iNEER Award Nomination

A. Nominator:

Dr. George E. Dieter, Glen L. Martin Institute Professor of Engineering; University of Maryland; 2145 Glenn L. Martin Hall; College Park, Maryland 20142-3035, USA; gdieter@eng.emd.edu; +1 301-405-5248.

Dr. John D. Carpinelli; Associate Professor of Electrical and Computer Engineering; New Jersey Institute of Technology; University Heights; Newark, New Jersey 07102-1982, USA; carpinelli@njit.edu; +1 973-596-3536.

B.1 Nominee: Gateway Engineering Education Coalition

Contact: Dr. Eli Fromm; Roy A. Brothers University Professor and Professor of Electrical and Computer Engineering; Drexel University; 3141 Chestnut St., Philadelphia, Pennsylvania 19104, USA; fromm@drexel.edu; +1 215-895-2201.

B.2 Category: Leadership

B.4 Summary of Accomplishments:

A collaborative program of 7 academic institutions headquartered at Drexel University in partnership with Columbia University, Cooper Union, New Jersey Institute of Technology, Ohio State University, Polytechnic University, and the University of South Carolina and supported by the Engineering Directorate of the National Science Foundation the Gateway Engineering Education Coalition has altered engineering education from a singular focus on course content to one inclusive of the development of human resources and the broader experience founded on a multidisciplinary, integrated curriculum. As intellectual threads, the introduction of engineering "up-front", the integrative aspects of the engineering process, the development of professional competencies, multidisciplinary emphasis, assessment and continuous improvement, and instructional technologies are woven together into an integrated educational fabric. This environment is achieved, in part, through innovative cross-institutional programs that diminish the barriers among institutions as well as within institutions. Some aspects go beyond the borders of the United States including "Globetech", a global technology management simulation.

The Coalition has changed the way the full spectrum of interactive segments of the engineering educational process is conducted. It has led the way not only in innovative curriculum developments, the concurrency of learning the technical/scientific skills with leadership and communication skills and ethics, but also how faculty interact with students, how students learn, how emerging technologies can be imbedded into the educational environment to make it more exciting and more effective and the assessment of how well the educational processes are meeting clearly defined objectives.

The partners of the Gateway Engineering Education Coalition have developed a model of the emerging engineering professional who possesses a broad set of competencies from the very first day of matriculation into engineering through an understanding of the context as well as the content of their academic program and their professional interests. The student has become a collaborative contributor to the learning process through an integrated curriculum and program where faculty and institutional leaders help the students make the connections; synthesize as well as analyze; develop a sense of open ended inquiry, and to do so through a learning environment that fuses experiential learning with the fundamental scientific and technical principles, all within the engineering context.

With an emphasis of design as the heart of engineering, almost all entering engineering freshmen at the partner schools now begin their studies with an engineering design experience including fabrication of devices in some instances. This is in significant contrast to the time when the Coalition began and almost no freshmen were involved in much engineering and certainly not engineering design. Integrated through this design team concept the students also learn aspects of organizational dynamics as well as communication and presentation skills. This concept of learning the fundamental mathematics and sciences in an engineering context has led to significant improvements in first to second year, and second to third year, student retention in engineering for all students and specifically for women and other underrepresented groups. Overall this has led to a 43% increase in the percent of degrees awarded to women and an 82% increase for African Americans.

Curricular innovations go from freshmen to seniors; many with a multidisciplinary emphasis. Examples of course developments and modules beyond the freshman experiences include such areas as systems and control, materials engineering, environmental engineering, engineering biotechnology, concurrent engineering and manufacturing, as well as embedding the issues of ethics and communications within the engineering program. In addition, modules on such emerging

fields as wireless communications, medical robotics, earthquake engineering, waste containment, engineering biotechnology, network security, internet technologies, and network security are a part of the portfolio of available resources. The Gateway Web Repository, **http://www.gatewaycoalition.org** , contains course materials, some complete downloadable programs, and samples of others that are available in full through traditional publishers.

