SEAL program is scalable to the extent that faculty advisors can be found on other campuses. It is our hypothesis that if the SEAL program on Southeastern's campus can be shown to be a success, other campuses will see the value of the program and be eager to participate. Further, by lending the expertise and reputation to be developed by Southeastern's SEALs, we can expedite the process of developing confidence of local industry in other SEAL programs. The PKSFI-PRS proposal under development by Tulane and their coworkers provides explicitly for extension of the SEAL concept to universities in that collaboration. This provides a natural "leg-up" in the process of scaling the program to other campuses. But while this would be helpful, it is in NO way necessary for that grant to be funded to ensure the success of the current proposal.

Leveraging of Resources

The current proposal seeks to leverage the scientific resources of Louisiana universities in the service of Louisiana business, both existing businesses and others that start or move here. We propose to start small, with the resources of the four PI's of this proposal. This comprises an organic synthesis lab (Dolliver), a microbiology lab (Doughty), a polymer characterization lab (Norwood), and a materials science lab (Yoshida). These labs were created with significant previous BOR funding, and so the current proposal constitutes a means of leveraging past BOR funding. Each of these labs has a history of addressing sophisticated scientific problems, usually of an esoteric and academic nature. In each case, the work was carried out with significant participation by undergraduate students. The current proposal seeks to turn these assets to problems of immediate interest to local businesses. Additionally, the PI's have a proven ability to develop collaborative research, and thus provide a means to leverage scientific resources besides those in their immediate control. Finally, as each of the PI's has a history of supervising research by undergraduate students, this proposal provides a means of leveraging Louisiana's human resources. These students come primarily from the surrounding parishes and thus constitute a principle source of labor for local businesses. A purpose of this proposal is to give them early experience in operating a business, managing others, decision-making, often in contact with industrial clients. It is proposed that this will make our SEAL graduates more confident, successful wealth generators. Some will, of course, go to graduate school—but

Louisiana's other universities are likely to find these students highly motivated *and well suited for a parallel program in the PKSFI Primarily Research Program being submitted by Tulane, LSU and the University of Louisiana—Lafayette.* That proposal, if awarded, could add substantial leverage to our own by providing postdoctoral support at nearby universities (our students may respond well to working with scientists just a few years beyond them in age). Also, that program brings more than twenty industrial partners to the mix.

Bibliography

Budget and Budget Narrative

BOARD OF REGENTS SUPPORT FUND
POST-KATRINA SUPPORT FUND INITIATIVE, FISCAL YEAR 2006-07

BUDGET
PROJECT YEAR (CIRCLE ONE):

(1) 2 3 4 5 COMPOSITE

Title of Proposed Project: _ APTEC/SEAL: Leveraging Louisiana's Industrial and Human Resources for Post-Katrina Recovery_

Principal Investigator(s): _ David Norwood, Debra Dolliver, Mike Doughty, Sanichiro Yoshida _

Institution(s) of Higher Education: _ Southeastern Louisiana University _

I. PROPOSED BUDGET:

	Support Fund Money Requested*	Institutional Match**	Private Sector/ Other Match***
1. Research Salaries	$_____	$_12,592 cash_	$_____
2. Clerical Salaries	_____	_____	_____
3. Subtotal	_____	_____	_____
4. Fringe Benefits (% of A.3)	_____	_____	_____
5. Graduate Asst.	_____	_____	_____
6. Student(s)	__50,400_____	_____	_____
7. Endowment(s)****	_____	_____	_____
8. Subtotal A	$_____	$_____	_____
B. Supportive Expenses:			
1. Travel	$_____	$_____	_____
2. Supplies	___8,000_____	_____	_____
3. Consultants	_____	_____	_____
4. Rentals	_____	_____	_____
5. Printing	_____	_____	_____
6. Equipment	_____	_____	_____
7. Other Expenses (Identify) a.	_____	_____	_____
b.	_____	_____	_____
8. Subcontracts	_____	_____	_____
9. Subtotal B	$_____	$_____	_____
C. Overhead:			
1.	NOT PERMITTED	$__22,176 in kind	$_____
TOTAL PROJECT COST:	$_58,400_____	$__34,768_____	$_____

*In the budget justification, distinguish between funds requested from the P-KSFI principal program and the Enhancement for Severely Impacted Institutions (ESIP). Note that ESIP funds may be used only at the institutions listed in Appendix A of this RFP.

**Stipulate whether in-cash or in-kind.

***The budget page(s) must reflect and the budget justification page(s) must explain any external funds that are claimed in the proposal. These funds must be itemized and their expenditure accounted for in the same manner as Support Fund money and institutional match. Refer to Section III.G of this RFP for details on matching requirements.

****Matching funds for the endowment of chairs may be requested through P-KSFI, though such requests must adhere to all regulations governing the BoRSF Endowed Chairs for Eminent Scholars Program.

II. BUDGET JUSTIFICATION: Project Year One

Support Fund Money Requested

Line 6: Students - **$50,400**. Year one provides for two student managers (at a rate of $18/hour) and two student researchers ($12/hour) (job descriptions are included in the body of the proposal). All students will work 20 hours per week for 15 weeks during two regular semesters, and 40 hours a week for 6 weeks in the summer. This is a total of 840 hours for each student. For two managerial students, the total wages are: $30,240. For two research students, the total wages are: $20,160. Total funds requested for students are thus: **$50,400.**

Line B2: Supplies - **$8,000**. Funds are requested to purchase incidental and consumable supplies to support the consulting work of the student researchers. Obviously, it cannot be known in advance what supplies will be needed. The table below shows examples of the sort of item that might be needed and estimates of the annual costs:

Item	Amount typically used in a year	Cost per unit [$]	Total / year [$]
Ammonium Nitrate	1 kg	45.00/kg	45
GPC columns	1-2	Varies by type, but typically from $700-$1000	1500
Capillary tubing and fittings for GPC apparatus, various types and diameters	Varies, in the past approx. $500 per year has been spent on these items.		500
Disposable filters, 0.1, 0.22 and 0.45 micron pores.	About 500 filters	Varies by type, approx. $2 per filter	1000

Institutional Match

Line1: Research salary: **$12,592** - Dr. David Norwood will serve as Faculty SEAL Director (duties described in the body of the proposal) for the first year. He will receive 2 hours ($1/6^{th}$ of his academic load) of release from Southeastern as a cash match. One sixth of his salary amounts to $9,686. Including a 30% fringe benefit rate gives the total shown: **$12,592**

Line C1: Overhead: **$22,176** - This represents unrecovered indirect costs associated with the University's support of the research described. Using a rate of 44% of the total salaries ($50,400), we obtain the amount shown: **$22,176**.

BOARD OF REGENTS SUPPORT FUND
POST-KATRINA SUPPORT FUND INITIATIVE, FISCAL YEAR 2006-07

BUDGET
PROJECT YEAR (CIRCLE ONE):

1 **(2)** 3 4 5 COMPOSITE

Title of Proposed Project: _ APTEC/SEAL: Leveraging Louisiana's Industrial and Human Resources for Post-Katrina Recovery_

Principal Investigator(s): _ David Norwood, Debra Dolliver, Mike Doughty, Sanichiro Yoshida _

Institution(s) of Higher Education: _ Southeastern Louisiana University _

I. PROPOSED BUDGET:

	Support Fund Money Requested*	Institutional Match**	Private Sector/ Other Match***
1. Research Salaries	$_____	$_11,394 cash_	$_____
2. Clerical Salaries	_____	_____	_____
3. Subtotal	_____	_____	_____
4. Fringe Benefits (% of A.3)	_____	_____	_____
5. Graduate Asst.	_____	_____	_____
6. Student(s)	__75,600_____	_____	_____
7. Endowment(s)****	_____	_____	_____
8. Subtotal A	$_____	$_____	_____
B. Supportive Expenses:			
1. Travel	$_____	$_____	_____
2. Supplies	__12,000 _____	_____	_____
3. Consultants	_____	_____	_____
4. Rentals	_____	_____	_____
5. Printing	_____	_____	_____
6. Equipment	_____	_____	_____
7. Other Expenses (Identify) a.	_____	_____	_____
b.	_____	_____	_____
8. Subcontracts	_____	_____	_____
9. Subtotal B	$_____	$_____	_____
C. Overhead:			
1.	NOT PERMITTED	$__33,264 in kind	$_____
TOTAL PROJECT COST:	$__87,600_____	$__44,658_____	$_____

*In the budget justification, distinguish between funds requested from the P-KSFI principal program and the Enhancement for Severely Impacted Institutions (ESIP). Note that ESIP funds may be used only at the institutions listed in Appendix A of this RFP.

**Stipulate whether in-cash or in-kind.

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****Matching funds for the endowment of chairs may be requested through P-KSFI, though such requests must adhere to all regulations governing the BoRSF Endowed Chairs for Eminent Scholars Program.

II. BUDGET JUSTIFICATION: Project Year Two

Support Fund Money Requested

Line 6: Students - **$75,600**. Year two provides for two student managers (at a rate of $18/hour), two senior student researchers ($15/hour), and two student researchers ($12/hour) (job descriptions are included in the body of the proposal). All students will work 20 hours per week for 15 weeks during two regular semesters, and 40 hours a week for 6 weeks in the summer. This is a total of 840 hours for each student. For two managerial students, the total wages are: $30,240. For two senior research students, the total wages are: $25,200. For two research students, the total wages are: $20,160. Total funds requested for students are thus: **$75,600**.

Line B2: Supplies - **$12,000**. Funds are requested to purchase incidental and consumable supplies to support the consulting work of the student researchers. Obviously, it cannot be known in advance what supplies will be needed. A table included in the Year One Budget Justification shows examples of the sort of item that might be needed and estimates of the annual costs.

Institutional Match

Line1: Research salary: **$11,394** - Dr. Debra Dolliver will serve as Faculty SEAL Director (duties described in the body of the proposal) for the second year. She will receive 2 hours (1/6th of her academic load) of release from Southeastern as a cash match. One sixth of her salary amounts to $8,665. Including a 31.5% fringe benefit rate gives the total shown: **$11,394**

Line C1: Overhead: **$33,264** - This represents unrecovered indirect costs associated with the University's support of the research described. Using a rate of 44% of the total salaries ($75,600), we obtain the amount shown: **$33,264**.

BOARD OF REGENTS SUPPORT FUND
POST-KATRINA SUPPORT FUND INITIATIVE, FISCAL YEAR 2006-07

BUDGET
PROJECT YEAR (CIRCLE ONE):

1 2 **(3)** 4 5 COMPOSITE

Title of Proposed Project: _ APTEC/SEAL: Leveraging Louisiana's Industrial and Human Resources for Post-Katrina Recovery_

Principal Investigator(s): _ David Norwood, Debra Dolliver, Mike Doughty, Sanichiro Yoshida _

Institution(s) of Higher Education: _ Southeastern Louisiana University _

I. PROPOSED BUDGET:

	Support Fund Money Requested*	Institutional Match**	Private Sector/ Other Match***
1. Research Salaries	$_____	$_14,826 cash_	$_____
2. Clerical Salaries	_____	_____	_____
3. Subtotal	_____	_____	_____
4. Fringe Benefits (% of A.3)	_____	_____	_____
5. Graduate Asst.	_____	_____	_____
6. Student(s)	_100,800_____	_____	_____
7. Endowment(s)****	_____	_____	_____
8. Subtotal A	$_____	$_____	_____
B. Supportive Expenses:			
1. Travel	$_____	$_____	_____
2. Supplies	__16,000 _____	_____	_____
3. Consultants	_____	_____	_____
4. Rentals	_____	_____	_____
5. Printing	_____	_____	_____
6. Equipment	_____	_____	_____
7. Other Expenses (Identify) a.	_____	_____	_____
b.	_____	_____	_____
8. Subcontracts	_____	_____	_____
9. Subtotal B	$_____	$_____	_____
C. Overhead:			
1.	NOT PERMITTED	$__44,352 in kind	$_____
TOTAL PROJECT COST:	$_116,800_____	$__59,178_____	$_____

*In the budget justification, distinguish between funds requested from the P-KSFI principal program and the Enhancement for Severely Impacted Institutions (ESIP). Note that ESIP funds may be used only at the institutions listed in Appendix A of this RFP.

**Stipulate whether in-cash or in-kind.

***The budget page(s) must reflect and the budget justification page(s) must explain any external funds that are claimed in the proposal. These funds must be itemized and their expenditure accounted for in the same manner as Support Fund money and institutional match. Refer to Section III.G of this RFP for details on matching requirements.

****Matching funds for the endowment of chairs may be requested through P-KSFI, though such requests must adhere to all regulations governing the BoRSF Endowed Chairs for Eminent Scholars Program.

II. BUDGET JUSTIFICATION: Project Year Three

Support Fund Money Requested

Line 6: Students - **$100,800.** Year three provides for two student managers (at a rate of $18/hour), four senior student researchers ($15/hour), and two student researchers ($12/hour) (job descriptions are included in the body of the proposal). All students will work 20 hours per week for 15 weeks during two regular semesters, and 40 hours a week for 6 weeks in the summer. This is a total of 840 hours for each student. For two managerial students, the total wages are: $30,240. For four senior research students, the total wages are: $50,400. For two research students, the total wages are: $20,160. Total funds requested for students are thus: **$100,800.**

Line B2: Supplies - **$16,000.** Funds are requested to purchase incidental and consumable supplies to support the consulting work of the student researchers. Obviously, it cannot be known in advance what supplies will be needed. A table included in the Year One Budget Justification shows examples of the sort of item that might be needed and estimates of the annual costs.

Institutional Match

Line1: Research salary: **$14,826 -** Dr. Michael Doughty will serve as Faculty SEAL Director (duties described in the body of the proposal) for the third year. He will receive 2 hours ($1/6^{th}$ of his academic load) of release from Southeastern as a cash match. One sixth of his salary amounts to $11,147. Including a 33% fringe benefit rate gives the total shown: **$14,826**

Line C1: Overhead: **$44,352** - This represents unrecovered indirect costs associated with the University's support of the research described. Using a rate of 44% of the total salaries ($100,800), we obtain the amount shown: **$44,352.**

BOARD OF REGENTS SUPPORT FUND
POST-KATRINA SUPPORT FUND INITIATIVE, FISCAL YEAR 2006-07

BUDGET
PROJECT YEAR (CIRCLE ONE):

1 2 3 **(4)** 5 COMPOSITE

Title of Proposed Project: _ APTEC/SEAL: Leveraging Louisiana's Industrial and Human Resources for Post-Katrina Recovery_

Principal Investigator(s): _ David Norwood, Debra Dolliver, Mike Doughty, Sanichiro Yoshida _

Institution(s) of Higher Education: _ Southeastern Louisiana University _

I. PROPOSED BUDGET:

	Support Fund Money Requested*	Institutional Match**	Private Sector/ Other Match***
1. Research Salaries	$_____	$_14,690 cash_	$_____
2. Clerical Salaries	_____	_____	_____
3. Subtotal	_____	_____	_____
4. Fringe Benefits (% of A.3)	_____	_____	_____
5. Graduate Asst.	_____	_____	_____
6. Student(s)	_100,800_____	_____	_____
7. Endowment(s)****	_____	_____	_____
8. Subtotal A	$_____	$_____	_____
B. Supportive Expenses:			
1. Travel	$_____	$_____	_____
2. Supplies	__16,000 _____	_____	_____
3. Consultants	_____	_____	_____
4. Rentals	_____	_____	_____
5. Printing	_____	_____	_____
6. Equipment	_____	_____	_____
7. Other Expenses (Identify) a.	_____	_____	_____
b.	_____	_____	_____
8. Subcontracts	_____	_____	_____
9. Subtotal B	$_____	$_____	_____
C. Overhead:			
1.	NOT PERMITTED	$__44,352 in kind	$_____
TOTAL PROJECT COST:	$_116,800_____	$__59,042_____	$_____

*In the budget justification, distinguish between funds requested from the P-KSFI principal program and the Enhancement for Severely Impacted Institutions (ESIP). Note that ESIP funds may be used only at the institutions listed in Appendix A of this RFP.

**Stipulate whether in-cash or in-kind.

***The budget page(s) must reflect and the budget justification page(s) must explain any external funds that are claimed in the proposal. These funds must be itemized and their expenditure accounted for in the same manner as Support Fund money and institutional match. Refer to Section III.G of this RFP for details on matching requirements.

****Matching funds for the endowment of chairs may be requested through P-KSFI, though such requests must adhere to all regulations governing the BoRSF Endowed Chairs for Eminent Scholars Program.

II. BUDGET JUSTIFICATION: Project Year Four

Support Fund Money Requested

Line 6: Students - **$100,800**. Year three provides for two student managers (at a rate of $18/hour), four senior student researchers ($15/hour), and two student researchers ($12/hour) (job descriptions are included in the body of the proposal). All students will work 20 hours per week for 15 weeks during two regular semesters, and 40 hours a week for 6 weeks in the summer. This is a total of 840 hours for each student. For two managerial students, the total wages are: $30,240. For four senior research students, the total wages are: $50,400. For two research students, the total wages are: $20,160. Total funds requested for students are thus: **$100,800**.

Line B2: Supplies - **$16,000**. Funds are requested to purchase incidental and consumable supplies to support the consulting work of the student researchers. Obviously, it cannot be known in advance what supplies will be needed. A table included in the Year One Budget Justification shows examples of the sort of item that might be needed and estimates of the annual costs.

Institutional Match

Line1: Research salary: **$14,690** - Dr. Sanichiro Yoshida will serve as Faculty SEAL Director (duties described in the body of the proposal) for the fourth year. He will receive 2 hours ($1/6^{th}$ of his academic load) of release from Southeastern as a cash match. One sixth of his salary amounts to $10,922. Including a 34.5% fringe benefit rate gives the total shown: **$14,690**

Line C1: Overhead: **$44,352** - This represents unrecovered indirect costs associated with the University's support of the research described. Using a rate of 44% of the total salaries ($100,800), we obtain the amount shown: **$44,352**.

(Form 3-P-KSFI, 1/2007)

BOARD OF REGENTS SUPPORT FUND
POST-KATRINA SUPPORT FUND INITIATIVE, FISCAL YEAR 2006-07

BUDGET
PROJECT YEAR (CIRCLE ONE):

1 2 3 4 **(5)** COMPOSITE

Title of Proposed Project: _ APTEC/SEAL: Leveraging Louisiana's Industrial and Human Resources for Post-Katrina Recovery_

Principal Investigator(s): _ David Norwood, Debra Dolliver, Mike Doughty, Sanichiro Yoshida _

Institution(s) of Higher Education: _ Southeastern Louisiana University _

I. PROPOSED BUDGET:

	Support Fund Money Requested*	Institutional Match**	Private Sector/ Other Match***
1. Research Salaries	$_____	$_15,412 cash_	$_____
2. Clerical Salaries	_____	_____	_____
3. Subtotal	_____	_____	_____
4. Fringe Benefits (% of A.3)	_____	_____	_____
5. Graduate Asst.	_____	_____	_____
6. Student(s)	_100,800_____	_____	_____
7. Endowment(s)****	_____	_____	_____
8. Subtotal A	$_____	$_____	_____
B. Supportive Expenses:			
1. Travel	$_____	$_____	_____
2. Supplies	__16,000 _____	_____	_____
3. Consultants	_____	_____	_____
4. Rentals	_____	_____	_____
5. Printing	_____	_____	_____
6. Equipment	_____	_____	_____
7. Other Expenses (Identify)			
a.	_____	_____	_____
b.	_____	_____	_____
8. Subcontracts	_____	_____	_____
9. Subtotal B	$_____	$_____	_____
C. Overhead:			
1.	NOT PERMITTED	$__44,352 in kind	$_____
TOTAL PROJECT COST:	$_116,800_____	$__59,764_____	$_____

*In the budget justification, distinguish between funds requested from the P-KSFI principal program and the Enhancement for Severely Impacted Institutions (ESIP). Note that ESIP funds may be used only at the institutions listed in Appendix A of this RFP.

**Stipulate whether in-cash or in-kind.

***The budget page(s) must reflect and the budget justification page(s) must explain any external funds that are claimed in the proposal. These funds must be itemized and their expenditure accounted for in the same manner as Support Fund money and institutional match. Refer to Section III.G of this RFP for details on matching requirements.

****Matching funds for the endowment of chairs may be requested through P-KSFI, though such requests must adhere to all regulations governing the BoRSF Endowed Chairs for Eminent Scholars Program.

II. BUDGET JUSTIFICATION: Project Year Five

Support Fund Money Requested

Line 6: Students - **$100,800**. Year five provides for two student managers (at a rate of $18/hour), four senior student researchers ($15/hour), and two student researchers ($12/hour) (job descriptions are included in the body of the proposal). All students will work 20 hours per week for 15 weeks during two regular semesters, and 40 hours a week for 6 weeks in the summer. This is a total of 840 hours for each student. For two managerial students, the total wages are: $30,240. For four senior research students, the total wages are: $50,400. For two research students, the total wages are: $20,160. Total funds requested for students are thus: **$100,800**.

Line B2: Supplies - **$16,000**. Funds are requested to purchase incidental and consumable supplies to support the consulting work of the student researchers. Obviously, it cannot be known in advance what supplies will be needed. A table included in the Year One Budget Justification shows examples of the sort of item that might be needed and estimates of the annual costs.

