

**Project Title: Transatlantic Biosystems Engineering Curriculum and Mobility
(TABE.NET)**

Consortium Structure

The consortium is comprised of four EU and two US institutions, with personnel from Biosystems Engineering (or similarly named) departments.

Co-directors:

University College Dublin, National University of Ireland Dublin (UCD) (EU lead)

Virginia Polytechnic Institute and State University (Virginia Tech) (VT) (US lead)

Partners:

Agricultural University of Athens (AUA) (EU partner)

Universidad Politécnica de Madrid (UPM) (EU partner)

University of Bari (UNIBA) (EU partner)

University of Illinois at Urbana-Champaign (UIUC) (US partner)

Project Period: September 1, 2009 – August 31, 2013

Introduction

There is global recognition of the importance of sustainable management of air, water, land, food, and other biological resources. All over the world, people are aware of the impacts of global environmental change and non-sustainable use of the earth's resources. There is a need for engineers competent to lead our collective utilization of finite resources.

Biosystems Engineering (BE) integrates engineering science and design with applied biological, environmental, chemical, and agricultural sciences to develop and apply engineering solutions to problems in biological systems. Biosystems Engineers are at the forefront of the search for practical solutions to global problems related to clean air and water, sustainable agricultural production, processing of safe foods, safe and healthy environments, climate change

impacts and adaptations, minimization of waste, and many other issues at the interface between human desires and environmental resources.

The overall goal of this project is to advance internationalization of BE curricula and develop a global awareness within the discipline. The academic discipline of Biosystems Engineering has emerged in the past 15-20 years in the US and Europe, as well as in other locations around the world. Most BE programs have evolved from Agricultural Engineering, which focuses on biological systems related to agriculture, while Biosystems Engineering includes a broader array including applications in foods, pharmaceuticals, energy, and environment. Biosystems Engineering is distinct from Biomedical Engineering (also known as Bioengineering), which focuses on medical applications.

While there are commonalities in Biosystems Engineering curricula around the world, there are also differences due to the rate and manner in which programs are developing. Some of the differences in program development have hindered widespread recognition of the field. Members of our consortium recently completed an EU-US Atlantis policy-oriented measures project focused on the evolving BE studies in the US and EU. That project recommended a range of policy-oriented measures. By implementing the recommended measures, the proposed project will address the need for unification and enhanced visibility of the discipline through internationalization of BE curricula. The results of this proposed mobility project could, in turn, lead to joint or dual degrees.

Project Objectives

The overall goal of the project is to advance internationalization of Biosystems Engineering curricula and to develop a global awareness within the discipline. The specific objectives to achieve this goal include the following:

1. Define the common threads within the BE discipline;
2. Globalize core BE courses by creating a database of multinational examples that can be drawn upon by instructors around the world;
3. Develop innovative courses to advance the continuing development of BE programs in the US and EU (and globally);
4. Design student and staff/faculty mobility experiences to enhance the global perspectives of both; and
5. Create a cohort of students aware of, and able to work in, a global employment market.

The project activities related to curriculum development will benefit both staff/faculty and students who avail themselves of the mobility option as well as those who do not.

These objectives build on recently completed and on-going projects focused on BE. The project also takes advantage of the strong collaborations that already exist among the partners.

Past and Ongoing Collaborations among Partners

All partners except UCD were participants in a recently completed EU-US Atlantis policy-oriented project entitled “POMSEBES: Policy Oriented Measures in Support of the Evolving Biosystems Engineering Studies in USA-EU” (<http://www.pomsebes.aua.gr/>). Key findings and recommendations of that project include the following ([http://www.pomsebes.aua.gr/Report on Proposed Policy Measures-v6.pdf](http://www.pomsebes.aua.gr/Report%20on%20Proposed%20Policy%20Measures-v6.pdf)):

- BE is “*the branch of engineering that prepares students to develop and apply engineering solutions to problems in biological systems.*”