Changes in the Gateway engineering educational process have led faculty and students to participate in professional development with a broader set of educational competencies. For faculty these changes involve the use of new educational support tools, an increase in understanding how students learn, and how faculty can help students increase their ability to apply new information, new tools, new skills, and new approaches. For students there are new programs that integrate communications skills, teaming and interpersonal skills, and the ethical dilemmas faced by engineers. Engineering faculty teaching the freshmen and sophomores has increased from twenty percent to sixty percent with three times as many senior faculty teaching these students when contrast to a decade ago. In keeping with Gateway's fundamental premise, these skill-based activities are imbedded within the student's educational program to bring the issues to life in real context rather than as separate programs to be provided outside of the College of Engineering.

In keeping with its objective of transferring educational initiatives across institutional boundaries Gateway was very early in using the internet for interaction of students and faculty across institutions. Gateway created a network to share expensive laboratory equipment in design model fabrication, teams across institutions working in a concurrent engineering model to design and develop such apparatus as a feeder for a paraplegic individual as well as a wheel chair mounted arm manipulator. There has been not only the sharing of facilities across institutions but also one of the earliest examples of remote access and control to laboratory and other unique facilities, remote control of student experiments, video conferencing to bring experts into the classroom in real time, as well as conducting electronic collaboration on course design and instruction.

The Coalition partners have embedded and institutionalized outcome-based assessment and continuous improvement processes within its engineering educational programs and departments, and colleges. The assessment program has embedded the tools and structured to instill the discipline of defining specific course objectives, measuring whether those objectives are being met, and establish a feedback process that enables the faculty and leadership to make valuable use of the information obtained. A complete turnkey web-based assessment program as well as tools and other aids to assist in identifying objectives, establishing outcomes, and creating survey instruments are available via the Coalition's web site. Also available are quantitative graphical illustrations of the changes in some of the parameters that have been monitored among the partner institutions since the Coalition's inception.

The Coalition has extended and shared its work far beyond the boundaries of the partner institutions. This has been accomplished through such traditional means as publications and presentations but also much more. Hundreds of products, as well as publications, have evolved from this work. These include full course materials, some in multi-media format, shorter modules on a specific topic and include the areas of not just technical curriculum but on such topics as professional development and assessment tools. All of these, and monographs, are freely downloadable from the Gateway web repository which includes a search engine to locate by topic, author, or institution. In addition, the partners of the Coalition have been pleased to host visitors from many other institutions and countries to share in the work and assist in transfer of materials of interest. Such interactions have taken place with more than 100 institutions including some from at least 14 from outside the United States.

B.5 Citation: For Leadership in Changing the Structure, Processes, and Culture of Undergraduate Engineering Education

B.6 Letters of Support: See attached.

B.7 Attendance: Prof. John Carpinelli will accept the award on behalf of the Gateway Engineering Education Coalition at the iNEER banquet on Monday, 18 October 2004

6208 Nelway Drive
McLean, VA 22101-3137

October 5, 2004

iNEER Awards Committee,
c/o iNEER Secretariat
New Jersey Institute of Technology
University Heights
Newark, NJ 07102-1982

Re Leadership Award for Gateway Engineering Education Coalition

This letter is in support of awarding the Gateway Coalition one of your Leadership Awards.

Until my retirement two years ago I was in the Directorate for Engineering at the National Science Foundation as Senior Adviser for Engineering. One of my several duties was to be the Program Director for the Gateway Coalition.

I have been very close to this Coalition, visiting all the members from time to time, being at all internal reviews and being the staff person when the Coalition was reviewed by external reviewers.

The purpose of the overall coalition program was to research and develop undergraduate engineering education on behalf of all engineering educators. Gateway was selected to be one of the coalitions as among other things, it proposed to develop further the "E4" concept that the leader of the coalition, Dr. Eli Fromm had worked on prior to the advent of the coalition program.