Institutional Match

Line1: Research salary: **$15,412** - Dr. David Norwood will serve as Faculty SEAL Director (duties described in the body of the proposal) for the fifth year. He will receive 2 hours ($1/6^{th}$ of his academic load) of release from Southeastern as a cash match. One sixth of his salary amounts to $11,332. Including a 36% fringe benefit rate gives the total shown: **$15,412**

Line C1: Overhead: **$44,352** - This represents unrecovered indirect costs associated with the University's support of the research described. Using a rate of 44% of the total salaries ($100,800), we obtain the amount shown: **$44,352**.

BOARD OF REGENTS SUPPORT FUND
POST-KATRINA SUPPORT FUND INITIATIVE, FISCAL YEAR 2006-07

BUDGET
PROJECT YEAR (CIRCLE ONE):

1 2 3 4 5 **(COMPOSITE)**

Title of Proposed Project: _ APTEC/SEAL: Leveraging Louisiana's Industrial and Human Resources for Post-Katrina Recovery_

Principal Investigator(s): _ David Norwood, Debra Dolliver, Mike Doughty, Sanichiro Yoshida _

Institution(s) of Higher Education: _ Southeastern Louisiana University _

I. PROPOSED BUDGET:

	Support Fund Money Requested*	Institutional Match**	Private Sector/ Other Match***
1. Research Salaries	$_____	$_68,914 cash_	$_____
2. Clerical Salaries	_____	_____	_____
3. Subtotal	_____	_____	_____
4. Fringe Benefits (% of A.3)	_____	_____	_____
5. Graduate Asst.	_____	_____	_____
6. Student(s)	_428,400_____	_____	_____
7. Endowment(s)****	_____	_____	_____
8. Subtotal A	$_____	$_____	_____
B. Supportive Expenses:			
1. Travel	$_____	$_____	_____
2. Supplies	__68,000 _____	_____	_____
3. Consultants	_____	_____	_____
4. Rentals	_____	_____	_____
5. Printing	_____	_____	_____
6. Equipment	_____	_____	_____
7. Other Expenses (Identify) a.	_____	_____	_____
b.	_____	_____	_____
8. Subcontracts	_____	_____	_____
9. Subtotal B	$_____	$_____	_____
C. Overhead:			
1.	NOT PERMITTED	$_188,496 in kind	$_____
TOTAL PROJECT COST:	$_496,400_____	$_257,410_____	$_____

*In the budget justification, distinguish between funds requested from the P-KSFI principal program and the Enhancement for Severely Impacted Institutions (ESIP). Note that ESIP funds may be used only at the institutions listed in Appendix A of this RFP.

**Stipulate whether in-cash or in-kind.

***The budget page(s) must reflect and the budget justification page(s) must explain any external funds that are claimed in the proposal. These funds must be itemized and their expenditure accounted for in the same manner as Support Fund money and institutional match. Refer to Section III.G of this RFP for details on matching requirements.

****Matching funds for the endowment of chairs may be requested through P-KSFI, though such requests must adhere to all regulations governing the BoRSF Endowed Chairs for Eminent Scholars Program.

II. BUDGET JUSTIFICATION: Project Composite

Support Fund Money Requested

Line 6: Students - **$428,400**. This proposal provides for student managers (at a rate of $18/hour), senior student researchers ($15/hour), and student researchers ($12/hour) (job descriptions are included in the body of the proposal). The number of student entrepreneurs starts at four (4) the first year, growing to eight (8) the third year and stabilizing there for the final two years. Each year, all students will work 20 hours per week for 15 weeks during two regular semesters, and 40 hours a week for 6 weeks in the summer. This is a total of 840 hours for each student. For managerial students, the total wages for all five years are $43,200 for summers and $108,000 for regular semesters. For senior research students, the total wages for all five years are $50,400 for summers and $126,000 for regular semesters. For research students, the total wages for all five years are $28,800 for summers and $72,000 for regular semesters. Total funds requested for students are thus: **$428,400**.

Line B2: Supplies - **$68,000**. Funds are requested to purchase incidental and consumable supplies to support the consulting work of the student researchers. Obviously, it cannot be known in advance what supplies will be needed. A table included in the Year One Budget Justification shows examples of the sort of item that might be needed and estimates of the annual costs. Funds of $2000 per student per year are requested. This results in $8000 for Year One, $12,000 for Year Two, and $16,000 each year for years Three, Four nad Five. The total requested is: **$68,000**.

Institutional Match

Line1: Research salary: **$68,914 -** Each of the co-Investigators will as Faculty SEAL Director (duties described in the body of the proposal) for one year on a rotating basis. Each will receive 2 hours ($1/6^{th}$ of their academic load) of release from Southeastern as a cash match. One sixth of the salary amounts to $21,018 (Norwood - will serve first and last year), $8665 (Dolliver - second year), $11,147 (Doughty - third year) and $10,922 (Yoshida - fourth year. Including a fringe benefit rate that grows from 30% (year one) to 36% (year five) gives the total shown: **$68,914**

Line C1: Overhead: **$188,496** - This represents unrecovered indirect costs associated with the University's support of the research described. Using a rate of 44% of the total salaries ($428,400), we obtain the amount shown: **$188,496**.

Biographical Sketches

BIOGRAPHICAL SKETCH			
Provide the following information for the key personnel and consultants and collaborators. Begin with the principal investigator/program director. Photocopy this page for each person.			
Name David Norwood		Position Title Associate Professor of Physics	
EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training.			
INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY
Lamar University, Beaumont Texas	BS	1984	Physics
North Texas State University	MS	1987	Physics
University of North Texas (name changed)	Ph. D.	1994	Physics

RESEARCH AND PROFESSIONAL EXPERIENCE:

Aug. 1997-present Associate Professor of Physics – Southeastern Louisiana University
Aug. 1997-Aug. 2003 Assistant Professor of Physics – Southeastern Louisiana University

Oct. 1994 to Aug. 1997 Post-Doctoral research associate – Tulane University

Refereed Journal Articles:

"Enzymatic degradation of polyester urethanes studied by multi-angle laser light scattering" D. Himel, D. P. Norwood and W. F. Reed, Chapter 23 in Biocatalysis in Polymer Science, (American Chemical Society, Washington, D.C., 2002).

"On-Line Comparison Of Single Capillary And Bridge Viscosimetric Detectors For Size-Exclusion Chromatography", D. P. Norwood, and Wayne. F. Reed, International Journal of Polymer Analysis and Characterization, **4**, 99-132 (1997)

"Luminescence-based test of fiber-optic continuity", D. P. Norwood, C. Vinches, J. F. Anderson and W. F. Reed, Applied Optics, **36**, 2529-32 (1997)

"Short-period transient grating measurements of perpendicular over-barrier diffusion in GaAs/AlGaAs multiple quantum wells", D. P. Norwood, A. L. Smirl, and H.-E. Swoboda, J. Appl. Phys., **77**, 1113-19 (1995)

"Characterization of a high gain picosecond flashlamp-pumped Nd:YAG regenerative amplifier", M. D. Dawson, W. A. Schroeder, D. P. Norwood, A. L. Smirl, J. Weston, R. N. Ettelbrick, R. Aubert, Optics Letters, **13**, 990 (1988) [Reviewed in Optics News, October 1988, p 36]

COLLABORATORS:

Newton Hilliard	Professor of Biochemistry	Eastern New Mexico University
Gary Howard	Professor of Biology	Southeastern Louisiana University
Edson Minatti	Professor of Chemistry	Universidade Federal de Santa Caterina
Wayne F. Reed	Professor of Physics	Tulane University
Sanichiro Yoshida	Professor of Physics	Southeastern Louisiana University

GRADUATE AND POSTDOCTORAL ADVISORS

Arthur L. Smirl	Professor of Physics	University of Iowa
Thomas F. Boggess	Professor of Physics	University of Iowa
Wayne F. Reed	Professor of Physics	Tulane University

BIOGRAPHICAL SKETCH			
Provide the following information for the key personnel and consultants and collaborators. Begin with the principal investigator/program director. Photocopy this page for each person.			
Name Debra D. Dolliver		Position Title Assistant Professor	
EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training.			
INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY
University of North Texas, Denton, TX	Bachelor of Arts	1985	English
Texas Woman's University, Denton, TX	Bachelor of Science	1994	Chemisty
Texas Woman's University Denton, TX	Master of Science	1997	Organic Chemistry
University of North Texas, Denton, Texas	Ph.D.	2001	Organic Chemistry

RESEARCH AND PROFESSIONAL EXPERIENCE: Starting with present position, list, in reverse chronological order, previous relevant employment, experience, and honors. Key personnel includes the principal investigator and any other individuals who participate in the development or execution of the project. Key personnel typically will include all individuals with doctoral or other professional degrees, but in some projects will include individuals at the masters or baccalaureate level provided they contribute in a substantive way to the development or execution of the project. Include present membership on any Federal Government public advisory committee. List, in reverse chronological order, the titles, all authors, and complete references to pertinent publications during the past five years and to representative earlier publications pertinent to this application. DO NOT EXCEED TWO PAGES.

Relevant Employment:

Assistant Professor, Southeastern Louisiana University, Organic Chemistry (08/2003-present)
Instructor, Southeastern Louisiana University (09/2001-08/2003)
Teaching Assistant, University of North Texas (09/1996-08/2001)
Adjunct Lecturer, Texas Woman's University (09/1997-08/2000)
Teaching Assistant, Texas Woman's University (09/1994-08/1996)

Relevant Research Projects:

Synthesis of novel surfactants to use in the synthesis of bio-compatible nanoparticles - Collaborative project of Dr. Dolliver with Dr. Cristina Sabliov at Louisiana State University, Department of Biological Engineering, and Dr. David Norwood, Southeastern Louisiana University, Department of Chemistry & Physics.

Synthesis of azido-oxime ethers - Collaborative project of Dr. Dolliver with Dr. Artie S. McKim, Gaylord Chemical Corporation, Bogalusa, Louisiana.

New synthetic routes to oxime ethers of controlled stereochemistry - Dr. Dolliver

Nucleophilic substitution reactions of N-alkoxyimidoyl fluorides by carbon nucleophiles -- Collaborative project of Dr. Dolliver with Dr. James Johnson, Texas Woman's University, Department of Chemistry & Physics, and Dr. Frank Fronczek, Louisiana State University, Department of Chemistry.

Synthesis of novel bisamidoximes -- Collaborative project of Dr. Dolliver with Dr. James Johnson, Texas Woman's University, Department of Chemistry & Physics, and Dr. Frank Fronczek, Louisiana State University, Department of Chemistry.

Relevant Publications:

1. D. D. Dolliver, D. B. Delatte, J. E. Johnson, J. E. Rowe, F. R. Fronczek, "Nucleophilic Substitution Reactions of O-Alkylarylhydroximoyl Fluorides by Carbon Nucleophiles," **in preparation**.

2. D. D. Dolliver, S. Smith, K. D. Patel, T. Thomas, J. Chagnard, J. E. Johnson, A. S. McKim, J. E. Rowe, F. R. Fronczek, "The Preparation of *N*-Alkoxyimidoyl Iodides and a comparison of their structure to other N-alkoxyimines," **in preparation.**
3. J. E. Johnson, C. Carvallo, D. D. Dolliver, N. Sanchez, V. Garza, D. C. Canseco, G. L. Eggleton, F. R. Fronczek, "Bisamidoximes: Synthesis and Complexation with Iron (III)," **in preparation.**
4. J. E. Johnson, L. Lu, H. Dai, D. D. Dolliver, F. R. Fronczek, "Synthesis and Characterization of α,β-Unsaturated Hydroximoyl Chlorides and Hydroximates," *Aust. J. Chem.*, **2006**, *59*, 439-444.
5. J. E. Johnson, D. C. Canseco, D. D. Dolliver, J. E. Rowe, and F. R. Fronczek, "Synthesis, Characterization, and Structural Analysis of Ethyl (*2Z*)-3-(4-Chlorophenyl)-2-cyano-3-(methoxyamino)prop-2-enoate, *J. Chem. Cryst.*, **2006**, *36*(10), 667-672.
6. J.E. Johnson, D. D. Dolliver, L. Yu, D. C. Canseco, M. A. McAllister, and J.E. Rowe, "Mechanism of Methoxide Ion Substitution in the Z and *E* Isomers of O-Methylbenzohydroximoyl Halides," *J. Org. Chem.*, **2004**, *69*, 2741-2749.
7. J. E. Johnson, N. M. Morales, A. Gorczyca, D. D. Dolliver, and M. A. McAllister, "Mechanisms of Acid-Catalyzed *Z/E* Isomerization of Imines," *J. Org. Chem.*, **2001**, *66*, 7979-7985.
8. J. E. Rowe, K. Lee, D. D. Dolliver, and J. E. Johnson, "The Preparation of Imidoyl Fluorides," *Aust. J. Chem.* **1999**, *52*, 807-811.
9. J. E. Johnson, S. M. Dutson, D. D. Dolliver, S. L. Todd, and M. R. Hotema, "Mechanism of Bimolecular Substitution Reactions of Hydroximoyl Halides with Amines in Acetonitrile Solution," *J. Phys. Org. Chem.*, **1995**, *8*, 344-350.

Honors

2006-2009	Louisiana Board of Regents Research Competitiveness Grant, $90,196.00.
2006-2008	American Chemical Society Petroleum Research Grant Type G, $35,000.00.
2001, 2000, 1999	Named Outstanding Teaching Assistant in Upper Level Chemistry Labs, University of North Texas
1998	George Vaughn Memorial Award for Outstanding First and Second Year Graduate Student, University of North Texas
1995, 1994	Willis Clark Scholarship, Texas Woman's University
1994	Magna Cum Laude graduate, B. S. Chemistry, Texas Woman's University
1993, 1992	Willis Clark Scholarship, Texas Woman's University
1985	Magna Cum Laude graduate, B. A. English, University of North Texas

BIOGRAPHICAL SKETCH			
Provide the following information for the key personnel and consultants and collaborators. Begin with the principal investigator/program director. Photocopy this page for each person.			
Name: Sanichiro Yoshida		Position: Title Associate Professor of Physics	
EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training.			
INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY
Keio University Keio University Keio University	B.A. M.S. Ph.D.	1980 1983 1986	Electrical Engineering Electrical Engineering Applied Physics

RESEARCH AND PROFESSIONAL EXPERIENCE: Starting with present position, list, in reverse chronological order, previous relevant employment, experience, and honors. Key personnel includes the principal investigator and any other individuals who participate in the development or execution of the project. Key personnel typically will include all individuals with doctoral or other professional degrees, but in some projects will include individuals at the masters or baccalaureate level provided they contribute in a substantive way to the development or execution of the project. Include present membership on any Federal Government public advisory committee. List, in reverse chronological order, the titles, all authors, and complete references to pertinent publications during the past five years and to representative earlier publications pertinent to this application. DO NOT EXCEED TWO PAGES.

Southeastern Louisiana University, Department of Chemistry and Physics, January 2001 – present

(1) Teach introductory and advanced physics courses to undergraduates.
(2) Pursue LIGO related and material science research. Mentor several physics and computer science major undergraduates.

University of Florida, Physics Department, Laser Interferometer Gravitational wave Observatory (LIGO) project, May 1997- January 2001

(1) Led installation of input optics in the LIGO Hanford and Livingston Observatory.
(2) Conducted high optical power test on LiNbO3-based electro-optical phase modulators, TGG-based Faraday rotators, and transmissive optics used in LIGO interferometers.

R & D Center for Appl. Phys., Indonesian Institute of Sciences, Dec. 1993 - April 1997

(1) Led optical interferometry research division.
(2) Performed research on application of electronic-speckle pattern interferometry to deformation analysis.

Hutech Research Laboratory, Director of Technical Division, Oct. 1990 - Nov. 1993

(1) Developed a pulsed, solid state laser system based on a Cr4+:YAG crystal under collaboration with General Physics Institute, Russian Academy of Sciences (RAS).
(2) Performed research on gauge theory applied to deformation of solid-state materials under collaboration with the Institute of Strength Physics, Siberian branch of RAS.

Industrial Research Institute, Project Leader for Chemical Laser Group, 1986-Sep. 1990

(1) Developed 1 kW cw chemical oxygen iodine lasers.
(2) Discovered new visible/near infrared emission lines from singlet oxygen.

Keio Univ. 3-14-1 Hiyoshi, Kohoku, Yokohama, 223 Japan, Gaseous Electronics Lab. (1982-1983), Leader for Laser Application Group, (1983-1986)

(1) Measured/calculated electron transport coefficients in rare-gas/metal-vapor mixtures to determine cross-sections of various types of electron-molecule collisions.
(2) Initiated a research program on experimental study of triggering lightning with high power laser radiation.

Joint Institute for Laboratory Astrophysics, Univ. of Colorado, Boulder CO. 80309, Visiting Scientist, 1981-1982 and Dec. 1984- Feb. 1985
Under the supervision of Dr. A.V. Phelps, performed Boltzmann analyses for N_2 gas at very high E/N taking into account the secondary-election energy distribution.

Publications (2003 - 2007)

1. S. Yoshida and Robert L. Rourks, "A method to increase fringe contrast in electronic speckle pattern interferometry", submitted to "Optical Engineering" (2007)
2. S. Yoshida, Experimental Mechanics "Report on the organization of NANOMEC06 Symposium" (2007) [in Japanese]
3. T. Findley, S. Yoshida and D. P. Norwood, "Analysis of the Pendular and Pitch Motions of a Driven Three-Dimensional Pendulum", Euro. J. Phys. 28, 331-340 (2007)
4. K. Gomi, K. Ichinose, S. Yoshida, H. Ishii and Y. Niitsu, "Physical Meaning of Optical Interferometric Band Pattern Front on Relations between the Pattern and Lüders Lines", Japanese Journal of Experimental Mechanics, 6, 4, 418-422 (2006)
5. S. Yoshida and T. Findley, "Analysis of a simple pendulum driven at its suspension point," Euro. J. Phys. 26 493-499 (2005)
6. S. Yoshida, "Physics Mesomechanics as a field theory", J. Physical Mesomechanics, 8, 5, 15-20, Anniversary issue (2005)
7. K. Ichinose, S. Yoshida, K. Gomi, K. Taniuchi, K. Fukuda and H. Ishii, "Detection of Crack Initiation by Observation of Free Surface Condition", Journal of Journal of ASTM (American Society for Mechanical Engineers) International, 35th Special Technical Publication (2005)
8. S. Yoshida, H. Ishii, K. Ichinose, K. Gomi and K. Taniuchi, "An optical interferometric band as an indicator of plastic deformation front," J. Appl. Mech., 72, 792-794 (2005)
9. S. Yoshida, H. Ishii, K. Ichinose, K. Gomi and K. Taniuchi, "Observation of Optical Interferometric Band Structure Representing Plastic Deformation Front under Cyclic Loading", J. Jap. Appl. Phys., 43, 5451-5454 (2004)
10. S. Yoshida, "Dynamics of plastic deformation and plastic deformation charge", Physical mesomechanics, 6, 4, 33-38 (2003)
11. S. Yoshida, D. H. Reitze, D. B. Tanner and J. D. Mansell, "Method for measuring small optical absorption coefficients with use of a Shack-Hartmann wave-front detector", Appl. Opt. 42, no. 24, 4835-4840 (2003)
12. S. Yoshida, "Introduction to Mesomechanics", Science of machine, 55, No.5 (2003) [in Japanese]

Publications (- 2002)

1. S. Yoshida and S. Toyooka, "Field theoretical interpretation on dynamics of plastic deformation", J. Phys., Condens. Matter 13, 6741-6757 (2001)
2. S. Yoshida, "Consideration on fracture of solid-state materials" Phys. Lett. A, 270, 320-325. (2000)
3. S. Yoshida et al. "Observation of plastic deformation wave in a tensile-loaded aluminum-alloy" Phys. Lett. A, 251, 54-60 (1999)
4. S. Yoshida et al. "Optical interferometric technique for deformation analysis" Optics Express, 2 (focused issue on "Material testing using optical techniques") 516 - 530 (1998)

Curriculum Vitae-Michael B. Doughty

(a) Professional Preparation

University of New Orleans, New Orleans, La	-	Major in Biology
Louisiana State University, Baton Rouge, La	B.S.	Biochemistry, 78
Louisiana State University, Baton Rouge, La	Ph.D.	Biochemistry with Organic minor, 82
Rockefeller University, New York, NY	Post Doc	Bioorganic Chemistry & Biochemistry, 82-86

(b) Appointments

2001-present	Associate Professor of Biochemistry (Professor applied for in Spring 2006, approved through University President), Department of Chemistry and Physics, Southeastern Louisiana University, Hammond, LA
1998-2001	Professor, Department of Medicinal Chemistry, The University of Kansas, Lawrence, KS.
1993-1998	Associate Professor, Department of Medicinal Chemistry, The University of Kansas, Lawrence, KS.
1987-1993	Assistant Professor, Department of Medicinal Chemistry, The University of Kansas.
1985-1987	NIH postdoctoral fellow, The Rockefeller University, Laboratory of Bioorganic Chemistry and Biochemistry, Research Director: the late Professor E. Tom Kaiser.
1983-1985	Rockefeller Postdoctoral Fellow, The Rockefeller University, Laboratory of Bioorganic Chemistry and Biochemistry, Research Director: the late Professor E. Tom Kaiser.
1978-1982	Graduate Research and Teaching Assistant, Louisiana State University, Research Director: G.E. Risinger.