- The concept that BE emphasizes “*integration of life and engineering*”, including both approaches, “*bringing engineering to life*” and “*bringing life to engineering*” should be promoted and disseminated.
- A list of domains, learning outcomes, and core competencies for students in BE should be developed to assist with the evolution and development of the discipline curriculum.
- A systematic comparison among study programs in the US and EU may lead to a standard definition of basics and a clarification of application areas, whereas a common definition of student course load should be developed to make EU and US BE curricula compatible;
- Relationships between quality assurance issues of programs of study and learning outcomes or student’s core competences should be encouraged. Accreditation processes for engineering degree programs in the EU and US provide a framework for establishing such a relationship.
- Publication of a database showing competencies of Biosystems Engineers and conversion tables of credits and grades between EU and US programs would enhance the mobility of EU and US BE graduates within global industry.

The proposed curriculum development and mobility project is designed to address many of the recommendations of the POMSEBES project. Because most of the current partners were involved in developing the recommendations, the project team already has momentum as we move forward to advance the BE curriculum and profession.

All EU partners have been involved in two EU funded Thematic Networks related to Agricultural Engineering (USAEE) and Biosystems Engineering (ERABEE). The major objectives of the current thematic network ERABEE are to:

1. Promote the critical transition from the traditional discipline of Agricultural Engineering to the emerging discipline of BE;
2. Exploit along this direction the outcomes accomplished by the USAEE-TN (EU funded predecessor);
3. Promote synergies between Education and Research: Promote the structured 3rd cycle programs of studies, also establishing linkage between education and research at all three cycles;
4. Enhance the compatibility among the new programs of BE in EU, aiding their recognition and accreditation at European and international level; and
5. Facilitate greater mobility of skilled personnel, researchers and students in the broader field of BE.

The six partners for this Excellence in Mobility project have signed a Memorandum of Understanding (MOU) agreeing to encourage the development of student and staff/faculty exchange and curriculum development in the subject area of BE. The MOU represents a commitment from the institutions and provides the framework for developing specific Exchange Agreements for the EU-US Atlantis Excellence in Mobility project. Those Exchange Agreements will be finalized within the first four months of the project, allowing the first students to begin traveling by January 2010. Exchange agreements already in place between some of the partners will form the basis of the additional agreements.

The lead US and EU institutions, Virginia Tech (VT) and University College Dublin (UCD), respectively, have had a student exchange program in place since 2000. Through the exchange between VT Biological Systems Engineering and UCD Biosystems Engineering, 19 students (10 from VT, 9 from UCD) have participated in the exchange since it began 10 years

ago. Most of the students have participated in a full academic year abroad; 3 have been abroad for a single semester.

Both US partners have exchange programs with UPM. In the past two years, UIUC and UPM have initiated a formal engineering student exchange program. To date, six U.S. students have studied at UPM and one UPM student at UIUC.

The EU partners AUA and UPM have Socrates-Erasmus agreements with each other.

Project Outcomes

Project outcomes will include both tangible products and more globally aware and educated students and staff/faculty. Some of the tangible products that will improve teaching and student learning include the following:

1. Common threads of BE (as a follow-up of POMSEBES and in synergy with ERABEE projects);
2. A globally accessible database of multinational examples that are relevant to core BE courses;
3. Collaborative online (web-based) design project course for students at partner institutions who are not traveling;
4. Online (web based) innovation and entrepreneurship course with multinational examples;
5. Online (web based) interactive course – What is Biosystems Engineering?
6. Project reports detailing staff/faculty and student experiences from engaging with the program. These will provide the substantive basis of the dissemination of the program.

Curriculum Development Activities

The emphasis of curriculum development activities will be to produce resources that can be implemented in a variety of ways by BE programs around the world. The outcomes of the project will be available for other programs to select from, based on their own emphases and constraints. Materials will be developed in English, with abstracts translated into the languages of the partners.

Curriculum development activities will involve all of the partners and will take place in a variety of formats, including face-to-face meetings, staff/faculty mobility, and virtual networking. There are a variety of platforms that can be used for virtual networking. For example, the platform most commonly used at UPM is MOODLE. To facilitate virtual networking, we will select a platform that fits all partners during the first four months of the project. Each partner will also develop live streaming and archiving of lecture material for use in curriculum development and language training (see language plan). For example, UCD will utilize the Irish government funded HEAnet media services for this activity.