This Coalition developed and applied the "Integrated Curriculum", which is a more effective and efficient teaching system which at the same time aids retention and diversity. They also used what they called "Engineering Up Front" to introduce students to engineering concepts early in the curriculum. This aids retention and focuses the student on engineering as a profession.

While the Coalition was very successful at the member schools, it did not neglect to practice aggressive outreach which is essential if the coalition program is to change engineering education as a whole, rather than just at the participating institutions.

The totality of the Gateway Coalition's achievements are fully documented at their website. They have made a substantial contribution toward aiding US undergraduate engineering education achieve its full potential and thus improving engineering education in general.

I strongly endorse your recognizing the achievements of the Gateway Engineering Education Coalition.

Sincerely,

William S. Butcher, Ph. D., P.E.

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RUSSEL C. JONES, PHD, PE
2001 MAYFAIR MCLEAN COURT
FALLS CHURCH, VA 22043

4 October 2004

MEMO TO: iNEER Awards Committee, c/o iNEER Secretariat

FROM: Russel C. Jones

SUBJECT: Support for Nomination for Award

It is my understanding that the Gateway Coalition has been nominated for an iNEER award, in recognition of its pioneering work for the improvement of engineering education. This letter is written to strongly support that nomination.

Eli Fromme and the Gateway Coalition were in the early leadership of the NSF Coalitions program, and helped to shape its very productive directions. In my judgment the NSF Coalitions, including Gateway, have been the most effective program for the updating and renewal of engineering education in the last several decades.

I have had occasion to examine the Gateway Coalition in depth, as part of NSF evaluation teams – and have found it to be solid and effective. Its efforts at combining math/science/engineering in exciting ways in the lower division, bringing design to the lower division, and demonstrating how to scale up innovative experiments to full college coverage have been outstanding.

I strongly support an appropriate iNEER award to the Gateway Coalition.

Russel C. Jones

Russel C. Jones

Post-it® Fax Note 7671	Date	# of pages ▶ 1
To [illegible]	From Russel Jones	
Co./Dept.	Co.	
Phone #	Phone # [illegible]	
Fax # 973 [illegible]	Fax # [illegible]	

Ernest T. Smerdon, Ph.D., P.E.
6721 Los Leones
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October 6, 2004

Dr. John Carpinelli
iNEER Awards Committee
Electrical and Computer Engineering
New Jersey Institute of Technology
University Heights
Newark, NJ 07102-1982

RE: Gateway Coalition

Dear Dr. Carpinelli:

I am writing in support of the Gateway Coalition for an iNEER Achievement Award. As you may know, I was a Senior Education Associate at NSF for three years and one of my primary duties was to oversee the NSF engineering education coalitions. I came to NSF after 10 years as Dean of Engineering at the University of Arizona and when I arrived the coalitions had been in existence for about 5 years. They were just entering the second half of a ten year life with NSF support. Eli Fromm, the director of the Gateway Coalition, was an innovative engineering educator even before the coalition was organized and he brought that innovation to bear in his leadership of the coalition. I was fortunate to be there when the coalitions were starting to get results and could document the positive results from their innovations in engineering education.

Gateway focused on achieving better integration of the subjects in engineering education, not just the technical subjects but also the subjects that lead to essential professional skills for engineers. This integration worked and some of the positive results were lower attrition of students, particularly in their first years of engineering study. Also, there was a positive effect on attracting and retaining various underrepresented groups in engineering. The success that Dr. Fromm had had in his original work at Drexel was extended to other universities and further new dimensions added. Participating universities in the second five years of the Gateway Coalition included a range of universities from the very large to relatively small. They were: Columbia University, The Cooper Union, Drexel University, New Jersey Institute of Technology, The Ohio State University, Polytechnic University of Brooklyn and the University of South Carolina. One key to progress was a highly structured assessment program to objectively determine the progress that was being made. Vast information on Gateway can be obtained on-line at www.gatewaycoalition.org

I am pleased to support the Gateway Coalition for an iNEER Award. Please let me know if you have questions.

Sincerely,

Ernest T. Smerdon
Dean of Engineering Emeritus, U of Arizona