(c) Publications

Closely Related

(1). Michael B. Doughty*[1], Zac Aboudehen, Garland Anderson, Ke Li, Bob M.Moore, and Tina Poolson, Side-Chain Conformational Restriction in Template-Competitive Inhibitors of *E. coli* DNA Polymerase I Klenow Fragment: Synthesis, Structural Characterization, and Enzyme Inhibition Activity, *Nucleosides, Nucleotides, and Nucleic Acids*, **2004,** *23*, 1751 - 1765.

(2). Andreas Gille, Gerald H. Lushington, Tung-Chung Mou, Michael B. Doughty, Roger A. Johnson, and Roland Seifert, Differential Inhibition of Adenylyl Cyclase Isoforms and Soluble Guanylyl Cylcase by Purine and Pyrimidine Nucleotides, **2004,** *Journal of Biological Chemistry, 279,* 19955–19969.

(3). Andreas Gille, Katharina Wenzel-Seifert, Michael B. Doughty, and Roland Seifert, GDP affinity and order state of the catalytic site are critical for function of

xanthine nucleotide-selective $G\alpha_s$ proteins, **2003**, *Journal of Biological Chemistry*, **278**, 7822-2828.

(4). Weiying Lin, K. Li, Bob Moore II, and Michael B. Doughty, Conformational properties of template competitive HIV-1 reverse transcriptase inhibitors: Analysis of enzyme binding modes, **2003** , *Nucleosides, Nucleotides, and Nucleic Acids*, **22** (3), 283-297.

(5). Weiying Lin , Ke Li, and Michael B. Doughty, Characterization of a binding site for template-competitive inhibitors of HIV I reverse transcriptase using photolabeling derivatives, **2002**, *Bioorganic and Medicinal Chemistry*, 10, 4131-4141.

Significant

(1) B. M. Moore, R. Jalluri and M. B. Doughty, DNA Polymerase Photoprobe 2-(4-Azidophenacyl)thio-dATP Identifies the Template Binding Region of the DNA Polymerase I Klenow Fragment, *Biochemistry*, **1996**, 36, 11642-11651.

(2) B. M. Moore, K. Li and M. B. Doughty, Deoxyadenosine-based DNA polymerase photoprobes: Design, synthesis and characterization as inhibitors of DNA polymerase I Klenow fragment, *Biochemistry*, **1996**, 35, 11634-11641.

(3) M. B. Doughty and L. Hu, The contribution of helical potential to the in vitro receptor binding activity of a neuropeptide Y N-terminal deletion fragment, *Biopolymers*, **1993**, 33, 1195-1206.

(4) D. R. Benson, B. R. Hart, X. Zhu and M. B. Doughty, Design, synthesis and circular dichroism investigation of a a peptide-sandwiched mesoheme, *J. Am. Chem. Soc.*, **1995**, 117, 8502-8510.

(5) L. Hu and M. B. Doughty, Neuropeptide Y acylation chemistry in aqueous solution: Significance to synthesis of a peptide-based photoaffinity label, *Journal of Protein Chemistry*, **1994**, 13, 135-140.

(d) Synergistic Activities

NIH Area Award (Academic Research Enhancement), Michael B. Doughty, Ph.D., 2003-2006; $150,000 direct costs. This program covers the design (in part by solid phase methodologies) of DNA polymerase and Reverse Transcriptase structural probes and kinetic analysis of enzyme activity, and is designed to train undergraduates for careers in biochemical sciences.

Louisiana Board of Regents (LaBOR) Research Competitiveness Award; Collaborative arrangement with Assistant Professor Jeffrey Temple to clone, purify and develop kinetic assays for West Nile Virus RNA polymerase.

Proposal Appendices

Project Proposal – Gaylord Chemical Corporation

Project Outline *Thickening excipients and Dimethyl Sulfoxide USP, Ph. Eur.*

Introduction. Gaylord Chemical Corporation is the world's largest manufacturer of Dimethyl Sulfoxide, a solvent with applications in pharmaceutical synthesis, electronics manufacturing, and polymer production. It produces a special DMSO product which is of interest to pharmaceutical formulators, which meets FDA requirements in place for materials used both as *active ingredients*[1] and *excipients*.

This product, Dimethyl Sulfoxide USP, Ph. Eur., is relatively new to scientists that develop drug products. To encourage new development with this product and generate new commercial applications for Dimethyl Sulfoxide, it is important to offer guidance to scientists on how to work with Dimethyl Sulfoxide USP. Formulators need to know what kinds of things DMSO is used for, about its safety profile, and how it interacts with other excipients and active ingredients.

Gaylord Chemical is constantly developing new performance and use data to support its products. In past years, solubility databases were built which provided data for over 100 drugs, and 35 pharmaceutically acceptable excipient products. Gaylord Chemical can provide this information to potential users through customer visits, trade show interactions, publication, and various marketing tools (company website, distribution partners, advertising, etc.)

Gaylord Chemical would now like to generate physical properties data to support the use of Dimethyl Sulfoxide USP with pharmaceutically acceptable gelling excipients. These products are used in topical / transdermal[2] formulations and controlled release systems.[3] Although the manufacturers of these products have developed a large amount of information in water / alcohol systems, no comprehensive database of DMSO-thickener physical properties data exists. This is despite the fact that DMSO USP is potentially valuable in such products due to some useful solvent properties.

- *DMSO is often a better solvent for many actives and excipients.* The high polarity of DMSO makes it capable of stabilizing finished pharmaceutical products. Also, many drugs (as an example, proteins) have poor solubility in water/alcohol systems, and cannot be delivered in the solvents. DMSO represents a powerful alternative when other solvents fail.
- *In some cases, DMSO can increase delivery rate across human skin.* DMSO itself can penetrate the skin, and can increase delivery kinetics of some drugs into the body.

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[1] An active ingredient has pharmacological activity; excipients are inert substances that are included in drug products that play roles as vehicles, fillers, binders, etc.

[2] Topical products are applied to the skin, and deliver a drug locally; transdermal products are also applied on the skin, but deliver a drug systemically (i.e. into the bloodstream)

[3] There are many interesting types of controlled release delivery systems, which deliver a drug dose at a desired level over a given time period. Gel products are useful in orally administered mucoadhesive products, and in hydrophilic matrix capsules, as examples. A good reference on this subject is Ranade, V.; Holinger, M. *Drug Delivery Systems* CRC Press: Boca Raton, Fl (2004)

- *DMSO is less volatile than many acceptable solvents.* This can aid in increasing a formulations stability and change its delivery profile.

Project Scope. With the guidance and assistance of researchers at Southeastern Louisiana University, we would like to describe the properties of DMSO / gel mixtures which are meaningful to pharmaceutical scientists. Table one provides a list commercial samples we have obtained for the project.

Table one. Common pharmaceutically acceptable thickening agents.

Hercules	Klucel	GF Pharm	Hydroxypropylcellulose
	Klucel	LF Pharm	Hydroxypropylcellulose
	Klucel	MF Pharm	Hydroxypropylcellulose
	Klucel	HF Pharm	Hydroxypropylcellulose
	Klucel	EF Pharm	Hydroxypropylcellulose
	Klucel	JF Pharm	Hydroxypropylcellulose
	Klucel	HXF Pharm	Hydroxypropylcellulose
Noveon	Carbopol	940 NF	Carbomer
	Carbopol	934 PNF	Carbomer
	Carbopol	941 NF	Carbomer
	Carbopol	980 NF	Carbomer
	Carbopol	934 NF	Carbomer
	Carbopol	981 NF	Carbomer
	Carbopol	1342 NF	Carbomer
	Carbopol	71G NF	Carbomer
	Carbopol	974P NF	Carbomer
	Carbopol	Ultrez 10 NF	Carbomer
	Carbopol	971P NF	Carbomer
Dow	Ethocel	Standard 10	Ethylcellulose
	Polyox	WSR N10 NF	poly(ethylene oxide)
	Methocel	A4M	Methylcellulose
	Methocel	E5 LV	Hydroxypropylmethylcellulose
	Methocel	E3 LV	Hydroxypropylmethylcellulose
	Methocel	E4M	Hydroxypropylmethylcellulose
	Ethocel	Standard 4 NF	Ethylcellulose
FMC Biopolymer	Gelcarin	GP 911NF	Carageenan
			Lecithin

Some guidance is available from gel product manufacturers as to specific tests for this work. Based on what is available, Table two provides some suggested tests for the project:

Table Two. Suggested experiments.

test	*property*	*...as a function of*	*test method*	*constant variable*
1	viscosity	pH	brookfield viscometer	polymer loading
2	viscosity	polymer loading	brookfield viscometer	pH
3	viscosity	ion content	brookfield viscometer	pH, polymer loading
4	mechanical shear	shear time	?	pH,polymer loading
5	temperature stability	viscosity	brookfield viscometer	pH, polymer loading
6	thixotrophy	?	?	?
7	bioadhesion		?	
	others?			

Ideally, it would be best to produce property data for all the products in a format similar to Figure 1. Because there are many available products, it might make sense to choose representative materials from each class.

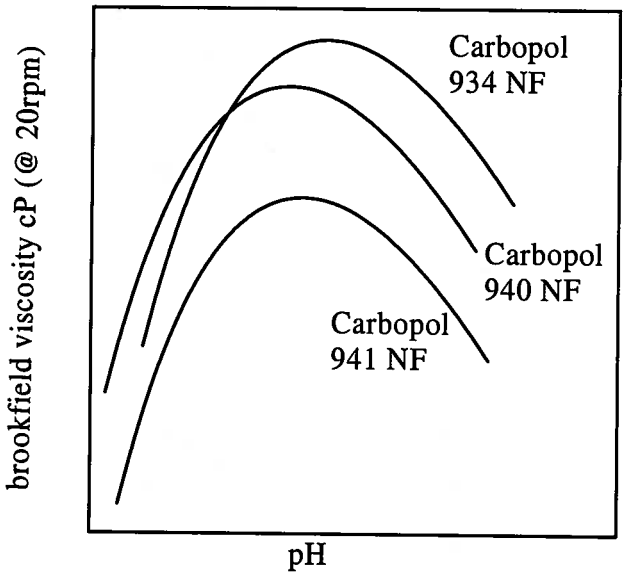


Figure one. Carbopol viscosity as a function of pH, in DMSO USP (20C, 0.5% polymer loading)
Note: This data is not real. The figure was generated for purposes of Illustration only.

Once the test set has been defined and the products for testing identified, Gaylord and SLU can develop the test methods together. Gaylord Chemical will supply the materials that are required.

Objectives. The data produced may be used in the following ways.

- Presentation at the 2007 National Meeting of the Controlled Release Society, July 22, 2007)
- Joint scientific publication
- Included in Gaylord Marketing Materials (product literature, Webpage tech package)
- Offered to manufacturers of Gel products, for inclusion in product literature

Student Researchers involved in the project will benefit by:

- Professional development resulting from interaction with Gaylord scientists
- Publication opportunities in appropriate scientific / trade publications
- Presentation opportunities (National Meetings of the AAPS, ACS, CRS)

Project Proposal – V-LABS

The thrust of the research proposed between Dr. David P. Norwood of Southeastern Louisiana University and V-LABS, Covington, LA. is that collaborators at V-LABS, inc., will provide samples of starches purified and fractionated by the membrane fractionation technique and the PI and his undergraduate colleagues will provide characterization of those samples, using the techniques of light-scattering, both static and dynamic, viscometry and high performance liquid chromatography. Measurements will be made as solution parameters are varied (e.g., ionic strength, pH, polymer concentration). In addition, V-LABS personnel have committed to provide access to their facilities and training to the undergraduate researchers on the purification and fractionation techniques. As a consequence, the purification techniques can be refined with the benefit of the extensive characterization and the characterization techniques will be challenged by access to a broad array of polysaccharide samples. Finally, the undergraduate researchers will benefit by the spectrum of training they will receive – sophisticated characterization techniques based upon light scattering performed in an academic environment, along with purification and fractionation techniques (as well as more straightforward characterization techniques typical of an industrial environment).

By virtue of the highly effective separations possible with modern membranes and the abilities to characterize these products so effectively with the laser light scattering applications described, the basic physics and chemistry of this proposal has broad implications for the food, pharmaceutical, water purification, and specialty chemicals manufacturing sectors such as humectants or anti-icing polymers.

Letters of Support

Letter of Support from Gaylord Chemical Corporation

Gaylord Chemical Corporation

Your Global Source for DMSO Solutions!

Dear Sir / Madam:

As a Louisiana company, Gaylord Chemical Corporation is excited by the prospect of working with University undergraduate research teams to develop future researchers, solve problems that face Industry, and create opportunities for all involved.

The benefits to such collaboration seem clear:

Student researchers can build relationships with chemical companies in Louisiana. This kind of interaction provides students with options which encourage them to remain in the area – thus fortifying the local economy. Working on projects of interest to the chemical industry can provide insight to students that is a strong complement to the Undergraduate experience.

An Industrial Partner can benefit from the 'state-of-the-art' knowledge base that Universities foster, and the ability to advance technological business objectives. As importantly, Universities such as Southeastern Louisiana University (SELU) provide a important pool of research talent for positions that are always tough to fill. Gaylord Chemical Corporation is grateful for this, and has hired two SELU graduates into research and analytical positions in the past three years.

Undergraduate research advisors such as Drs. Norwood and Dolliver also have the ability to advance research goals through participation in projects with an industrial partner. Exposure to industrial project ideas can offer new investigational avenues for exploration, and offers research advisors the unique ability to offer students a rich combination of industrial and academic experience.

To exemplify the way in which we could work together, I originally learned of this opportunity by discussing some current project needs with Drs. Dolliver and Norwood. We produce an excipient for pharmaceutical applications (Dimethyl Sulfoxide, USP) and need to produce physical properties data which described its use in gel formulations. As polymer physics is Dr. Norwood's specialty, it made sense to go to him for ideas in an area which is not part of my background. It became evident that a joint development project could help both of us.

- Students directed by Dr. Norwood could benefit from the experience of performing the needed research. Findings from this work should lead to the type of publication and presentation opportunities that are an important part of a scientist's professional development.

- Gaylord Chemical intends to promote this data to pharmaceutical formulators at the July 2007 Annual Meeting of the Controlled Release Society. This type of information builds credibility with a sophisticated scientific audience, and is essential in developing new opportunities for Dimethyl Sulfoxide, USP. It will also be used in a growing product formulary which is used for Marketing purposes on an ongoing basis.

In closing, we see many ways in which a relationship with APTEC/SEAL could benefit individual students, University Research Advisors, Louisiana Companies like Gaylord Chemical Corporation, and the State's economy. If you would like to discuss the possibilities further, please feel free to contact me.

Sincerely

A. S. McKim Ph.D MBA
Technical Director, Gaylord Chemical Corporation
209 Industrial Parkway, Bogalusa LA 70433 USA
+001 (985) 732.6308 amckim@gaylordchem.com

Contract Work Plan

APPENDIX B

Work Plan and Time Lines

Year 1:
Recruit students into SEAL program – to include outreach in local high schools
Attract business clients

Year 2:
Recruit students into SEAL program – to include outreach in local high schools
Attract business clients
Promote SEAL program to Universities in APTEC collaboration

Year 3:
Recruit students into SEAL program – to include outreach in local high schools
Attract business clients – to include, at this stage, PAID contracts from business clients
Promote SEAL program to Universities in APTEC collaboration

Year 4:
Recruit students into SEAL program – to include outreach in local high schools
Attract business clients – to include, at this stage, PAID contracts from business clients
Establish SEAL programs at Universities in APTEC collaboration
Promote SEAL program to Universities outside APTEC collaboration

Year 5:
Recruit students into SEAL program – to include outreach in local high schools
Attract business clients – PAID contracts from business clients comparable to BOR funds
Establish SEAL programs at Universities outside APTEC collaboration

Activity	Year 1	Year 2	Year 3	Year 4	Year 5
Recruit students					
Attract clients					
Attract paying clients					
Promote SEAL to APTEC schools					
Promote SEAL to non-APTEC schools					
Establish SEAL at					

APTEC schools					
Establish SEAL at non-APTEC schools					
Self sufficiency					

Scope of Services

a. Goals and Objectives

At the end of the five-year grant period, we propose to have a self-sustaining program in which undergraduate students at Southeastern Louisiana University perform research on problems posed by local businesses. This program, termed Student Entrepreneurs as Active Leaders (SEAL). Years One and Two will be spent establishing the program. That is, the PI's will recruit students into the program and cultivate contacts with industrial clients. By Year Three, we have two intermediate goals: to begin securing paid contracts from industry clients on the way to full self-sufficiency and to begin establishing SEAL teams at other universities. By Year Five, we propose to have a fully self sufficient SEAL program at Southeastern Louisiana University, to have SEAL Teams in place at Louisiana universities outside the APTEC collaboration, and to leverage the reputation and expertise developed by the PI's in building Southeastern's SEAL program to aid other universities in securing sufficient industry funding to themselves be self sufficient.

b. Deliverables

Deliverables of this project are project and financial status reports on the following schedule:

June 30, 2008 Annual (First-Year) Project Report and Financial Status Report
June 30, 2009 Annual (Second-Year) Project Report and Financial Status Report
June 30, 2010 Annual (Third-Year) Project Report and Financial Status Report
June 30, 2011 Annual (Fourth-Year) Project Report and Financial Status Report
June 30, 2012 Final Project Report
September 30, 2012 Final Expenditures Report

c. Performance Measures

There are several metrics by which to assess this program. The most obvious is number of students involved in the program. The positions provided for in the grant should surely be filled, but an important measure of success is the number of students involved beyond this minimum. Another measure is a simple count of industrial clients served and projects pursued. Another is an assessment of the regular reports to be made to industrial clients. This may be more reflective of the effort devoted and progress made. Another performance measure is dollars committed to the program by industrial clients, which we expect to become available by year three of the program. Finally, an important measure of the scalability of the SEAL concept is its spread to other Louisiana universities. And

so a final performance measure is the number of such programs functioning at other Louisiana universities.

d. Monitoring Plan

As a means of monitoring the progress of this project, the Board and its representatives shall have the right to inspect the progress of the work, as well as financial records pertaining to the work, and of future inspection upon expiration of the contract term. The reports described in part b) above will be reviewed by the Commissioner of Higher Education, acting for the Board, and perhaps by out-of-state consultants whose assessment will guide the Board in determining the effectiveness with which the objectives of this project have been fulfilled.

e. Utility of the Final Product

A key benefit to the state of Louisiana of the project under this contract is the training of undergraduate students in the practice of running a technical business, with the economic growth and job creation implicit therein. Secondary benefits include: placing the equipment and expertise of university scientists at the disposal of Louisiana businesses, further encouraging economic growth and leveraging the resources of Louisiana universities; and through SEAL outreach to local high schools, exemplifying the value of higher education and encouraging students to embark on careers in science, technology, engineering and mathematics (STEM).

Annual Report for Year 3 (ending 6/30/2010)

PKSFI Program Report for LEQSF(2007-12)-ENH-PKSFI-PES-06

Third Interim report – 30 June 2010

Author: David Norwood, Assoc. Prof. Of Physics
Department of Chemistry and Physics
Southeastern Louisiana University
Hammond LA 70810
dnorwood@selu.edu
985/549-3938

Executive Summary:

In the third reporting period, sixteen (16) SEAL students and five (5) SEAL faculty have worked on ten (10) projects for seven (7) clients, resulting in thirteen (13) written reports (totaling 94 pages – included as Appendix A) to clients, four (4) oral presentations to clients and seven (7) oral and poster presentations at scientific meetings. In addition, SEAL students have reported their progress to SEAL faculty at monthly group meetings and in weekly written reports (totaling 552 pages – included as Appendix B).

Personnel:

FACULTY:

David Norwood – Assoc. Prof. of Physics

David Norwood (Ph. D. - Physics) is the Principal Investigator for the APTEC/SEAL program and the SEAL Faculty Director. As such, he is responsible for all aspects of the SEAL research program. In particular, he plays a key role in promoting the program both on and off campus. Examples of these activities are:

1. Recruiting and assessing students as potential SEAL researchers, from the Southeastern student body and from the pool of high school students who may enroll at Southeastern (the latter also informs high school graduates of the importance of science and industry in Louisiana's future).
2. Promoting the program to other faculty at Southeastern and at other Universities, in order to foster collaborative activities with these other faculty in support of the goals of the SEAL program.
3. Promoting the program to Louisiana businesses, with the goal of developing projects for SEAL students and connecting SEAL students with potential employers.

In addition to these ongoing responsibilities, Norwood plays a day-to-day role in developing policies and procedures under which the SEAL program is to operate. This is a continuation and refinement of activities undertaken in the late summer of 2007 and in subsequent reporting periods, in which the basic structure of the SEAL program was developed by Norwood, other SEAL faculty, former SEAL Student Managers, Megan Lanier and Jordan Dinser, and current SEAL Student Manager Amber Bordelon

Finally, Norwood plays a direct role in the research performed by the SEAL students. In addition to a general supervisory role (e. g., proofreading reports to clients, training on and enforcing safety standards, reading weekly reports) over all SEAL students, he directly supervises the research associated with the V-LABS, USCPS, Bercen and Gaylord clients (described in detail later in the report).