Common Threads of the Biosystems Engineering Discipline

The core concepts, or threads, of BE are variously understood by those within the discipline, but have never been unequivocally defined due to the comparative youth of the discipline. This makes communication and teaching difficult compared to other well established engineering subjects. The Atlantis POMSEBES project and Erasmus Network “ERABEE” have worked towards defining core curriculum for the discipline, but this needs to be taken further by defining the threads that link courses together. These may include concepts such as defining biological constraints; sustainability assessment; biological thermodynamics and systems

analysis. Once defined, these threads will be available for global development of the BE discipline.

Database of Multinational Examples for Core Courses

While the BE curriculum is built on a foundation of mathematics, science and engineering science, as are all engineering disciplines, key courses for biosystems engineers include:

- *Biology for engineers*, including specific consideration of: (i) plants; (ii) animals; (iii) microbiology; and (iv) molecular biology
- *Thermodynamics of biological systems*
- *Unit operations in biological systems*, including specific consideration of biological, chemical and physical processes
- *Fundamentals of sustainable environmental engineering*
- *Innovation: sustaining biological resources utilization*

Including multinational examples in these courses would increase the global relevance of the courses and enhance the learning experience of the students. After we design the database structure, we will develop a format for describing a multinational example. We will then solicit examples from staff/faculty of our partner departments; the examples will be submitted in the given format. We will then enter the examples into the database which will be made accessible through the project website. Of particular interest are examples that illustrate the variability and similarity of global issues with respect to geography, climate, political system, culture, and other characteristics. Examples might include:

- Environmental transport, e.g. pollutant transfer in desert, Mediterranean, humid temperate and frozen environments

- Applications of fermentation processes, e.g. beverage production, biofuels and food safety
- Food safety processes and procedures, e.g. standards and processes for maintaining food chain integrity
- Bioenergy: production, conversion, environmental impact
- Biosensors and/or bioinstrumentation to assess biological processes including plant and crop health, and animal health and welfare.

Collaborative Online (web-based) Design Project Course

Design and teamwork are fundamental engineering skills that have to be developed by all professionals. We will develop a web-based course built around a simple design task. Students enrolled in the partners' programs will be eligible to enrol in the course. The course coordinator will compile international teams to work on the design problem using eTutors/eMentors to support the teams and provide structured learning support materials. The course will be based on the UCD course BSEN10010 *Biosystems Engineering Design Challenge* (found by following links at http://www.ucd.ie/students/course_search.htm).

Online (web based) Innovation and Entrepreneurship Course

Recent international developments are driving universities to move beyond teaching and research and extension into the realms of innovation and job creation. It is incumbent on BE as a discipline to provide training in innovation and entrepreneurship. A web-based module will be developed using resources from UCD Nova (see example material at <http://www.ucd.ie/nova/podcasts/>) and other partner institutes addressing issues such as business plans, intellectual property, marketing finances and law. Core curriculum will be supplemented

by localization and examples drawn from BE and existing entrepreneurship courses (e.g. engineering.illinois.edu/news/index.php?xId=071509120742).

Course Development: What is Biosystems Engineering?

We will develop a BE seminar course for all partners, focusing on key global issues about which biosystems engineers have expertise, specifically, water, air, biological resources, energy, and food. The goal will be to introduce BE students to these global issues, including the role of biosystems engineers in addressing problems in these areas. Seminar materials will be developed and contributed by all partners. A blended learning approach will be used, including common lectures (seminar presentations) on-line and local tutorials. The common lectures will use a “web meeting” format so that groups from all institutions can participate simultaneously. The local tutorials or courses (with internationally developed support materials) and field trips, as appropriate, will provide smaller group interactions. Students will complete collaborative team projects, with teammates from different universities. The projects will focus on the key global issues addressed in the course. The target student will be a mid-level undergraduate, for example a sophomore or junior in the US and in the 3rd year of level 1 or 1st year of level two in EU. The implementation of this course will also serve as a recruiting tool on each campus for the planned student exchanges.