Debra Dolliver – Assoc. Prof. of Chemistry

Debra Dolliver (Ph. D. - Chemistry) is a co-PI for the APTEC/SEAL program. She plays a valuable role in assessing the technical needs associated with chemistry projects proposed by industrial clients, and is thus intimately involved in the initial meetings when a proposed project has a pronounced chemical basis. As with Norwood, above, she plays a day-to-day role in developing policies and procedures under which the SEAL program is to operate. This is a continuation and refinement of activities undertaken in the late summer of 2007 and in subsequent reporting periods, in which the basic structure of the SEAL program was developed by Dolliver, the other SEAL faculty and the SEAL Student Managers, Megan Lanier and Jordan Dinser. In addition, Dolliver acts as Faculty Director on those occasions when the PI, Norwood, is away from campus.

Finally, Dolliver plays a direct role in the research performed by the SEAL students. In addition to a general supervisory role (e. g., proofreading reports to clients, training on and enforcing safety standards) over all SEAL students, she directly supervises the research associated with the Gaylord, Bercen and USCPS clients (described in detail later in the report).

Rhett Allain – Assoc. Prof. of Physics

Rhett Allain (Ph. D. - Physics) is an Associate Professor of Physics at Southeastern specializing in Educational Physics. In the SEAL program, he supervises a project for the client United States

Composite Pipe South (USCPS – Zachary, LA), in which SEAL Researcher Kishor Budhathoki and high school student Jeff Parrozzo (Louisiana School for Math, Science and the Arts – LSMSA, Natchitoches, LA) calculated the deflection of a hanging beam. Dr. Allain supervised an extension of that project in which a hanging beam was simulated using packaged computer software.

Hye-Young Kim – Asst. Prof. of Physics

Hye-Young Kim (Ph. D. – Physics) has begun a more active role in the SEAL program in training SEAL Researcher Adam Dillon in the use of molecular dynamics simulations to characterize polymer structure under the influence of interactions potentials. While there is no specific client for this research, we are confident that the results and particularly the skills Adam will develop will be beneficial to Louisiana's economic development.

Jean Fotie – Asst. Prof. of Chemistry

Jean Fotie (Ph. D. – organic chemistry) is playing a direct role in developing SEAL projects with SEAL client Bercen, Inc. (Denham Springs, LA). In this capacity, he met with Bercen personnel on 18 JUN 2010 to discuss initial directions for collaboration. He acts as Faculty Director when Norwood and Dolliver are not present. In addition, he is training SEAL Student Researchers Kristin Allen and Saurav Malla in the basics of organic chemistry research. They are currently working on projects relating to the synthesis of dihydroquinolines, compounds that have direct application in the pharmaceutical and food processing industries. Thus, not only does the product of their current research have direct economic consequences in a general sense, the skills they are learning should have application to the needs of future clients.

The following faculty have explicitly committed to participate in the SEAL program should a project arise requiring their area of expertise:

Faculty Member	**Ph. D. in:**	**Expertise**
Jeffrey Temple	Biochemistry	Protein cloning, purification and characterization
Thomas Sommerfeld	Physical Chemistry	Ab initio molecular structure calculations
Michael Doughty	Biochemistry	Protein cloning, purification and characterization
Sanichiro Yoshida	Physics	Laser physics and material science
Santino Ladogana	Chemistry	Inorganic chemistry

OTHER SOUTHEASTERN PERSONNEL:

Wanda Crawford/Laura Lips – Human-Resources Analysts

Wanda and Laura have made an effort above and beyond to help implement the goals of the SEAL program within the standard higher education employment structure. Though this is part and parcel of their position in the HR department, finding ways to implement the novel SEAL program within the existing structure of Louisiana higher education enhances the scalability and sustainability of the SEAL model.

STUDENTS (Current SEALs):

Amber Bordelon (Chemistry) – Student Manager

As a Student Manager, Amber's responsibilities encompass those of a Senior Student Researcher, with additional duties and responsibilities. Amber has been with the SEAL program for just over a year and has rapidly risen to the level of Student Manager. Her initial research was to create specific isomers of benzohydroxyphenones, part of a comprehensive research program to synthesize single isomers of pharmacologically important compounds. Since then, Amber has played a primary role in a measurement of samples (United States Composite Pipe South, Zachary LA), which included preparing the budget and research plan for the project and preparing the proposal for the client (USCPS), and working closely with then-Student Manager Jordan Dinser, and later supervising Student Researcher Sumit Libi in a later phase of that project. She supervised Senior Student Researcher Patrick Gentry and Student Researcher Bishwas Ghimire in calculating the carbon footprint of client USCPS. She played a principle role in the use of fluorescence data as a quality assurance method for dimethyl sulfoxide, measurements performed for client Gaylord Chemical, Inc., (Slidell, LA). She arranged to make measurements using equipment at LSU to compare to our results. She has reported on those projects to the clients, at a departmental seminar with other SEAL students (26 FEBRUARY 2010), and at the Spring 2010 Meeting of the Louisiana Academy of Sciences (27 FEB 2010, Alexandria LA). Further, she delegates research activities to other SEALs, trains them and supervises their progress (in particular, with respect to the carbon footprint project and pipe leaching project). She also supervises and advises SEALs with respect to reporting on their results, whether in the form of an oral or written report to a client (e.g., Sumit Libi's report to USCPS), or in the case of a public presentation. She meets with current or prospective clients to assess possible contracts (e. g., the Gaylord Fluorescence project and the Bercen, Inc. projects). And as a manager, she plays a direct role in dealing with financial and human-resources issues. For example, she reviewed applications, interviewed and hired two new SEALs in March of 2010. She has periodically reviewed the SEAL budget to ensure that there were funds sufficient to support the planned research activities over the spring and summer of 2010.

Patrick Flowers (Chemistry) – Senior Student Researcher

As a senior researcher, Patrick's responsibilities encompass direct lab research (including reporting), planning of research and delegation of research to other SEALs (including supervision). He performs direct research on synthesis of alkoxyimidoyl tosylates, part of a comprehensive research program to synthesize single isomers of pharmacologically important compounds; measurement of fluorescence data as a quality assurance method for dimethyl sulfoxide for client Gaylord (Slidell, LA), which included collaboration with colleagues at LSU to check our results. He supervised dynamic light scattering measurements of samples from Bercen Inc. (Denham Springs LA) by Sarah Sihvonen (Centenary College, LA) and prepared a job description for Sarah in order to satisfy requirements of the Human Resources office at Southeastern. He presented results of his work at departmental seminar to the Department of Chemistry and Physics (26 FEB 2010, Southeastern Louisana University) and at the Spring 2010 Meeting of the Louisiana Academy of Sciences. He supported outreach by supervising the activities of a student from the LSMSA.

Arjun Pandey (Chemistry) – Senior Student Researcher

As a senior researcher, Arjun's responsibilities encompass direct lab research (including reporting), planning of research and delegation of research to other SEALs (including supervision). His principle research has been synthesis of alkoxyimidoyl tosylates, part of a comprehensive research program to synthesize single isomers of pharmacologically important compounds; modifying polysaccharides purified from corn stover and arabinoxylans to serve as potential water purification

compounds for client V-LABS (Covington, LA), which involved training and supervising Student Researcher Kishor Buthatoki in the use of triple detection HPLC. He reported upon his research at at seminar for the Department of Chemistry and Physics (26 FEB 2010) and at the Spring 2010 Meeting of the Louisiana Academy of Sciences (27 FEB 2010, Alexandria LA). He participated in outreach by supervising two of three students from the Louisiana School for Math, Science and the Arts (LSMSA, Natchitoches, LA) who participated with SEALs for the summer of 2010.

Jessica Rhodus (Chemistry) – Student Researcher

As a Student Researcher, Jessica's responsibility is to perform and report on research as directed. Her primary research is to create specific isomers of alkoxyimidoyl iodides from alkoxyimidoyl tosylates, part of a comprehensive research program to synthesize single isomers of pharmacologically important compounds; synthesized the compound ethyl methyl sulfoxide (EMSO) as a quality control element for client Gaylord Chemical ,Inc (Slidell, LA). She supported the SEAL program by designing business cards to be used in developing client connections and revising the updating the SEAL website. She assisted SEAL Researcher Arjun Pandey in a project modifying corn stover to make compounds as prospective water purification materials for client V-LABS (Covington, LA). She has reported on her work to clients (e.g., Gaylord, Slidell LA), at a Departmental seminar for the Department of Chemistry and Physics, Southeastern Louisiana University (26 FEB 2010) and at the Spring 2010 Meeting of the Louisiana Academy of Sciences (27 FEB 2010, Alexandria LA).

Sumit Libi (Physics) – Student Researcher

As a Student Researcher, Sumit's responsibility is to perform and report on research as directed. He participated in a program of market research regarding home energy efficiency, the goal of which was to support the developing Home Energy Rater business in Louisiana. He aided in market research regarding alternative fuels for client CGBG (Hammond LA). He preformed calculations relating to articulated erosion control blocks and developed a spreadsheet implementing those calculations for client International Coastal Revetment Products (ICRP, Hammond LA). He aided Student Researcher Lexi Ruibal in setting up the triple-detection HPLC system. He performed calculations regarding carbon footprint, simulations regarding a cantilever pipe and performed measurements (including GC/MS and SPME techniques) for client USCPS (Zachary LA). He is training on the dynamic light scattering instrument to aid in measurements for client Bercen Inc. (Denham Springs, LA) and to maintain continuity of knowledge when the current operator, Sarah Sihvonen (Centenary College, LA) ends her activities with SEAL in August, 2010.

Bijay Bhattarai (Chemistry) – Student Researcher

As a Student Researcher, Bijay's responsibility is to perform and report on research as directed. He was hired into the SEAL program in late March, 2010, and thus has limited activity to report. He primarily synthesizes compounds in support of a comprehensive research program to synthesize single isomers of pharmacologically important compounds. He participated in outreach by supervising the activities of LSMSA students Brandi Givens and Caroline Larmeu.

Kishor Budhathoki (Physics) – Student Researcher

As a Student Researcher, Bijay's responsibility is to perform and report on research as directed. He was hired into the SEAL program in late March, 2010, and thus has limited activity to report. He has played a significant role in refurbishing the pump for the triple-detection HPLC and calibrating the light scattering detector, in support of measurements on Senior Researcher Arjun Pandey's synthesis for client V-LABS (Covington LA) and characterization of samples provided by client Bercen Inc. (Denham Springs LA); he performed a calculation of beam bending using Euler-Bernoulli linear theory for client United Composite Pipe South (Zachary LA); he supervised LSMSA student Jeff Parrozzo in

extending this linear theory.

STUDENTS (Temporary SEALs):

(In order to maximize the effect of Board of Regents Funds, the SEAL Student Managers and Faculty Director have hired three Southeastern Students as SEALs for the Summer of 2010. While funding is insufficient to maintain them beyond August, 2010, it is felt that as the program expands funding by industry clients, it may be possible to continue their employ. In any event, the training they receive will benefit them, Southeastern's faculty and the state.)

Adam Dillon (Physics) – Student Researcher

Adam's work involves the use of molecular dynamics simulations to study the efficiency of nanoparticle supported polymer materials as light weight liners and fuel lines in aerospace systems.

Kristin Allen (Chemistry) – Student Researcher

Kristin's work involves the synthesis of dihydroquinolines by novel mechanisms. Dihydroquiniolines are known to display numerous biological and pharmacological activities, as well as applications in the food processing industry, and thus have obvious economic benefits.

Saurav Malla (Chemistry) – Student Researcher

Saurav's work involves the synthesis of dihydroquinolines by novel mechanisms. Dihydroquiniolines are known to display numerous biological and pharmacological activities, as well as applications in the food processing industry, and thus have obvious economic benefits. (While the goal of Saurav's work is the same as Kristin's, it uses different starting materials and reaction conditions, essentially doubling the rate at which reactions parameters can be explored.)

STUDENTS (Former SEALs):

Megan Lanier (Chemistry) – Student Manager

In May 2010, Megan graduated from Southeastern Louisiana University, and will be attending the Duke University beginning in the Fall of 2010. She continues with the SEAL Program in order to maintain continuity of knowledge; specifically, by training Student Researchers in basic organic synthesis, applied to Suzuki-Miyaura coupling reactions and aiding in the transition of student management of the SEAL Program from previous managers Megan and Jordan Dinser, to present manager Amber Bordelon. Our ability to hire Megan as a Student Researcher to aid in this transition is in significant part due to the efforts of Laura Lips, HR Analyst in the Human Resources office of Southeastern. In the past year, Megan's responsibilities as a Student Manager included all those of a Senior Student Researcher, with additional duties and responsibilities. Her specific activities have included: aiding in NMR analysis of the biodeisel product for client Neill Corp.; aiding in setting up and extracting sample for the USCPS project. She has reported on those projects to the clients and at the Regional Undergraduate Chemistry Symposium (24 OCT 2009, Rice University, Houston TX), a competitive presentation for which she won FIRST PLACE, at the Spring 2010 Meeting of the Louisiana Academy of Sciences (27 FEB 2010, Alexandria LA), and at the Southwest Regional Meeting of the American Association for the Advancement of Science (8 APR 2010, Houston TX). She has supervised and directed the work of other SEALs. She reviews and proofreads written reports prepared by other SEALs (e.g., proofing Senior Student Researcher Patrick Gentry's reports to CGBG) and is involved in assessing prospective projects (e.g., the USCPS project and the Gaylord EMSO project). She aids in preparation of contracts for client research (e.g., the USCPS project). She has developed work schedules for the Fall 2009 and Spring 2010 working periods in order to assess budget needs and compare those projected needs to current budget reserves. She has actively promoted the

SEAL program on Southeastern's campus by visiting freshman and sophomore classes. She reviews applications for employment, interviews applicants and makes hiring decisions (including a role in hiring former SEAL Bishwas Ghimire, and current SEALs Jessica Rhodus, Sumit Libi and Arjun Pandey) and decisions to promote (e.g., the promotion of Amber Bordelon to Senior Researcher and then to Student Manager). She aided several international students in the unique requirements they face in securing employment in the SEAL program. She developed materials to aid in training and scalability of the SEAL program (e.g., the SEAL Student Manager's Guide, included as an Appendix). She played an active role in outreach by participating in and preparing visual aids for the Department of Chemistry and Physics recruiting video (found on the Dept. website), mentoring students from the Louisiana School for Math, Science and the Arts (who were hosted by the SEAL program for the summer) and handling ALL arrangements for a visit by students from Sumner High to Southeastern on 21 APRIL 2010.

Jordan Dinser (Chemistry) – Student Manager

In May 2010, Jordan ended her tenure with the SEAL program upon her graduation from Southeastern Louisiana University, and will be attending the University of Texas at Austin in the Fall of 2010. Jordan's responsibilities as a manager mirrored those of Megan (see above). Her specific activities have included: synthesis of specific isomers of azido-oxime ethers via a novel sequence involving tosylates; gas chromatography/mass spectrometry measurements (USCPS, Zachary LA); assisted in a project involving modification of corn stover, attempting to develop a novel water purification compound for client V-LABS (Covington, LA); synthesizing highly pure ethyl methyl sulfoxide (EMSO) for quality control applications by client Gaylord Chemical Inc (Slidell, LA). She has reported on those projects to the clients (e.g., pipe project for client USCPS) and at the 238th Annual Fall Meeting of the American Chemical Society (Poster CHED #251, 17 AUG 2010, Washington, DC) and at the Spring 2010 Meeting of the Louisiana Academy of Sciences (27 FEB 2010, Alexandria LA). She has supervised and directed the work of other SEALs (e.g., guiding SEAL Senior Researcher Patrick Gentry in: directing SEAL Researcher Patrick Weber and Lexi Ruibal in activities on the Greenstop project, directing SEAL Researchers Arjun Pandey and Bishwas Ghimire in a home efficiency project, and his direct differential scanning calorimetry researech in support of the Neill biodeisel project). She reviews and proofreads written reports prepared by other SEALs (e.g., she proofread the abstracts submitted by SEAL Researchers to the Spring 2010 LAS Meeting) and is involved in assessing prospective projects (e.g., the USCPS project and the Gaylord EMSO project). She aids in preparation of contracts for client research (e.g., the USCPS project). She has developed work schedules for the Fall 2009 and Spring 2010 working periods in order to assess budget needs and compare those projected needs to current budget reserves. She has actively promoted the SEAL program on Southeastern's campus by visiting freshman and sophomore classes. She reviews applications for employment, interviews applicants and makes hiring decisions (including a role in hiring former SEAL Bishwas Ghimire, and current SEALs Jessica Rhodus, Sumit Libi and Arjun Pandey) and decisions to promote (e.g., the promotion of Amber Bordelon to Senior Researcher and then to Student Manager). She developed materials to aid in training and scalability of the SEAL program (e.g., the SEAL Student Manager's Guide, included as an Appendix). She played an active role in outreach by participating in and preparing visual aids for the Department of Chemistry and Physics recruiting video (found on the Dept. website).

Patrick Gentry (Business) – Senior Student Researcher

Patrick's service with SEAL ended in MAY 2010 upon his graduation from Southeastern. He is currently employed with American General Finance in Denham Springs, LA. He began this reporting period as a Student Researcher, and his performance merited promotion to Senior Student Researcher in OCTOBER 2009. As a Senior Researcher, Patrick's duties are to plan, perform and report research

and supervise the research of Student Researchers. His direct research was: to analyze the conversion efficiency of biodeisel production using differential scanning calorimetry (DSC) for client Neill Corp. (Hammond LA) which included preparing a user's guide for the DSC instrument (included as an appendix); market research for client Clean Green BioGas (CGBG) a company engaged in alternative energy and alternative fuel marketing; . In his capacity as a Senior Researcher, he supervised the work of SEAL student Researchers Bishwas Ghimire and Sumit Libi in the area of home efficiency, with the aim of supporting home energy audit businesses in LA; trained SEAL Researcher Lexi Ruibal in the use of the DSC; working with and supervising the activities of SEAL Researcher Sumit Libi doing calculations related to erosion control systems for client International Coastal Revetment Products (ICRP, Hammond LA); supervised the work of Bishwas Ghimire in calculating carbon footprint for client USCPS (Zachary LA). He has reported his results in written reports to clients (e.g., to CGBG re: sources of alternative fuels), at a Dept. of Chemistry and Physics Seminar (26 FEB 2010), at the Fall 2009 Triple EX Undergraduate Research Meeting (29 OCTOBER 2010, LSU, Baton Rouge LA) and the Spring 2010 Meeting of the Louisiana Academy of Sciences (27 FEB 2010, Alexandria LA). He has reveiwed the reports of Student Researchers (e.g., Lexi Ruibal's report for client Gaylord, Sumit Libi's report for client ICRP). He has consulted with prospective clients (e.g., ThruTubing Systems, New Iberia LA and Tempico, Hammond LA). He has played an active role in supporting the SEAL program, arranging for Dr. Holly Syrdal of Southeastern to aid in the preparation of a new SEAL promotional brochure and contacting former clients to inquire after further projects.

Patrick Weber (Biology) – Student Researcher

Patrick's service with SEAL ended in MAY 2010 upon his graduation from Southeastern. As a Student Researcher, his duties have been to perform and report on research as directed. His work consisted primarily of performing transesterification of vegetable oil to produce biodeisel and attempting to develop NMR as a means of analyzing the yield, with the ultimate goal of tuning the yield for client Neill Corporation (Hammond LA). He measured the flow rate of the triple-detection HPLC system in support of polymer characterization efforts, using an automated system implemented by Student Researcher Lexi Ruibal (user's guide attached as an appendix). He assisted in market research regarding alternative fuels for client CGBG LLC (Hammond LA). Presented the results of his work with the client (Neill Corp., Hammond LA and CGBG LLC, Hammond LA) and at the Triple EX Undergraduate Research Conference (29 OCT 2010, LSU, Baton Rouge LA). He promoted the SEAL program by thoroughly updating the SEAL website. He participated in outreach by participating in the visit by students of Sumner High to Southeastern (21 APRIL 2010).

Lexi Ruibal (Physics) – Student Researcher

Lexi Ruibal separated from the SEAL program by mutual agreement between her, the SEAL Student Managers and the Faculty Director. Despite her great talent and value to the SEAL organization, it seemed that Lexi was having trouble balancing the work with SEAL and her responsibilities as a physics major. In keeping with the priorities set by the SEAL organization (that coursework is paramount and outside research is to be an adjunct to that), it was agreed that Lexi would end her association with SEAL until such time as she was able to return without jeopardizing her academic standing. Her talent is indicated by the accomplishments described: she repaired the triple detection HPLC system, which included refurbishing the Sykam pump and removing, cleaning and reinstalling the flow cell for the DAWN EOS light scattering detector. These are quite sophisticated tasks that many graduate students could not be expected to accomplish. She worked out a method of analyzing NMR traces for the biodeisel project (a task which had stymied two other Student Researchers).

Bishwas Ghimire (Physics) – Student Researcher

Bishwas Ghimire separated from the SEAL program by mutual agreement between him, the SEAL Student Managers and the Faculty Director. Bishwas determined that his priorities did not fit in with the responsibilities of a SEAL member. He participated in a program of market research regarding home energy efficiency, the goal of which was to support the developing Home Energy Rater business in Louisiana. He aided in market research regarding alternative fuels for client CGBG (Hammond LA). He aided Student Researcher Lexi Ruibal in setting up the triple-detection HPLC system. He performed calculations regarding carbon footprint for client USCPS (Zachary LA).

Activities and Findings:

- **Major research and educational activities, student training and workforce development;**

In the third year of the APTEC/SEAL program, major research and educational activities by student researchers have been on nine projects for six industrial clients. The major findings and the supporting evidence are summarized here and discussed in more detail in the appendices. Further, student training and workforce development is an integral part of the SEAL program. By having students work on research projects related directly to industry needs and report the results to industry representatives (i.e., clients), students are developing skills of direct relevance to Louisiana industry and developing contacts in the industries that have need of their services. The projects worked on during this reporting period and the industrial clients are:

1) Analysis of samples (Client: US Composite Pipe South, Zachary LA 70791)

   USCPS provided Southeastern Louisiana University SEAL research team with a set of samples, requesting analysis of them. (DETAILS WITHELD AT CLIENTS REQUEST.) The samples were analyzed using the Varian gas chromatograph/mass spectrometer (GC/MS, detection limit parts per million) in conjunction with solid phase microextraction (SPME, detection limits parts per billion). It was determined that any contaminants were below the detection limits.

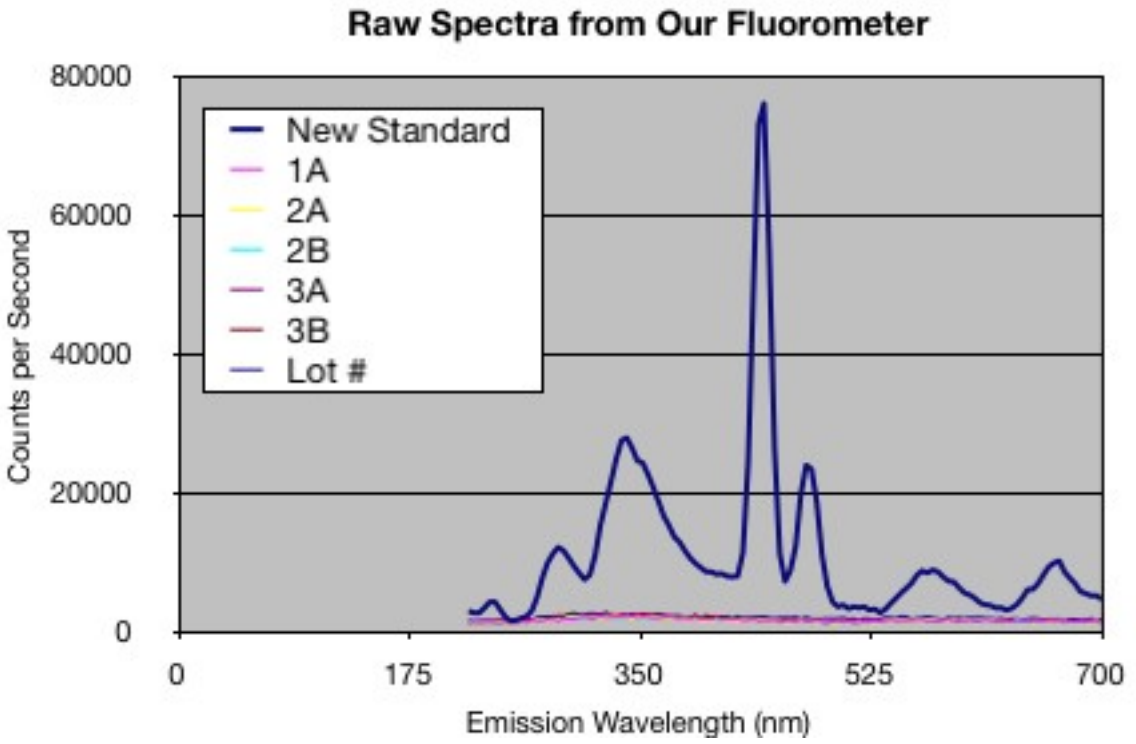
2) Carbon Footprint Calculation (Client: US Composite Pipe South, LLC. Zachary LA 70791)

   Research was conducted in order to determine what factors contribute to the carbon footprint of USCPS and to discover ways to calculate the footprint. After examining the chemistry of the polymerization and curing processes utilized by USCPS, it was determined that there is no direct production of carbon dioxide associated with these chemical processes. Therefore, electricity and fuel usage (if USCPS has any, for example, fleet for transport and delivery) are the primary factors that contribute to the carbon footprint of USCPS. It was determined that carbon dioxide emitted due to electricity and fuel usage is assigned to the carbon footprint of the consumer rather than the producer. The carbon footprint can be calculated by using the amount of an energy source like electricity or fuel consumed, and multiplying it by the amount of carbon dioxide produced by that consumption. It was also determined that a change in energy source for electricity production can significantly affect the equivalent carbon emission rate.

3) Fluorometry Analysis of Dimethylsulfoxide Samples (Client: Gaylord Chemical Company, LLC. Slidell LA 70458)

   For our analysis, a stock quinine solution in 0.0500M sulfuric acid was prepared and subsequently diluted to match the concentration of the standard described. All samples were run in quartz cuvettes. Through our methods we were able to conclude that all the samples we tested yielded an emission spectra much lower in intensity than the quinine standard. The spectra of the dimethylsulfoxide samples conclusively indicates that each sample passes the

fluorescent emission quality control test.



4) Calculations relating to Articulated Concrete Block erosion control systems (Client: International Coastal Revetment Systems, Baton Rouge LA)
In order to support sales and marketing, ICRP engaged the SEALs to develop a spreadsheeet based product to enable salespersons to immediately display the results of "what-if" style scenarios for prospective clients of ICRP's product, the Articulated Concrete Block (ACB) system for erosion control. In the course of this development, the SEALs were able to point out errors in ICRP's existing sales materials and also to demonstrate significant reductions in CO2 production when using ACB systems as compared to poured concrete.

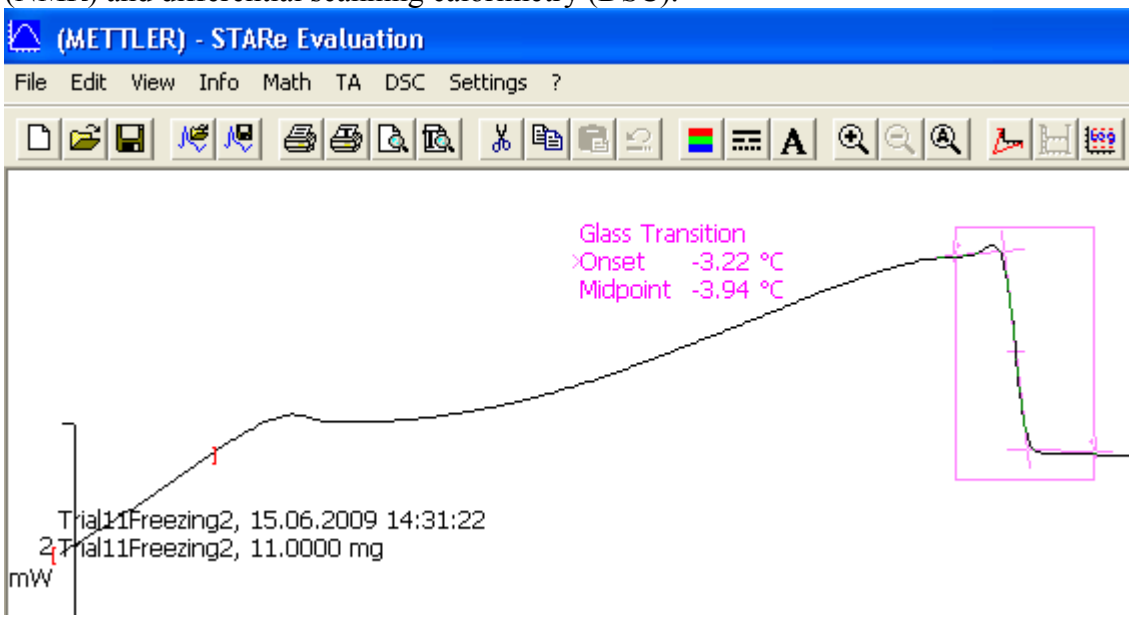
5) Modification of polysaccharides for water purification (Client: V-LABS, Inc., Covington LA 70433)
V-LABS, Inc. is a chemical manufacturing and consulting firm that manufactures carbohydrates and polysaccharides for the food, biochemical and pharmaceutical industries. Well characterized corn stover mixed aggregate hemicellulose will be made with potential industrial scale up using preparative extraction and membrane filtration techniques. The hemicellulose will be modified by selected organic chemical reactions of known effectiveness for chelation, ion exchange, and zeta potential contributions to flocculation properties. Physical characterization through multiangle laser light scattering and other methods will accurately define molecular weight and molecular dimensions of the products. The modified hemicellulose products will be tested by water technology treatment methods as probably candidates for water remediation applications. An experienced wastewater treatment technologist will evaluate promising products with agricultural, food processing, industrial and municipal water system effluents. In this project potential industrial use of these materials will be assessed economically and the logistics of feedstock provision and manufacturing assigned in feasibility of marketing

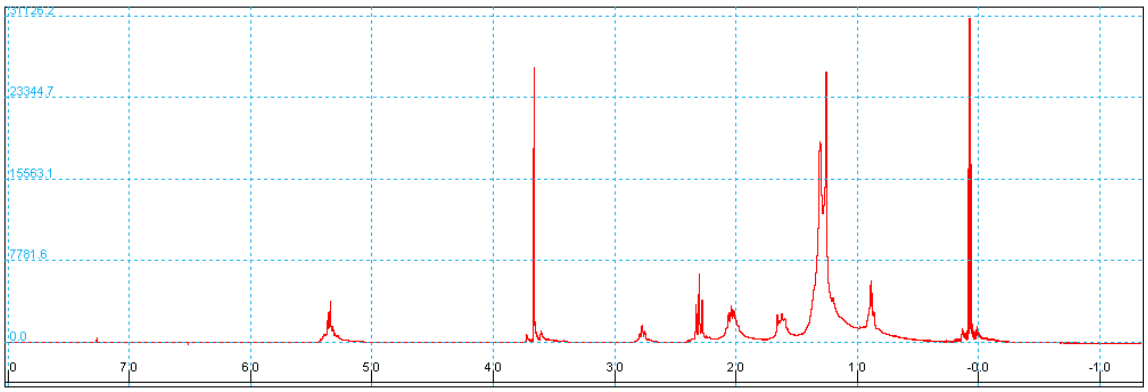
new biodegradable wastewater treatment polymers.

6) Synthesis of highly pure EMSO (Client: Gaylord Chemical Company, LLC. Slidell LA 70458)
Gaylord Chemical (Slidell, LA) provided Southeastern Louisiana University SEAL research team with a project to synthesize ethyl methyl sulfoxide from ethyl methyl sulfide. The ethyl methyl sulfoxide would be used as a standard in detecting ethyl methyl sulfoxide as an impurity in Gaylord Chemical's synthesis of DMSO. Ethyl methyl sulfoxide was synthesized by an oxidation reaction with hydrogen peroxide as the oxidizing agent in acetonitrile following a literature procedure: "A Simple and Convenient Method for the Oxidation of Sulphides."

7) Market research for alternative fuels (Client: CGBG LLC, Baton Rouge, LA 70801)
This project is constrained by a non-disclosure agreement executed between CGBG LLC and Southeastern Louisiana University. Thus, only information of a very general nature can be revealed in this public document. In an attempt to evaluate a market opportunity to promote the use and distribution of alternative fuels, CGBG enlisted the aid of the SEAL research team to perform market research using Internet-based, phone-based and on-site resources. Several of the SEALs played an active role in this project, but in particular SEAL Researcher Patrick Gentry, with primary supervision and help from Student Manager Megan Lanier.

8) Monitoring transesterification of triglycerides (Client: Neill Corporation, Hammond LA 70403)
William Curry of Neill Corporation has established (using SEAL help in the last reporting period) a reactor to convert used cooking oil to biodiesel for use in Neill Corporation delivery trucks. In order to optimize his conversion of oil to biodiesel, Curry has engaged the SEALs to develop optimum reaction conditions and techniques to monitor the ongoing reaction. Primary work on this project is by SEAL researcher Patrick Weber, with significant help from SEAL Managers Megan Lanier and Jordan Dinser, SEAL Senior Researcher Patrick Gentry and the supervision of Dr. Debra Dolliver. The present phase involved primarily the the development of methods to assess the conversion efficiency using nuclear magnetic resonance (NMR) and differential scanning calorimetry (DSC).





9) Characterization of additives (Client: Bercen, Inc., Denham Springs LA)

This project is constrained by a non-disclosure agreement executed between CGBG LLC and Southeastern Louisiana University. Thus, only information of a very general nature can be revealed in this public document. Bercen personnel have provided the SEAL research team with samples, requesting characterization by triple detection HPLC, dynamic light scattering and zeta-potential analysis.

10) Development of novel additives (Client: Bercen, Inc., Denham Springs LA)

This project is constrained by a non-disclosure agreement executed between CGBG LLC and Southeastern Louisiana University. Thus, only information of a very general nature can be revealed in this public document. Bercen personnel have requested from the SEAL team analysis and development of novel additives. SEAL Faculty members Debra Dolliver and Jean Fotie will meet with Bercen representatives to propose further collaboration.

• **Community Development and/or Outreach Activities**

Community outreach activities are of three general forms: 1) presentations to local high school and middle school students to promote the SEAL program in particular and the role of science in Louisiana's future in general, 2) presentations to industrial clients, either to promote the SEAL program in search of projects or to report on the results of an on-going project, and 3) presentations of the results of projects at scientific meetings, to promote SEAL, Southeastern and the client. Examples of such activities appear below:

Presentations to middle- and high school students:

21 April 2010

SEAL Manager Megan Lanier arranged ALL aspects of a day-long visit by about 20 students from Sumner High School to the Department of Chemistry and Physics. The visit included lab and classroom visits, meeting with faculty and administrators of Southeastern and demonstrations of chemistry and physics by other SEAL personnel.

June 2010

Three students from the Louisiana School for Math, Science and the Arts (LSMSA, Natchitoches LA) were mentored by SEAL students, trained in basic chemical and physics research. Brandi Givens and Caroline Larmeu expressed and interest in chemistry, and thus were instructed in basic chemistry

synthesis by SEAL Researchers. Jeff Parrozzo expressed an interest in physics, and was therefore mentored by physics majors in simulations of cantilever bending using computer simulaiton software.

Presentations to industrial personnel:

23 September 2009

SEAL Faculty Director David Norwood, and all SEAL Students met with Garrett Doucet, of US Composite Pipe South (USCPS, Zachary LA) to introduce him to the SEAL program and it's capabilities, and discuss possible research collaborations.

05 December 2009

SEAL Faculty Director David Norwood, and SEAL Senior Researcher Patrick Gentry met with Jerome Stuart, CEO of Clean Green BioGas (CGBG, Hammond LA) regarding market research concerning alternative transportation fuels.

15 April 2010

SEAL Faculty Director David Norwood, SEAL Faculty Member Debra Dolliver, and SEAL Student Manager Amber Bordelon, SEAL Senior Researcher Patrick Flowers and SEAL Student Researcher Jessica Rhodus met with Dr. Artie McKim, of Gaylord Chemical Inc., to discuss and plan for two projects: fluorescence as a quality assurance measurement for dimethyl sulfoxide (DMSO) and synthesis of highly purified ethyl methyl sulfoxide (EMSO).

10 June 2010

SEAL Faculty Director David Norwood, SEAL Faculty Member Debra Dolliver, and SEAL Student Manager Amber Bordelon, SEAL Senior Researcher Patrick Flowers and SEAL Student Researcher Jessica Rhodus met with Dr. Artie McKim, of Gaylord Chemical Inc., to report on the results of two projects: fluorescence as a quality assurance measurement for dimethyl sulfoxide (DMSO) and synthesis of highly purified ethyl methyl sulfoxide (EMSO).

Presentations at scientific meetings:

17 August 2009

Megan Lanier and Jordan Dinser attended the 238th American Chemical Society Meeting in Washington DC and presented their research as poster CHED 251: Cyclization vs. rearrangement of *N*-alkoxyimidoyl azides: The effect of the electrophile and solvent

Reactions of a new class of imidoyl azides, N-alkoxyimidoyl azides, have been investigated in electrophilic conditions. Other imidoyl azides in electrophilic media have been shown to undergo a Schmidt-type rearrangement in some cases and a Z/E isomerization leading to intramolecular cyclization in other cases. An investigation into the role of solvent polarity and of the electrophile on the mechanistic pathway chosen has been performed. It has been demonstrated that, when treated with a Brønsted acid, these compounds primarily produce the Schmidt-type rearrangement product with only a small amount of the intramolecular cyclization product being generated. This mechanism results from protonation of an azide nitrogen, loss of diatomic nitrogen and migration of the aromatic ring to the electron-deficient nitrogen. When treated with an acid chloride, the imidoyl azide undergoes reversible acylation at the imine nitrogen, rotation around carbon-nitrogen bond, and spontaneous

intramolecular cyclization to form a tetrazole. Solvent polarity has no affect on the mechanistic route taken or on the product distribution. Ab initio calculations have indicated that the rearrangement product is the thermodynamically more stable product, and the intramolecular cyclization product (the kinetic product) results when the barrier for migration of the aromatic ring is prohibitively high. Details of these two competing mechanisms and their reaction coordinates will be discussed.

24 October 2009

SEAL Student Manager Megan Lanier (Chemistry) gave an oral presentation of her work at the Regional Undergraduate Chemistry Symposium at Rice University. Her talk was entitled: "Reactions of O-Alkylarylhydroximoyl Azides in Electrophilic Media,"

27 February 2010

The following presentations were made at the 84th Annual Meeting of the Louisiana Academy of Sciences, Louisiana State University at Alexandria, Alexandria LA

Patrick Gentry reported on his analysis of biodiesel yields.

Patrick Flowers and Amber Bordelon reported on the synthesis of alkoxyimidoyl tosylates.

Jessica Rhodus and Arjun Pandey reported on the production of alkoxyimidoyl iodides from alkoxyimidoyl tosylates.

Jordan Dinser gave an oral presentation entitled: Synthesis of single geometric isomers of oxime ethers of unsymmetrical benzophenones by palladium-catalyzed cross coupling reactions

10 April 2010

SEAL Student Manager Megan Lanier (Chemistry) gave an oral presentation of her work at the 2010 Annual SouthWest Regional Meeting (SWRM) of the American Association for the Advancement of Science (AAAS) at Rice University. Her talk was entitled: "SYNTHESIS OF SINGLE GEOMETRIC ISOMERS OF OXIME ETHERS OF UNSYMMETRICAL BENZOPHENONES BY PALLADIUM-CATALYZED CROSS COUPLING REACTIONS"

Additional outreach that does not fit into the above categories:

SEAL researchers Jordan Dinser, Megan Lanier, Arjun Pandey, Amber Bordelon, Patrick Flowers, and Patrick Gentry presented their work at a seminar given to the Department of Chemistry and Physics of Southeastern on 26 February 2010.

- **Problems Encountered:**
  No problems were encountered.

Contributions:

To undergraduate science education:

Significant improvements to undergraduate education have been made, particularly at the freshman and sophomore level. This is demonstrated by the fact that the SEAL program has targeted these students for recruitment: virtually all student applications for SEAL employment were from freshman, sophomores or students proposing to enter Southeastern as freshmen and both new SEALs were freshman or sophomores when they began their employment. The contributions of research to undergraduate science education are well known: experiential learning in its purest form, problem solving of a type seldom seen in traditional coursework, the application of knowledge in a context other than that in which it was gained, and motivation of students to enter and remain in scientific disciplines. Further, the SEAL program enhances science education in areas typically overlooked by traditional science education. These include:

1. Written and spoken communication: SEALs write progress reports for their industrial clients and weekly reports for their research supervisors and prepare oral and poster presentations of their research for public presentation (examples of these are included as an appendix).
2. Organization and planning: SEALs are given guidance and instruction on scientific practice, but are required to manage their time and organize their data, thus developing skills crucial to success after graduation.

Finally, we contribute to science education in our visits with middle and high school students in which we stress the importance of science and technology and scientific education to the future of Louisiana and its citizens.

To institutional and community capacity, and project sustainability:

The SEAL program builds community capacity and project sustainability by its interactions with Louisiana businesses. By training students in skills of direct relevance to Louisiana business and providing connection with potential employees, we build Louisiana's future. By working on current research problems, we help Louisiana based companies grow their businesses now. Our actions in this area include performing research for existing clients, and broadening that base with new clients. Examples beyond the existing clients discussed above are Kleinpeter Dairy Inc. who have arranged to meet with SEAL Faculty Director David Norwood and SEAL Student Manager Jordan Dinser. The project will ultimately be sustainable if area businesses are convinced that the services of SEAL, currently underwritten by the Board of Regents, are worth paying for. The original SEAL proposal established year three of the five year grant period as a benchmark for some private funding of the SEAL program and year five as the benchmark for private funding to be the sole support of the SEAL program. We have met this benchmark as the SEAL program has now begun to attract paid contracts regularly. If we manage to expand this in these uncertain economic times, the SEAL program will be well positioned to become self sufficient.