In addition to the curriculum development activities described above, the European partners may develop a series of annual intensive programmes open to all partner institutions (seeking funding under the Erasmus Intensive Programme calls; this activity depends on available parallel funding) to focus on key issues such as biometrics, biofuels, bio-based materials, and bioprocessing. A second possibility that we will aggressively pursue is to secure alternate funding for US students to go on short-term visits during May-July in which student

teams will be assigned a specific engineering problem and work with fellow students at a partner EU institution. This also could serve as both a recruiting tool and as a means for screening students in the selection process for semester-long exchange.

Added Value for the Biosystems Engineering Discipline and Profession

The project will contribute to educational excellence and global awareness in BE through the collaborative development and dissemination of curricular materials with a multinational focus. Innovative approaches will be used in the development and delivery of the courses.

The project will provide participants the opportunity to acquire more than just a technical BE education. Using both mobility and home programs, participants will have opportunities to develop their professional skills in an international context, including written and oral presentation, social skills, interactive communications, personal and team management, and cultural awareness. The combination of technical and professional skills will enhance the mobility of graduates in the global marketplace.

The mobility project will greatly enhance the on-going VT-UCD, VT-UPM, and UIUC-UPM exchanges. With more partners involved, there will be a greater pool of students from which to recruit and the students will have more choices of institutions on both sides of the Atlantic. The broader choice of institutions (including multiple European languages) will expand the opportunity for the US students. Another significant expansion will be the involvement of faculty in curriculum development that will benefit all partners of the project, including students who participate in the exchange as well as those who do not.

Integration of the Mobility Program among the Consortia Institutions

Academic Credits

Credit and grade equivalencies will be defined in the exchange agreements that will be executed within the first four months of the project. The project will make use of the European Credit Transfer System (ECTS) and Diploma Supplement councilors (http://ec.europa.eu/education/lifelong-learning-policy/doc48_en.htm) available in Italy, Ireland, and Greece (<http://ec.europa.eu/education/lifelong-learning-policy/doc/ectscouns.pdf>) to assist with the development of the highest possible standard of credit transfer for the partnership. In Spain, both ECTS and Diploma Supplement are mandatory by Royal Decree.

The existing agreements among partners provides a strong basis for moving quickly to finalize the exchange agreements. For example, course equivalencies, credit transfers, and grading equivalencies are being established by UIUC and UPM. For the ongoing UCD-VT exchange, evaluation of course materials has shown that 5 ECTS credits at UCD is equivalent to 3 semester credit hours at VT.

Each partner institution has policies in place for transfer of credits from another institution. For example, at VT and UCD, credits transfer from study abroad, but grades do not. At VT, to receive transfer credit, undergraduate students must receive the equivalent of a final grade of C or better, and graduate students must receive the equivalent of a final grade of B or better. UCD is in transition to a system of full GPA transfer in situations where full equivalency can be determined, which should come into effect during the life of this project. At AUA, ECTS credits are only awarded for courses that are part of the approved study program. At UPM, US exchange students are provided with a Diploma supplement, with information on the courses, ECTS, and the grades in the Spanish system (numerical from 0 to 10, passing the course with 5 or more).

The Cooperative Mechanisms and Administrative Structure for Institutionalization, Meetings, Roles for Partners, and Communications

The student mobility activities of the project will be part of the already established mechanisms and structures at each partner institution for student exchanges. All partners have such offices and experience; we will take advantage of the expertise already in place for institutionalizing the exchange.

The project partners will meet both face-to-face and virtually throughout the project period. Face-to-face meetings will occur in conjunction with the annual Atlantis meetings and with several of the ERABEE Workshop meetings, which generally take place every six months. Quarterly conference calls of the project partners will be conducted using technology such as Skype. Such calls have been very beneficial in developing this proposal.

Communications will also be facilitated by a project website. All project activities will be documented there. VT and UCD will manage site content and UCD will host the site. All partners will include links to the site from their own websites. The website will be helpful in student recruitment, dissemination of project outputs, and communication among partners and with others outside of the project.