To project scalability:

Scalability of the program is approached through broadening the program to other Louisiana universities. Presentations by the Faculty Director and SEAL students to the APTEC board of directors and to the research faculty of Louisiana State University in Baton Rouge are efforts in this regard.

Project Revision

No significant revisions of the program have been made in this reporting period.

A minor variation in hiring is the assumption of three temporary SEALS, students who will not be maintained beyond the summer but will reap the advantages of the SEAL program for this period.

Annual Report for Year 2 (ending 6/30/2009)

PKSFI Program Report for LEQSF(2007-12)-ENH-PKSFI-PES-06

Second Interim report – 30 June 2009

Author: David Norwood, Assoc. Prof. Of Physics
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Executive Summary:

In the second reporting period, seven SEAL students and two SEAL faculty have worked on ten projects for six clients, resulting in 17 written reports (totaling 72 pages – included as Appendix A) to clients, five oral presentations to clients and three oral and six poster presentations at scientific meetings. In addition, SEAL students have reported their progress to SEAL faculty at monthly group meetings, at a departmental seminar for the Southeastern Department of Chemistry and Physics and in weekly written reports (totaling 407 pages – included as Appendix B).

Personnel:

FACULTY:

David Norwood – Assoc. Prof. of Physics

David Norwood (Ph. D. - Physics) is the Principal Investigator for the APTEC/SEAL program and the SEAL Faculty Director. As such, he is responsible for all aspects of the SEAL research program. In particular, he plays a key role in promoting the program both on and off campus. Examples of these activities are:

1. Recruiting and assessing students as potential SEAL researchers, from the Southeastern student body and from the pool of high school students who may enroll at Southeastern (the latter also informs high school graduates of the importance of science and industry in Louisiana's future).
2. Promoting the program to other faculty at Southeastern and at other universities, in order to foster collaborative activities with these other faculty in support of the goals of the SEAL program.
3. Promoting the program to Louisiana businesses, with the goal of developing projects for SEAL students and connecting SEAL students with potential employers.

In addition to these ongoing responsibilities, Norwood plays a day-to-day role in developing policies and procedures under which the SEAL program is to operate. This is a continuation and refinement of activities undertaken in the late summer of 2007 and in the first reporting period, in which the basic structure of the SEAL program was developed by Norwood, other SEAL faculty and the SEAL Student Managers, Megan Lanier and Jordan Dinser.

Finally, Norwood plays a direct role in the research performed by the SEAL students. In addition to a general supervisory role (e. g., proofreading reports to clients, training on and enforcing safety standards, reading weekly reports) over all SEAL students, he directly supervises the research associated with the V-LABS and Gaylord clients (described in detail later in the report).

Debra Dolliver – Asst. Prof. of Chemistry

Debra Dolliver (Ph. D. - Chemistry) is a co-PI for the APTEC/SEAL program. She plays a valuable role in assessing the technical needs associated with chemistry projects proposed by industrial clients, and is thus intimately involved in the initial meetings when a proposed project has a pronounced chemical basis. As with Norwood, above, she plays a day-to-day role in developing policies and procedures under which the SEAL program is to operate. This is a continuation and refinement of activities undertaken in the late summer of 2007 and in the first reporting period, in which the basic structure of the SEAL program was developed by Dolliver, the other SEAL faculty and the SEAL Student Managers, Megan Lanier and Jordan Dinser. In addition, Dolliver acts as Faculty Director on those occasions when the PI, Norwood, is away from campus.

Finally, Dolliver plays a direct role in the research performed by the SEAL students. In addition to a general supervisory role (e. g., proofreading reports to clients, training on and enforcing safety standards) over all SEAL students, she directly supervises the research associated with the Gaylord client (described in detail later in the report).

The following faculty have explicitly committed to participate in the SEAL program should a project arise requiring their area of expertise:

Faculty Member	**Ph. D. in:**	**Expertise**
Hye-Young Kim	Physics	Theory of nanomaterials
Rhett Allain	Physics	Remote data acquisition
Jeffrey Temple	Biochemistry	Protein cloning, purification and characterization
Thomas Sommerfeld	Physical Chemistry	Ab initio molecular structure calculations
Michael Doughty	Biochemistry	Protein cloning, purification and characterization
Sanichiro Yoshida	Physics	Laser physics and material science
Santino Ladogana	Chemistry	Inorganic chemistry

OTHER SOUTHEASTERN PERSONNEL:

Dennis Herringshaw – Industrial Liaison and Intellectual Property Officer

In his capacity as the Industrial Liaison for Southeastern, Dennis Herringshaw has been a valuable contributor to the SEAL Program. In addition to general support with administrative interactions and referring of potential projects, Dennis has been of great help in developing a one-page contract for industrial clients and a model Non Disclosure Agreement (a legal one for clients and a symbolic one to be used to stress to SEAL Students the importance of discretion in industrial connections). He also assisted in resolving issues regarding liability of SEAL students in their research activities and has been instrumental in facilitating interactions with industrial clients.

STUDENTS (Current SEALs):

Megan Lanier (Chemistry) – Student Manager

As a Student Manager, Megan's responsibilities encompass those of a Senior Student Researcher, with additional duties and responsibilities. As a researcher, Megan plays a primary role in taking data for a DMSO synthesis project (Gaylord LLC, Slidell), a waste management project (cellulose sources and markets, Tempico Inc., Hammond), a project to characterize dietary fiber (AXOS II for V-LABS, Covington), use of environmentally benign solvent mixtures as lens cleaning solvents (Gaylord LLC, Slidell) and market research for the CGBG/Greenstop project. She arranged to make measurements using equipment at LSU to compare to our results. She has reported on those projects to the clients, at a departmental seminar (26 SEP 2008), at the 64th Annual Southwest Regional Meeting (SWRM) of the ACS (Fall 2008), the Fall 2008 University of Louisiana Lafayette Undergraduate Research Invitational and at the Spring 2009 Meeting of the Louisiana Academy of Sciences (at which she also served as a student assistant to the conference organizing committee). Further, she delegates research activities to other SEALs, trains them and supervises their progress (in particular, with respect to the CGBG/Greenstop project). She also supervises and advises SEALs with respect to reporting on their results, whether in the form of an oral or written report to a client, or in the case of a public presentation. She meets with current or prospective clients to assess possible contracts (e. g., the CGBG Greenstop project and the “green” solvents project). And as a manager, she plays a direct role in dealing with financial and human-resources issues. For example, she performed a cost

analysis of the Gaylord lens cleaning project. She periodically reviewed the SEAL budget to ensure that there were funds sufficient to support the planned research activities over the Fall of 2008 and the spring and summer of 2009. She reviews applications for employment, interviews applicants and makes hiring decisions. She prepared a proposal for the Chemistry and Physics Department Head describing a possible role for the SEAL program in a proposed summer outreach program. Finally, in part because of her excellent performance as a SEAL manager and largely due to her excellence as a chemistry student and researcher, Megan was one of two students nationwide selected for a Gladys Anderson Emerson Scholarship from the Iota Sigma Pi National Honor Society for Women in Chemistry.
http://www.iotasigmapi.info/ISPstudentawards/2009emerson.pdf

Jordan Dinser (Chemistry) – Student Manager

Jordan's responsibilities as a manager mirror those of Megan (see above). Her specific activities have included direct research in azide synthesis in DMSO (Gaylord) and the use of those azides in electrophilic reaction media, the implementation of quality assurance/quality control testing for food packaging (Millard Foods, Slidell) which included setting up an in-house lab and developing training materials, and testing of environmentally benign solvents to clean microelectronics (Gaylord). She has reported on those projects to the clients (e.g., a meeting on Friday, 15 August 2008 with Albemarle executives regarding the e-waste project results) and at the 64th Annual Southwest Regional Meeting (SWRM) of the ACS and at the Spring 2009 Meeting of the Louisiana Academy of Sciences. She supervises and directs the work of other SEALs (e.g., the e-waste project performed by Patrick Gentry, the division of work elements for the International Coastal Revetment Products project and the Neill Corporation biodeisel project). She reviews and proofreads written reports prepared by other SEALs and is involved in assessing prospective projects (e.g., the CGBG/Greenstop project). She has developed cost estimates to justify the SEAL consulting rate and assessed a realistic Overhead (F&A) rate to be charged by the University. She has developed work schedules for the Fall 2008 and Spring and Summer 2009 working periods in order to assess budget needs and compare those projected needs to current budget reserves. She reviews applications for employment, interviews applicants and makes hiring decisions. She has played an active role in outreach activities (e.g., arranging and supervising a visit to Southeastern by students from Ponchatoula High School on 1 May 2009).

Alexandra Ruibal (Physics) – Senior Student Researcher

As a senior researcher, Alexandra's responsibilities encompass direct lab research (including reporting), planning of research and delegation of research to other SEALs (including supervision). She performs direct research on the various viscosity projects (e.g., water/methanol mixtures in support of a previous Gaylord project) and "green" cleaning solvent (assessing the use of DMSO solvent mixtures to clean microelectronics for client Gaylord). She developed an automated data acquisition system to link an Ohaus analytical scale to a data acquisition computer (and developed users notes to allow other students to make use of this system) in support of flow calibrations of a syringe pump and did preliminary work on a temperature control system for a single capillary viscometer. She presented results of her work at the Fall 2008 Southwest Regional Meeting of the ACS and at the Spring 2009 Meeting of the Louisiana Academy of Sciences Meeting. She performed literature research in support of the CGBG/Greenstop project.

Patrick Gentry (Business) – Student Researcher

As a researcher, Patrick's duties are to perform research as directed and report on that research. He has performed research on cellulose from landfills (as a source for client Tempico), an e-waste project for client Albemarle, a part of literature research for client CGBG/Greenstop and work on the spreadsheet for client ICRP (in the course of which he was able to advise the client of errors in ICRP's

marketing materials). He is in the process of developing a means to monitor biodeisel reactions (esterification of triglycerides) using differential scanning calorimetry (in the process of which he developed a user's guide that will be used in the physical chemistry lab, CLAB 396). He has reported his results at the Fall 2008 SWRM ACS Meeting, at the Spring 2009 Meeting of the Louisiana Academy of Sciences, and at a meeting of Albemarle executives on 15 August 2008. He has played an active role in outreach, arranging for promotion of the SEAL program on Southeastern's KSLU radio station, and promoting the SEAL program in a presentation to Nancy Saragusa's science club at Hammond High School on Monday, 12 Jun 2009. After this presentation, Patrick prepared a "lessons learned" document to serve as a starting point to develop outreach guidelines for use by Southeastern SEALs and to be made available to interested parties. Patrick visited the biodeisel reactor run by Bill Curry of Neill Corporation (and prepared notes describing the visit), which visit developed into a project with Neill to optimize their biodeisel production. He revised the SEAL brochures and consulted with Dr. Holly Syrdal of Southeastern, who volunteered to involve her advertising class in further development of the SEAL promotional materials. He played an active role in arranging the visit of Ponchatoula High School students to Southeastern.

Patrick Weber (Biology) – Student Researcher

As a researcher, Patrick's duties are to perform research as directed and report on the results. He has worked primarily on the Neill Corporation biodiesel project, but also on various elements of the CGBG/Greenstop project, some in collaboration with Dr. Rick Miller (Biology - Southeastern). He has been involved in outreach activities such as developing an in-house research journal to promote Southeastern and SEAL and presenting a poster regarding the SEAL program at the Hammond Elementary Science Fair, 31 March 2009.

Amber Bordelon (Chemistry) – Student Researcher

As a researcher, Amber's duties are to perform research as directed and report on the results. She has just begun work as a SEAL (June 2009) and thus has no work to report as yet.

STUDENTS (Former SEALs):

Andrew Holt (Physics) – Student Researcher

As a researcher, Andrew's duties were to perform research as directed and report on the results. He performed research on the implementation of quality assurance/quality control testing for food packaging (Millard Foods, Slidell) which included setting up an in-house lab and developing training materials and evaluating the development of an intonation device designed and patented by Richard Schwarz (Music). He worked on a project to evaluate the effectiveness of certain environmentally benign solvents in cleaning lenses. He presented the results of his research at the Spring 2009 Meeting of the Louisiana Academy of Sciences.

Activities and Findings:

- **Major research and educational activities, student training and workforce development;**

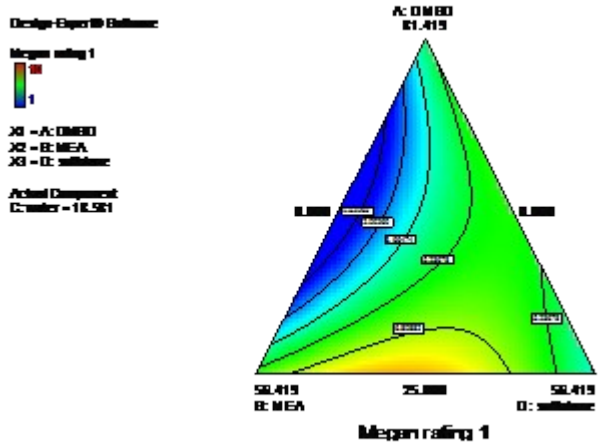
In the first year of the APTEC/SEAL program, major research and educational activities by student researchers have been on nine projects for six industrial clients. The major findings and the supporting evidence are summarized here and discussed in more detail in the appendices. Further, student training and workforce development is an integral part of the SEAL program. By having students work on research projects related directly to industry needs and report the results to industry representatives (i.e., clients), students are developing skills of direct relevance to Louisiana industry and developing contacts in the industries that have need of their services. The projects worked on

during this reporting period and the industrial clients are:

1) Synthesis of azidoxime ethers in dimethyl sulfoxide (DMSO) (Client: Gaylord Chemical Company, LLC. Slidell LA 70458)
   A more detailed report on this project is included as an appendix. This is a continuation of a project undertaken in the first reporting period. Supervised by SEAL faculty member Debra Dolliver, SEAL Student Managers Megan Lanier and Jordan Dinser have synthesized a new class of organoazides (azidoximes), which exhibit a high degree of thermal stability and do not display the typical reactivity of organoazides. This work constitutes the first general synthesis for O-alkylarylhydroximoyl azides and their full characterization. It has been demonstrated that, when treated with a Brønsted acid, these compounds primarily produce the Schmidt-type rearrangement product with only a small amount of the intramolecular cyclization product being generated. When treated with a Lewis acid, the primary product formed is the cyclization product. In demonstrating that this synthesis is possible in the solvent DMSO, this research provides the opportunity for the client, Gaylord Chemical Company, to expand the market for this product.

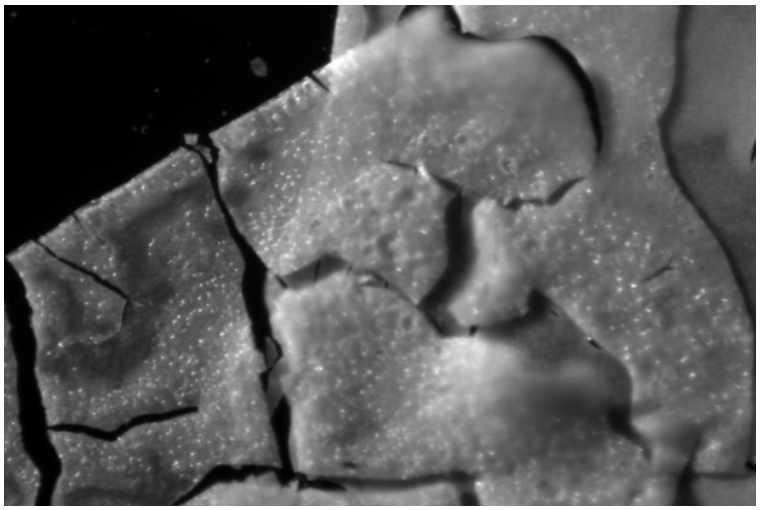
2) Sources of and markets for cellulose products (Client: Tempico, Inc. Hammond LA 70401)
   In order to support the development of alternative markets for their rotoclave system, SEAL members Megan Lanier and Patrick Gentry performed market research aimed at targeting markets for the use of Tempico's Rotoclave technology to pulverize cellulose, as well as sources of cellulose to serve as feedstocks.

3) Use of DMSO mixtures as environmentally benign cleaning solvents (Client: Gaylord Chemical Company, LLC. Slidell LA 70458)
   This comprises two projects. The first regards the evaluation of various DMSO-based formulations to replace a hazardous solvent used to clean lenses. Ultimately, a successful formulation was identified and Gaylord was able to use these results to gain a new client for this product. The following figure identifies the optimum solvent mix:



   The yellow region at the bottom represents the solvent mix most tolerant to water contaminants (the problem faced by Garylord's client).
   The second project was to assess the ability of various solvents to dissolve photoresist from silicon wafers, to open a market in the microelectronics industry. This project depended upon collaboration with the Biology department to access a microscope with digital camera to create images of the silicon surfaces. Example images are below:

Some elements of this work were presented by Gaylord personnel at the SEMATECH Surface Preparation and Cleaning Conference, held in Austin, TX on 23-25 March 2009. Further work has been discussed with the client (Gaylord) to develop an optimal solvent.



4) Calculations relating to Articulated Concrete Block erosion control systems (Client: International Coastal Revetment Systems, Baton Rouge LA)
In order to support sales and marketing, ICRP engaged the SEALs to develop a spreadsheeet based product to enable salespersons to immediately display the results of "what-if" style scenarios for prospective clients of ICRP's product, the Articulated Concrete Block (ACB) system for erosion control. In the course of this development, the SEALs were able to point out errors in ICRP's existing sales materials and also to demonstrate significant reductions in CO_2 production when using ACB systems as compared to poured concrete.

5) Molecular weights of dietary fiber (AXOS II) measured by light scattering (Client: V-LABS, Inc., Covington LA 70433)
V-LABS, Inc. is a chemical manufacturing and consulting firm that manufactures carbohydrates and polysaccharides for the food, biochemical and pharmaceutical industries. SEALs evaluated a dietary fiber AXOS II marketed by V-LABS using light scattering and HPLC. SEALs results for this sample were significantly larger than are the results of V-LABS assays, but SEALs results are consistent with those obtained at LSU. This inconsistency is currently unresolved, but may represent an previously unreported colloid formation.|

6) Assessment of gum arabic as an emulsifier using light scattering (Client: V-LABS, Inc., Covington LA 70433)
V-LABS was approached by an importer of gum arabic, desiring Multi-Angle-Laser-Light-Scattering (MALLS) measurements to obtain RMS radii of their samples as a means of assessing the viability of their gum arabic as a soft drink emulsifier. V-LABS engaged SEAL to perform the measurements as a subcontractor. Ultimately, the results were negative (the gum arabic sample was not suitable as an emulsifier) and the project was terminated.

7) Market research for alternative fuels (Client: CGBG LLC, Baton Rouge, LA 70801)
Unlike the other projects described in this report (which concern marketing information intended to be public), this project is constrained by a non-disclosure agreement executed between CGBG LLC and Southeastern Louisiana University. Thus, only information of a very

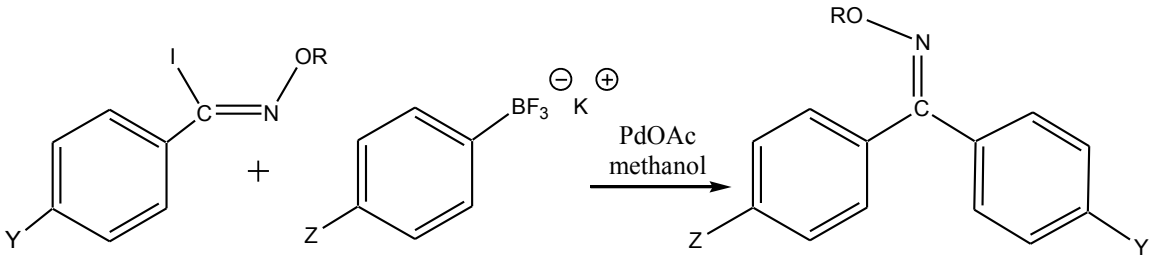
general nature can be revealed in this public document. In an attempt to evaluate a market opportunity to promote the use and distribution of alternative fuels, CGBG enlisted the aid of the SEAL research team to perform market research using Internet-based, phone-based and on-site resources. Several of the SEALs played an active role in this project, but in particular SEAL Researcher Patrick Gentry, with primary supervision and help from Student Manager Megan Lanier.

8) Monitoring transesterification of triglycerides (Client: Neill Corporation, Hammond LA 70403)
William Curry of Neill Corporation has established (using SEAL help in the last reporting period) a reactor to convert used cooking oil to biodiesel for use in Neill Corporation delivery trucks. In order to optimize his conversion of oil to biodiesel, Curry has engaged the SEALs to develop optimum reaction conditions and techniques to monitor the ongoing reaction. Primary work on this project is by SEAL researcher Patrick Weber, with significant help from SEAL Managers Megan Lanier and Jordan Dinser, and the supervision of Dr. Debra Dolliver.

9) Pyrolysis of waste plastic for fine chemicals and alternative fuels (Client: Carroll Lanier Consulting, Baton Rouge LA)
The need for a better way to dispose of waste plastic is clearly visible on the landscape and shores of the world. Even on the plains of East Africa, plastic shopping bags are scattered in the brush and trees for miles from any population center. Conventional recycling techniques today still can only handle a very small fraction of the waste plastic generated. Most waste plastic ends up in dumps and municipal landfills creating serious environmental problems. Pyrolysis and catalytic cracking of waste plastic can be an attractive alternative for this problem. Finding cheap attractive catalysts for this purpose is the key to widespread implementation of waste plastic conversion to valuable materials. Keys to success have been fairly well defined by many studies conducted all over the world in the last thirty years. Catalysts that allow cracking to be done at lower temperatures than simple thermal pyrolysis save on energy requirements, produce superior products and can save in equipment costs. Catalysts that have better life cycles and/or less severe catalyst regeneration cost are much preferred. SEAL has engaged with Carroll Lanier to develop methods to screen catalysts for the pyrolysis of waste plastics. Preliminary conversations have begun to collaborate with chemical engineering professor Kerry Dooley of LSU on this project.

10) Coupling of (Z)-*O*-alkylbenzohydroximoyl iodides with potassium phenyltrifluoroborates (No client – This is a part of general training of SEAL Researchers, as provided for in the statement of work)
The project involves the coupling of (Z)-*O*-alkylbenzohydroximoyl iodides with potassium phenyltrifluoroborates in the presence of a palladium catalyst (Scheme1). The goal of the project is controlling the stereochemistry of the carbon-nitrogen double bond. The (Z)-*O*-alkylbenzohydroximoyl iodides are synthesized by reacting the corresponding (Z)-*O*-alkylbenzohydroximoyl bromide with sodium iodide in sulfolane. The (Z)-*O*-alkylbenzohydroximoyl bromides are prepared by reacting *O*-alkylbenzohydroxamates with PBr_3 and Br_2 in benzene. The *O*-alkylbenzohydroxamates are prepared by reacting benzoyl chlorides with (*O*)-methylhydroxylamine hydrochloride. The potassium phenyltrifluoroborates are synthesized by reacting phenylboronic acids with potassium hydrogen fluoride.

Scheme 1:



• **Community Development and/or Outreach Activities**

Community outreach activities are of three general forms: 1) presentations to local high school and middle school students to promote the SEAL program in particular and the role of science in Louisiana's future in general, 2) presentations to industrial clients, either to promote the SEAL program in search of projects or to report on the results of an on-going project, and 3) presentations of the results of projects at scientific meetings, to promote SEAL, Southeastern and the client. Examples of such activities appear below:

Presentations to middle- and high school students:

12 January 2009

SEAL researcher Patrick Gentry and SEAL Faculty Director David Norwood presented the details of the SEAL program to the Science Club of Hammond High School, advised by Nancy Saragusa.

1 May 2009

SEAL Student Researchers Patrick Gentry and Patrick Weber presented the details of the SEAL program to students of Ponchatoula High School, who were visiting Southeastern with their physics teacher, Keith Edwards.

12 January 2009

SEAL researcher Patrick Weber presented a poster describing the SEAL program at the Hammond Elementary Science Fair.

Presentations to industrial personnel:

15 August 2008

SEAL Faculty Director David Norwood, and SEAL Student Manager Jordan Dinser met with Albemarle executives to present the progress made on the e-waste project. Presenting was SEAL Researcher Patrick Gentry and present from Albemarle were Wyndham Cook (Educational Liaison) and Dr. David Cleary (Corporate Sustainability Officer).

18 September 2008

SEAL Faculty Director David Norwood, and SEAL Student Manager Jordan Dinser met with Joe Impastato, CFO of Millard Foods to develop a project in which SEALs would implement Quality Assurance/Quality Control testing procedures for Millard Food products. Dinser and SEAL Researcher Andrew Holt developed procedures and training materials and equipped an

in-house testing lab ot allow Millard to perform the QA/QC testing themselves.

22 May 2009

SEAL Faculty Director Dr. David Norwood and SEAL Faculty member Debra Dolliver, along with Dennis Herringshaw (Industry Liaison, Southeastern) and Carole Lachney (OSRP, Southeastern) met with Carroll Lanier and Joe Sauer regarding a project to screen catalysts for pyrolysis of waste plastic.

26 May 2009

SEAL Faculty Director Dr. David Norwood and SEAL Faculty member Dr. Debra Dolliver, along with Dennis Herringshaw (Industry Liaison, Southeastern) and William Joubert (Director, SBDC, Southeastern) met with Jerome Stuart of CGBG LLC/Greenstop regarding collaboration on a $10 million DOE/ARPA grant to develop his Greenstop concept.

1 June 2009

SEAL Faculty Director David Norwood, and SEAL Faculty Member Dr. Debra Dolliver met with John (Chief Scientist) and Sharon Vercellotti (President) of V-LABS to discuss a collaborative project to develop markets for corn cob based hemicellulose. An SBIR proposal will be submitted to the USDA in September, 2009.

Presentations at scientific meetings:

1-4 October 2008

The following presentations were made at the 64th Southwest Regional Meeting (SWRM) of the American Chemical Society:

Poster 132:
Patrick Gentry presented details of the work he performed for a client (who wishes to be undisclosed) in order to: 1. determine the profitability of locating facilities that collect electronics and reuse materials in the plastics, 2. Identify if the plastics contain valuable resource chemicals, and 3. recycling these plastics to collect these resources. In this effort landfills were contacted by phone and visited. To determine the makeup of plastics, data was taken from samples of electronics that were in landfills using a portable x-ray fluorescence device.

Poster 205:
Alexandra Ruibal presented results of her work (largely performed in the previous reporting period) for client Gaylord Chemical Company, LLC, on single capillary viscosity measurements of various solvent and gel mixtures with DMSO.

Poster 217:
Megan Lanier reported on her work (with Jordan Dinser) for client Gaylord Chemical regarding the first general synthesis for O-alkylarylhydroximoyl azides and their full characterization. The stability of these compounds and their reactivity in intramolecular cyclization reactions, Schmidt-type rearrangements, and 1,3-dipolar addition reactions was reported.

Oral Presentation 360:

Jordan Dinser reported on her work (with Megan Lanier) for client Gaylord Chemical regarding the reactions of a new class of imidoyl azides (*O*-Alkylarylhydroximoyl azides) in electrophilic media, comparing and contrasting the results with that of prior workers. It has been demonstrated that, when treated with a Brønsted acid, these compounds primarily produce the Schmidt-type rearrangement product with only a small amount of the intramolecular cyclization product being generated. When treated with a Lewis acid, the primary product formed is the cyclization product.

15 November 2008

SEAL Student Manager Megan Lanier (Chemistry) was invited to attend the Fall 2008 University of Louisiana Lafayette Undergraduate Research Invitational. The abstract of her presentation is as follows:
The use of organic azides in synthetic schemes is becoming more widespread, primarily due to the fact that this functional group has become important in many pharmaceutical compounds. While the azide moiety has yet to be found in natural products, this functional group acts as a bioisostere of many other functional groups. Also azides are useful starting materials in the synthesis of heterocycles. Despite this recent interest, many shy away from these compounds because some are explosive in their decomposition to release nitrogen. We report the first general synthesis of O-alkylarylhydroximoyl azides 2Z (azidoxime ethers) and discuss their stability and reactivity.

27 February 2009
The following presentations were made at the 83rd Annual Meeting of the Louisiana Academy of Sciences, Southeastern Louisiana University, Hammond LA

Megan Lanier gave an oral presentation of her work on reactions of O-alkylarylhydroximoyl azides in electrophilic media.

Patrick Gentry presented a poster of his work on electronic waste.

Alexandra Ruibal and Andrew Holt presented a poster of their work on environmentally benign cleaning solvents for the cleaning of lenses and microelectronics.

Jordan Dinser presented a poster of her work on synthesis of O-alkylarylhydroximoyl azides .

Additional outreach that does not fit into the above categories:

SEAL was nominated by Dennis Herringshaw for an Educational Innovation award from the Louisiana Technology Council/Greater New Orleans Inc., New Orleans LA. Although we were not selected, SEAL received some publicity at the awards luncheon on 20 November 2008.

SEAL researchers Jordan Dinser, Megan Lanier, Alexandra Ruibal, and Patrick Gentry presented their work at a seminar given to the Department of Chemistry and Physics of Southeastern on 26 September 2008.

SEAL Faculty Director David Norwood presented the details of the SEAL Program as a seminar in the PHYS 130 class at Southeastern, a course specifically designed for freshman physics and science majors to portray the opportunities in physics and other sciences.

Megan Lanier's receipt of the national Gladys Anderson Emerson Scholarship for outstanding female junior chemistry major presented not only herself, but the SEAL program, Southeastern Louisiana University and Louisiana in a very positive light. The press release from the Iota Sigma Pi Women's Honor Society described Megan as follows:

> Megan Lanier is an outstanding junior Chemistry major at Southeastern Louisiana University. Her nominator, Debra Dolliver writes that Megan "is the best overall student I have had during my teaching career." Megan participates in the Student Entrepreneurs as Active Leaders (SEAL) program doing research under the guidance of Professor David Norwood for the industrial client, Gaylord Chemical Company. Her exceptional performance has lead to promotion all the way to Student Manager. In addition to her own research, she supervises and guides the work of other SEAL researchers, training them in scientific procedures and reviewing the presentations and reports prepared for clients. Ultimately, Megan wishes to pursue a Ph.D. in Chemistry.

Finally, SEAL, Southeastern and the Board of Regents received some publicity from an article in the Summer 2008 issue of the Economic Reporter (which covers economic issues relevant to the North Shore of Lake Pontchartrain) which SEAL Program and included quotes by Dennis Herringshaw regarding the commitment of Southeastern to spreading the SEAL Program to other Universities.

- **Problems Encountered:**

  No problems were encountered.

Contributions:

To undergraduate science education:

Significant improvements to undergraduate education have been made, particularly at the freshman and sophomore level. This is demonstrated by the fact that the SEAL program has targeted these students for recruitment: three of five student applications for SEAL employment, or 60%, were from freshman, sophomores or students proposing to enter Southeastern as freshmen and both new SEALs were freshman or sophomores when they began their employment. The contributions of research to undergraduate science education are well known: experiential learning in its purest form, problem solving of a type seldom seen in traditional coursework, the application of knowledge in a context other than that in which it was gained, and motivation of students to enter and remain in scientific disciplines. Further, the SEAL program enhances science education in areas typically overlooked by traditional science education. These include:

1. Written and spoken communication: SEALs write progress reports for their industrial clients and weekly reports for their research supervisors and prepare oral and poster presentations of their research for public presentation (examples of these are included as an appendix).
2. Organization and planning: SEALs are given guidance and instruction on scientific practice, but are required to manage their time and organize their data, thus developing skills crucial to success after graduation.

Finally, we contribute to science education in our visits with middle and high school students in which we stress the importance of science and technology and scientific education to the future of Louisiana and its citizens.

To institutional and community capacity, and project sustainability:

The SEAL program builds community capacity and project sustainability by its interactions with Louisiana businesses. By training students in skills of direct relevance to Louisiana business and providing connection with potential employees, we build Louisiana's future. By working on current research problems, we help Louisiana based companies grow their businesses now. Our actions in this area include performing research for existing clients, and broadening that base with new clients. Examples beyond the existing clients discussed above are Kleinpeter Dairy Inc. who have arranged to meet with SEAL Faculty Director David Norwood and SEAL Student Manager Jordan Dinser. The project will ultimately be sustainable if area businesses are convinced that the services of SEAL, currently underwritten by the Board of Regents, are worth paying for. The original SEAL proposal established year three of the five year grant period as a benchmark for some private funding of the SEAL program and year five as the benchmark for private funding to be the sole support of the SEAL program.

To project scalability:

Scalability of the program is approached through broadening the program to other Louisiana universities. Presentations by the Faculty Director and SEAL students to the APTEC board of directors and to the research faculty of Louisiana Tech in Ruston are efforts in this regard.

Project Revision

No significant revisions of the program have been made in this reporting period.

A minor variation in hiring is planned for the coming year, since we may have the ability to hire an additional student (perhaps for a limited period). A review of the current and expected budget by Student Managers Megan Lanier and Jordan Dinser suggests that we may have the funds to broaden the access of the SEAL program to another student.

Annual Report for Year 1 (ending 6/30/2008)

PKSFI Program Report for LEQSF(2007-12)-ENH-PKSFI-PES-06

First Interim report – 30 June 2008

Author: David Norwood, Assoc. Prof. Of Physics
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Executive Summary:

In the first reporting period, seven SEAL students and four SEAL faculty have worked on six projects for four clients, resulting in nine written reports (totaling 78 pages) to clients, four oral presentations to clients and three poster presentations at scientific meetings. In addition, SEAL students have reported their progress to SEAL faculty at monthly group meetings and in weekly written reports (totaling 228 pages). International coverage of the program was provided by an article in the chemistry trade journal Chemical and Engineering News and local coverage by two articles in the Hammond Daily Star newspaper.

Personnel:

FACULTY:

David Norwood – Assoc. Prof. of Physics

David Norwood (Ph. D. - Physics) is the Principal Investigator for the APTEC/SEAL program and the SEAL Faculty Director. As such, he is responsible for all aspects of the SEAL research program. In particular, he plays a key role in promoting the program both on and off campus. Examples of these activities are:

1. Recruiting and assessing students as potential SEAL researchers, from the Southeastern student body and from the pool of high school students who may enroll at Southeastern (the latter also informs high school graduates of the importance of science and industry in Louisiana's future).
2. Promoting the program to other faculty at Southeastern and at other Universities, in order to foster collaborative activities with these other faculty in support of the goals of the SEAL program.
3. Promoting the program to Louisiana businesses, with the goal of developing projects for SEAL students and connecting SEAL students with potential employers.

In addition to these ongoing responsibilities, Norwood plays a day-to-day role in developing policies and procedures under which the SEAL program is to operate. This is a continuation and refinement of activities undertaken in the late summer of 2007, in which the basic structure of the SEAL program was developed by Norwood and the other SEAL faculty.

Finally, Norwood plays a direct role in the research performed by the SEAL students. In addition to a general supervisory role (e. g., proofreading reports to clients, training on and enforcing safety standards, reading weekly reports) over all SEAL students, he directly supervises the research associated with the V-LABS and Gaylord clients (described in detail later in the report).

Debra Dolliver – Asst. Prof. of Chemistry

Debra Dolliver (Ph. D. - Chemistry) is a co-PI for the APTEC/SEAL program. She plays a valuable role in assessing the technical needs associated with chemistry projects proposed by industrial clients, and is thus intimately involved in the initial meetings when a proposed project has a pronounced chemical basis. As with Norwood, above, she plays a day-to-day role in developing policies and procedures under which the SEAL program is to operate. This is a continuation and refinement of activities undertaken in the late summer of 2007, in which the basic structure of the SEAL program was developed by Dolliver and the other SEAL faculty. In addition, Dolliver acts as Faculty Director on those occasions when the PI, Norwood, is away from campus.

Finally, Dolliver plays a direct role in the research performed by the SEAL students. In addition to a general supervisory role (e. g., proofreading reports to clients, training on and enforcing safety standards) over all SEAL students, she directly supervises the research associated with the Gaylord client (described in detail later in the report).

Thomas Sommerfeld – Asst. Prof. of Chemistry

Thomas Sommerfeld (Ph. D. - Chemistry) supervised the theoretical calculations performed by Rebecca Weber (below) in support of the Gaylord synthesis project (described in detail later in the report).

Mike Doughty – Prof. of Chemistry

Mike Doughty (Ph. D. - Chemistry) was a co-PI of the original SEAL grant and played an active role in preparing the grant and designing the basic structure of the SEAL program in late summer of 2007. As an expert in biochemistry, he is committed to serve as the supervisor to SEAL researchers should they undertake a biochemistry-related project.

Sanichiro Yoshida – Assoc. Prof of Physics

Sanichiro Yoshida (Ph. D. - Physics) was a co-PI of the original SEAL grant and played an active role in preparing the grant and designing the basic structure of the SEAL program in late summer of 2007. As an expert in laser physics and material science, he is committed to serve as the supervisor to SEAL researchers should they undertake a project in these areas.

Santino Ladogana – Instructor of Chemistry

Santino Ladogana (Ph. D. - Chemistry) has played an active role in supervising research related to inorganic chemistry and chemical analysis. Specifically, he made preliminary measurements for a prospective biofuels project (Neill Corporation, Hammond LA) and participated in discussions regarding an oil-extraction project (Epic Labs, Ponchatoula LA). He is currently planning and directing the measurements to be made for a "green-chemistry" project (Albemarle, described below).

The following faculty have explicitly committed to participate in the SEAL program should a project arise requiring their area of expertise:

Faculty Member	**Ph. D. in:**	**Expertise**
Hye-Young Kim	Physics	Theory of nanomaterials
Rhett Allain	Physics	Remote data acquisition
Jeffrey Temple	Biochemistry	Protein cloning, purification and characterization

STUDENTS (Current SEALs):

Megan Lanier (Chemistry) – Student Manager

As a Student Manager, Megan's responsibilities encompass those of a Senior Student Researcher, with additional duties and responsibilities. As a researcher, Megan plays a primary role in taking data for a DMSO synthesis project (Gaylord), a polysaccharide characterization project (V-LABS) and a "green-chemistry" project (Albemarle). She has reported on those projects to the clients and at the Annual Meeting of the American Chemical Society in New Orleans (Spring 2008). Further, she delegates research activities to other SEALs, trains them and supervises their progress (in particular, with respect to the Gaylord and V-LABS projects). She also supervises and advises SEALs with respect to reporting on their results, whether in the form of an oral or written report to a client, or in the case of a public presentation. She meets with current or prospective clients to assess possible contracts (e. g., the oil-extraction project and the "green-chemistry" project). And as a manager, she plays a direct role in dealing with financial and human-resources issues. For example, she prepared an employee manual for beginning SEALs, outlining their duties and responsibilities. She reviewed the SEAL budget to ensure that there were funds sufficient to support the planned research activities over the spring and summer of 2008, and developed specific policies to implement the faculty guideline on minimum GPA for SEALs. These documents are included in the current report as appendices.

Jordan Dinser (Chemistry) – Student Manager

Jordan's responsibilities as a manager mirror those of Megan (see above). Her specific activities have included direct research in azide synthesis in DMSO (Gaylord) and "green chemistry" (Albemarle) projects. She has reported on those projects to the clients and at the Annual Meeting of the Louisiana Academy of Sciences in Natchitoches, LA (Spring 2008) and at the Spring Meeting of the American Chemical Society in New Orleans, LA (Spring 2008). She reviews and proofreads written reports prepared by other SEALs and is involved in assessing prospective projects (e. g., the oil extraction project - COMPANY). She has developed work schedules for the summer of 2008 and (with Megan) devloped procedures to implement the GPA requirements for SEALs.

Alexandra Ruibal (Physics) – Senior Student Researcher

As a senior researcher, Alexandra's responsibilities encompass direct lab research (including reporting), planning of research and delegation of research to other SEALs (including supervision). She performs direct research on the DMSO gel project (Gaylord – described below) and supervises the activities of Patrick Weber in support of that project (flow rate measurements of the viscometer). In addition, she is developing a temperature control system to augment the viscometry measurements and possibly begin an oil viscosity project (Dow).

Patrick Gentry (Business) – Student Researcher

As a researcher, Patrick's duties are to perform research as directed and report on that research. He has performed research on a "green chemistry" project (Albemarle) and reported the results to the client, both in written form and orally, at a Q&A session with the client.

Patrick Weber (Biology) – Student Researcher

As a researcher, Patrick's duties are to perform research as directed and report on the results. He has worked on flow rate measurements of the pump driving a viscometer, including current efforts to computerize those measurements (connecting a scale to a computer and acquiring the data automatically).

STUDENTS (Former SEALs):

Alexandra McNicoll (Biology) – Student Researcher

As a researcher, Alexandra's duties were to perform research as directed and report on the results. She performed research measuring the properties of polysaccharides by light scattering (V-LABS) and reported on those results to the client, orally and in written form. The written reports are included in this report as an appendix.

Christopher Hill (Physics/Math) – Student Researcher

As a researcher, Chris's duties were to perform research as directed and report on the results. His work was to measure the optical properties of polysaccharides in solution in support of the V-LABS project. He presented his results in a departmental seminar.

STUDENTS (Not affiliated with SEALs):

Rebecca Weber (Chemistry)

Though not affiliated with the SEAL program, Rebecca performed theoretical calculations in support of experiments performed for the Gaylord client by SEALs Megan Lanier and Jordan Dinser.

Her work was supervised by Thomas Sommerfeld (above) and reinforced conclusions drawn by Dolliver, Lanier and Dinser from their experiments.

Activities and Findings:

• **Major research and educational activities, student training and workforce development;**

In the first year of the APTEC/SEAL program, major research and educational activities by student researchers have been on six projects for four industrial clients. The major findings and the supporting evidence are summarized here and discussed in more detail in the appendices. Further, student training and workforce development is an integral part of the SEAL program. By having students work on research projects related directly to industry needs and report the results to industry representatives (i.e., clients), students are developing skills of direct relevance to Louisiana industry and developing contacts in the industries that have need of their services. The projects worked on during this reporting period and the industrial clients are:

1) Synthesis of azidoxime ethers in dimethyl sulfoxide (DMSO) (Client: Gaylord Chemical Company, LLC. Slidell LA 70458)
   A more detailed report on this project is included as an appendix. Supervised by SEAL faculty member Debra Dolliver, SEAL managers Megan Lanier and Jordan Dinser (supported by other non-SEAL students) have synthesized a new class of organoazides (azidoximes), which exhibit a high degree of thermal stability and do not display the typical reactivity of organoazides. These compounds have been found to undergo a Schmidt-type rearrangement in acidic media, to produce an alkoxyurea. Work is currently underway to characterize a second product, believed to be tetrazole, found in electrophilic media in nonpolar solvents. Computational analysis (by non-SEAL researcher Rebecca Weber, supervised by faculty member Thomas Sommerfeld) and experimental data indicate that the type of solvent may affect whether the kinetic product (i.e., tetrazole) or thermodynamic product (i.e., urea) is formed. In demonstrating that this synthesis is possible in the solvent DMSO, this research provides the opportunity for the client, Gaylord Chemical Company, to expand the market for this product.

2) Viscosity of DMSO/cellulose gel formulations for pharmaceutical applications (Client: Gaylord Chemical Company, LLC. Slidell LA 70458)
   A more detailed report on this project is included as an appendix. Supervised by SEAL faculty member David Norwood, SEAL researcher Alexandra Ruibal made viscosity measurements of various DMSO gel formulations. The motivation for these measurements is to expand the market for DMSO (manufactured by Gaylord) into pharmaceutical applications. Specifically, the goal is to use suitably thickened DMSO as a means of delivering pharmaceutically active ingredients through the skin. A single capillary viscometer built around a Validyne Engineering pressure transducer was calibrated using pure water and then tested using pure DMSO. The measured viscosity of DMSO was within a few percent of the tabulated viscosity of pure DMSO. Measurements of viscosity were then taken for a set of cellulose thickeners dissolved in DMSO as a function of concentration and as a function of shear. The concentration of cellulose varied from 0.5 to 2.0 % (by weight) and seem to show a transition in that concentration range from a thick solution to a gel. The thickening additives were various brands of: methylcellulose, hydroxypropyl-cellulose, hydroxypropyl-methylcellulose, and polyacrylic acid. The DMSO solutions showed a rich behavior, including Newtonian (viscosity independent of shear) and thixotropic (viscosity decreasing with increased shear), depending upon the

additive and its concentration. It was pointed out to the client that thixotropic behavior was a potential selling point, in that the viscosity decreases as the gel is flowing (making delivery easier) and then increases once flow stops (making application less messy). In some cases, the transition from Newtonian to thixotropic behavior was observed. In these cases, the data fit a modified Carreau-Yassuda model of viscosity:

$$\eta = \frac{\eta_0}{(1+(\gamma\tau)^2)^a} \qquad (1)$$

where a and τ are fit parameters, η_0 is the low-shear viscosity (determined independently) and γ is the average shear rate (calculated from the flow rate). Data taken with the single capillary viscometer at Southeastern were compared to data taken by the client with a Brookfield viscometer, and it was discovered that the Brookfield viscosity was uniformly and significantly higher than that measured by the single capillary viscometer. This difference was rationalized as due to the significant delay between the time the measurements were made with the Brookfield viscometer and the time the samples were delivered to Southeastern for measurement. In order to test that idea, we are currently making side by side measurements of newly made samples using both viscometers and also following these measurements over time. Preliminary data indicate that we were correct to think that the viscosity decreases with time. However, the mismatch between the two measurement methods is now reversed, with the Brookfield viscosity being significantly below the single capillary results. We are currently exploring the possibility that this is due to differing effects of thixotropy on the very different viscometer geometries.

3) Viscosity of DMSO/water and DMSO/methanol mixtures (Client: Gaylord Chemical Company, LLC. Slidell LA 70458)

A more detailed report on this project is attached as an appendix. Dimethyl sulfoxide (DMSO) is an important solvent, having the ability to dissolve both polar and nonpolar compounds, while being miscible with a great many other solvents. Gaylord Chemical Company is a leading supplier of this solvent. As a part of their customer support activities, and in an effort to understand certain anomalies in the behavior of mixtures of DMSO with other solvents, the client was interested in knowing the viscosity of DMSO/water and DMSO/methanol mixtures as function of concentration (expressed as the fraction, by mass, of DMSO). Under the supervision of SEAL faculty member David Norwood, SEAL senior researcher Alexandra Ruibal made the measurements. Different concentrations of DMSO in a DMSO/water mixture were prepared using purified, biochemistry-grade water and HPLC grade DMSO (provided by Gaylord) and the viscosity of these were measured using a single capillary viscometer. The viscosity ranged from (1.0104±0.0044) cP at 10% DMSO (by weight) to a maximum of (3.086±0.031) cP at about 80% DMSO (where the molarity of DMSO is approximately that of water), then back down to (2.514±0.012) cP at 90% DMSO. This peaked behavior is in contrast to that of organic solvents, in which the viscosity of a binary mixture varies smoothly (almost linearly) between the viscosity of the two components. Similar measurements were made on mixtures of DMSO and methanol. In this case, there was no pronounced peak as with the water mixture. However, simple interpolation formulas (e.g., the Carr and Refutas equations) failed to fit the experimental data. A simple one-parameter model was developed that fits the DMSO/water data very well, but is less successful with the DMSO/methanol data. SEAL researcher Alexandra Ruibal is making measurements of water/methanol mixtures are being made in an attempt to understand the discrepancy. In support of this project, SEAL researcher Patrick

Weber is making extensive measurements of the flow rate of the pump driving the single capillary viscometer. In order for the viscosity results from the single capillary viscometer to be valid, it is necessary that the volume flow rate of the pump be uniform and also consistent from one set of measurements to another and under varying experimental circumstances. Results so far indicate that the pump performs as required, aside from an overall 3% variation in flow rate from pump specifications. (Small variations in flow rate, so long as they are constant over all measurement conditions, cancel in the calibration step). Ruibal and Weber are refining these measurements by incorporating computerized data acquisition. That is, they will interface an analytical balance to a data acquisition computer with the intent of refining the flow rate measurements. Finally, a temperature control system is being developed that will allow better control of the temperature of the single capillary viscometer, and may permit temperature dependent light scattering measurements (see the Dow project below).

4) Molecular weights of polysaccharide fractions measured by light scattering (Client: V-LABS, Inc., Covington LA 70433)

More details on this project are included as an appendix to this report. V-LABS, Inc. is a chemical manufacturing and consulting firm that manufactures carbohydrates and polysaccharides for the food, biochemical and pharmaceutical industries. V-LABS wished to validate their in-house characterization of polysaccharides (primarily by gel permeation chromatography – GPC – with refractive index detection) against the more sophisticated light-scattering and triple-detection GPC techniques available at Southeastern. Supervised by SEAL faculty member David Norwood, former SEAL researcher Alexandra McNicoll and SEAL manager Megan Lanier made light scattering and triple detection GPC measurements of a variety of maltodextrin fractions provided by V-LABS. McNicoll made measurements of identical samples using both batch and triple-detection GPC and found that the results were generally consistent (although there were exceptions – see the appendix). However, these consistent results were uniformly larger than the results provided by V-LABS, sometimes significantly so. We attribute this difference to a well-known difficulty regarding molecular weight measurements of aqueous systems using GPC with only a concentration detector (such as refractive index or ultraviolet absorption) or a viscometer (using the so-called Universal Calibration). In order for a molecule to dissolve in water, it must be somewhat polar and in order for water to wet and thus penetrate a column packing material, it must likewise be polar. Thus, in an aqueous system, one has a polar molecule in a polar solvent passing through a polar stationary phase. It is thus clear that interactions will play a role in the elution profile. One may see a variation in the molecular weight derived from GPC from a comparatively minor 10-20% (for similar molecules in a similar solvent) to orders of magnitude (a polyelectrolyte in varying ionic strength, for example). V-LABS provided a set of other polysaccharides and SEAL manager Megan Lanier made similar measurements. Her results were consistent with those of McNicoll. Furthermore, her data showed explicitly that GPC with only a concentration detector underestimated the molecular weight of her samples, confirming the attribution described above (see also the appendix).

A parameter required in order to make molecular weight determinations from light scattering is the refractive index increment (the change in refractive index caused by a unit change in polymer concentration). While its value varies little for water soluble polymers (from about 0.11 mL/g to 0.2 mL/g), precise results for molecular weight require precise knowledge of this parameter. Thus, former SEAL researcher Christopher Hill and student manager Megan Lanier made measurements of the refractive index increment for the V-LABS samples using a

Chromatix KMX-16 refractive index detector and a Shodex RI-71 refractive index detector. With these results, greater confidence in our molecular weight measurements is achieved.

5) Market research for green chemistry (Client: Albemarle Corporation, Baton Rouge, LA 70801) Unlike the other projects described in this report (which concern marketing information intended to be public), this project is constrained by a non-disclosure agreement executed between Albemarle Corporation and Southeastern Louisiana University. Thus, only information of a very general nature can be revealed in this public document. In an attempt to evaluate a market opportunity to minimize the impact of flame retardant plastics upon the environment, Albemarle enlisted the aid of SEAL researcher Patrick Gentry to perform market research using Internet-based, phone-based and on-site resources. As an undergraduate business major, Gentry is uniquely suited to this research which is of the type that he will routinely perform as a practicing businessman. We expect that as the project progresses, Patrick will perform chemical analysis under the guidance of the SEAL managers and faculty. Although this is NOT the sort of work that Patrick will undertake as a businessman, the experience will aid him in interacting with scientists and directing a science-based business.

6) Light scattering measurements of oils (Client: Dow Chemical Company, Houston, TX 77042) This is a very preliminary project to be undertaken in conjunction with APTEC researchers at Louisiana State University. As it involves light scattering as a function of temperature, SEAL researcher Patrick Weber, supervised by senior researcher Alexandra Ruibal and SEAL faculty David Norwood, is developing a temperature control system that will be used to vary the temperature of an oil sample while measuring the light scattered with a dynamic light scattering system. Even in the absence of this project, the temperature controller will also be used with the single capillary viscometer to permit temperature-controlled and temperature-dependent measurements of viscosity.

• **Community Development and/or Outreach Activities**

Community outreach activities are of three general forms: 1) presentations to local high school and middle school students to promote the SEAL program in particular and the role of science in Louisiana's future in general, 2) presentations to industrial clients, either to promote the SEAL program in search of projects or to report on the results of an on-going project, and 3) presentations of the results of projects at scientific meetings, to promote SEAL, Southeastern and the client. Examples of such activities appear below:

Presentations to middle- and high school students:

19 October 2007

SEAL researcher Chris Hill and SEAL Faculty Director David Norwood presented the details of the SEAL program to visiting students from Ponchatoula High School. The students were visiting the Department of Chemistry and Physics with their physics teacher, Keith Edwards. (One student asked if it's possible for a high school student who attends Southeastern part-time to be a SEAL).

29 November 2007

SEAL Senior Student Researcher Megan Lanier and SEAL Faculty Director David Norwood

presented the details of the SEAL program to students of Loranger High School in Loranger, Louisiana on 29 November 2007. Included was a simulated sunset to demonstrate Rayleigh scattering (one of the experimental techniques SEALs use).

9 April 2008

SEAL Senior Student Researcher Jordan Dinser and SEAL Faculty Director David Norwood presented the details of the SEAL program to students of J. Q. Adams Middle School in Metairie, Louisiana on 9 April 2008. Included was a simulated sunset to demonstrate Rayleigh scattering (one of the experimental techniques SEALs use). A question and answer period with the students followed.

Presentations to industrial personnel:

20 September 2007

SEAL Faculty Director Dr. David Norwood presented the details of the SEAL program at a quarterly meeting of a Technical and Marketing Team of Gaylord Chemical (Bogalusa, LA), in order to discuss new collaborative directions. Several possible collaborations using the equipment and expertise provided by SEAL were discussed. Present for Gaylord at the meeting were: Robert Strub (Director, Market Develoment), Craig Alexander (VP- Marketing and Business Development), Artie McKim (Technical Director) and George Kvakovszky (Director of Technology).

26 September 2007

SEAL Faculty Director David Norwood, and SEAL Faculty Debra Dolliver and Santino Ladoganga met with Bill Curry of the Neill Corporation regarding a plan to develop biodeisel for their delivery trucks. Dr. Ladogana made preliminary measurements of the Mr. Curry's biodeisel product. Reports on those measurements are included in the appendix.

9 October 2007

SEAL researcher Alex McNicoll, along with SEAL faculty David Norwood and Debra Dolliver met with clients John and Susan Vercellotti of V-LABS (Covington, LA) to discuss the progress of the Maltodextrin analysis project. V-LABS personnel were impressed with the progress and eager to continue the collaboration.

30 October 2007

Darrell Phillips, Director of the Epic Lab in Ponchatoula, LA attended the monthly SEAL status meeting to hear presentations by the SEAL Researchers and discuss possible collaborations between SEAL and Epic. Mr. Phillips was very impressed by the work being done by the SEALs and expressed an eagerness to collaborate. Plans were discussed in which SEALs would perform a simple daily characterization of the output of the Epic Lab purification process.

Presentations at scientific meetings:

13 November 2007

Research performed by SEAL Student Researcher Lexi Ruibal in collaboration with Dr. Artie McKim (Gaylord Chemical Company in Bogalusa, LA.) was presented at the annual meeting of the American Association of Pharmaceutical Scientists, held 11-15 November, 2007 at the San Diego Convention Center, San Diego, CA.

20 February 2008 – at APTEC board meeting

SEAL Faculty Director David Norwood presented the details and status of Southeastern's SEAL program to the Board of Directors of the Applied Polymer Technology Extension Consortium. Present were: Paul Russo (LSU), Su-Seng Pang (LSU), Eyassu Woldesenbet (LSU), Daniel DeKee (Tulane) and Wayne Reed (Tulane). After the status report, a strategy discussion ensued in which plans for building and extending the SEAL program were made.

15 March 2008

SEAL Senior Researcher Megan Lanier (Chemistry) attended a meeting of various polymer researchers from Louisiana State University, Oak Ridge National Laboratory and the Institute of Chemistry of the Chinese Academy of Sciences. The purpose of this meeting was to foster collaborative research activities among these institutions, and in particular to establish a connection with the International School of Polymer Education in China, a joint operation with the Max Planck Institute in Germany. In addition to describing the SEAL program in general, Megan described the work she has done on synthesis with DMSO as a solvent (in collaboration with Gaylord, LLC, Bogalusa, LA) and on characterization of polysaccharides by light scattering (in collaboration with V-LABS, Covington, LA).

15 March 2008

SEAL researchers Jordan Dinser (Chemistry) and Lexi Ruibal (Physics) presented the results of their research at the 2008 Meeting of the Louisiana Academy of Sciences. Jordan's presentation was entitled “Synthesis of O-methylbenzohydroximoyl azides and their reactions in acidic/electrophilic media.” and discussed work she did in collaboration with Gaylord, LLC of Bogalusa, LA. Lexi's poster was entitled "The SEAL Program and DMSO Viscosities" and discussed measurements of the viscosity of DMSO with various additives, also performed in collaboration with Gaylor, LLC. Lexi and Jordan secured funding for their trips by writing grants to the Southeastern College of Science and Technology STAR Program.

27 March 2008

SEAL Faculty Director David Norwood presented the details and progress of the SEAL program at the 17th Annual USM/USA Miniconference on Undergraduate Research, hosted at Southeastern Louisiana University on 27 March 2008. Present were faculty and students from the University of South Alabama and Louisiana Tech. Contacts developed there with Louisiana Tech faculty resulted in a visit and presentation on 1 May 2008 by SEAL personnel to Louisiana Tech in Ruston LA.

11 April 2008

SEAL Student Managers Megan Lanier and Jordan Dinser presented a poster at the Spring 2008 Meeting of the ACS. Her poster, CHED # 672, was entitled “Schmidt-type rearrangements reactions of N-alkoxyimidoyl azides". Coauthors included SEAL Senior Researcher Jordan Dinser, SEAL Faculty advisor Dr. Debra Dolliver and Megan's client in this project, Dr. Artie McKim of Gaylord Chemical LLC. Other coworkers were Veronica Wells and Caitlin Costanza. This presentation resulted in an article in the international chemistry trade publication, Chemical and Engineering News (page 45 in Volume 86, No. 20, 19 April 2008).

Additional outreach that does not fit into the above categories:

SEAL researchers Jordan Dinser, Megan Lanier, Alexandra McNicoll, Alexandra Ruibal, and Chris Hill presented their work at a seminar to the Department of Chemistry and Physics.

In a presentation unrelated to SEAL, SEAL faculty member Debra Dolliver and SEAL managers Megan Lanier and Jordan Dinser joined Southeastern chemistry faculty member Gina Little in demonstrating chemical changes to students attending a summer camp on 3 June 2008. The camp was sponsored by the 21st Judicial District (covering Tangipahoa, St. Helena and Livingston parishes) and the Truancy Assessment and Service Center. Approximately 75 at-risk students were shown how to generate and detect carbon dioxide gas in an attempt to show them the power and importance of education and science.

Finally, SEAL, Southeastern and the Board of Regents received some publicity from two articles in the Hammond Daily Star newspaper, once near the beginning of the current reporting period (20 Jun 2007) and again just recently (24 Jun 2008).

- **Problems Encountered:**

The only significant problem encountered concerned the involvement of the co-PIs in the SEAL program. Due to significant other commitments, the other PIs have found that they are unable to assume the responsibilities of Faculty Director. The original proposal provided that the co-PIs would each serve a year as Faculty Director on a rotating basis. It has been decided that the PI, David Norwood, would serve in that position for all five years of the proposed grant period. Further, only two of the PIs, Norwood and Dolliver, are playing an active role in the day-to-day operations of the program. The other co-PIs are still committed to participating as research supervisors.

Contributions:

To undergraduate science education:

Significant improvements to undergraduate education have been made, particularly at the freshman and sophomore level. This is demonstrated by the fact that the SEAL program has targeted these students for recruitment: 10 of 13 student applications for SEAL employment, or 77%, were from freshman, sophomores or students proposing to enter Southeastern as freshmen and 5 of 7, or 71%, of SEALS were freshman or sophomores when they began their employment. The contributions of research to undergraduate science education are well known: experiential learning in its purest form, problem solving of a type seldom seen in traditional coursework, the application of knowledge in a

context other than that in which it was gained, and motivation of students to enter and remain in scientific disciplines. Further, the SEAL program enhances science education in areas typically overlooked by traditional science education. These include:

1. Written and spoken communication: SEALs write progress reports for their industrial clients and weekly reports for their research supervisors and prepare oral and poster presentations of their research for public presentation (examples of these are included as an appendix).
2. Organization and planning: SEALs are given guidance and instruction on scientific practice, but are required to manage their time and organize their data, thus developing skills crucial to success after graduation.

Finally, we contribute to science education in our visits with middle and high school students in which we stress the importance of science and technology and scientific education to the future of Louisiana and its citizens.

To institutional and community capacity, and project sustainability:

The SEAL program builds community capacity and project sustainability by its interactions with Louisiana businesses. By training students in skills of direct relevance to Louisiana business and providing connection with potential employees, we build Louisiana's future. By working on current research problems, we help Louisiana based companies grow their businesses now. Our actions in this area include performing research for existing clients, and broadening that base with new clients. Examples beyond the existing clients discussed above are Epic Lab, Neill Corp., for whom SEAL made preliminary measurements, and Tempico Inc. who have arranged to meet with SEAL Faculty Director David Norwood and SEAL Student Manager Jordan Dinser. The project will ultimately be sustainable if area businesses are convinced that the services of SEAL, currently underwritten by the Board of Regents, are worth paying for. The original SEAL proposal established year three of the five year grant period as a benchmark for some private funding of the SEAL program and year five as the benchmark for private funding to be the sole support of the SEAL program.

To project scalability:

Scalability of the program is approached through broadening the program to other Louisiana universities. Presentations by the Faculty Director and SEAL students to the APTEC board of directors and to the research faculty of Louisiana Tech in Ruston are efforts in this regard.

Project Revision

The only significant change made to the SEAL program is the practice of rotating the Faculty Director position among the SEAL co-PIs. The modification is that David Norwood will assume this duty for all five years of the funding period. Due to greater than expected responsibilities in other areas, the co-PIs are unable to devote the time required. Note that this in no way degrades the capabilities of the program or relaxes any benchmarks or deadlines. It simply maintains the same person as director (it may even be argued that keeping the same person in the position enhances the program, with the knowledge and skill gained by that person maintained and increased over the grant period).

A minor variation in hiring is planned for the coming year, since we may have the ability to hire an additional student (perhaps for a limited period). A review of the current and expected budget by Student Managers Megan Lanier and Jordan Dinser suggests that we may have the funds to broaden the access of the SEAL program to another student.