The roles of the partners are defined as follows:

UCD and VT: co-direct the project; coordinate activities among partners; oversee all aspects of the project; coordinate project meetings and conference calls; keep partners informed of activities; facilitate student selection; coordinate project evaluation; prepare annual reports; manage project website content; management of dissemination of outputs; and

Each partner: recruit students; host students, contribute to curriculum development activities, including providing materials, faculty leadership, and faculty time; provide faculty who will participate in mobility trips for curriculum development and related activities.

Tuition and Fees

Students will pay compulsory costs of their education in accordance with the regulations of their home institutions. At VT and UIUC, this includes tuition and fees. At UCD and UNIBA, this includes fees and a student levy while additional services fees (e.g. aspects of sports centre services) are on a pay by use basis. At AUA, studies are free of tuition or fees.

Reduced student tuition and fees are possible for UIUC College of Engineering students engaged in semester or longer study abroad, as part of the strategic plan to increase international experiences. During the 2008-09 academic year, for example, the tuition charge was roughly 20% of in-state tuition, and most other student fees were waived.

Mechanisms for Student Mobility between Hosting Institutions

Student Recruitment

Students will be recruited at all partner institutions during the 1st or 2nd year of their studies regardless of whether they are on a 4, 4+1 or 3+2 year programme. Recruitment will start early to ensure that students have enough time to develop appropriate cultural and language proficiency before their mobility visit. A variety of recruiting approaches will be used, including information on each partner's website, promoting the exchange directly in BE and general engineering courses (depending on the individual campus scenarios). Advertising to a wider

engineering student audience at each home institution could be part of promoting the BE program and perhaps recruiting students to the program as well as to the exchange project.

Student Selection

A student selection committee, comprised of one representative from each partner institution, will be co-chaired by the project co-directors, Wolfe (US) and Holden (EU). The committee will be responsible for reviewing student applications and selecting the students to participate each year. A common application process will be used by all partners. Each partner will define a minimum standard for hosting an incoming student (e.g., grade point average); the minimum standards will be documented in the exchange agreements. In all cases, students applying for exchange must be in good academic standing at their home institution. In addition, we will establish other selection criteria prior to designing the application form. For example, the application to study in the US will be completed in English. In all cases, some level of proficiency in the language of the host institution and/or a definitive plan to acquire that proficiency will be required. Students will apply to go to hosts in rank order. The committee will review the applications and allocate each application to a host institution, ensuring a balance of incoming and outgoing students for each partner over the duration of the project. The student will then apply to the host institution; since the selection committee will have considered the host institution's standards before the student is told to apply there, rejection of an applicant by a host institution should be rare, if at all.

To ensure time for any needed language instruction, students will be required to apply one year before their intended study abroad semester (students can also choose to go for a full academic year, with no additional funds provided for the additional term). Applications will be due in February for the following academic year.

Logistical Support for Students

Each of the partners has an office in place that provides logistical support for students. For example, at VT, the Education Abroad office (<http://www.educationabroad.vt.edu>) serves as the primary coordinating unit for most logistical issues for both outgoing and incoming students. The UIUC Study Abroad Office (<http://www.cte.uiuc.edu/dme/placement/student/otherFL.htm>) provides administrative support, assistance, and advice for travel health, safety, and insurance. The International Office at UCD (<http://www.ucd.ie/international/>), the Department of International and Public Relations at AUA, and the International Office at UNIBA (www.dardre.uniba.it) provide logistical, welfare and social support services for incoming and outgoing students.

Language Plan

Each student participating in a mobility exchange will acquire an appropriate proficiency in the language of the home institution. Students will be required to take appropriate language courses at their home institution prior to the exchange. In addition, while at the home institution, students will listen to archived lectures from BE courses from the host institution; these lectures will be streamed and archived by the partners. Listening to technical lectures in the host language will contribute to the student developing language proficiency.

At UIUC, language training is available through the College of Engineering's newly established spring semester intensive language course, beginning 2009, and through an intensive Language Instruction Program offered to students and faculty each winter break. Greek language training is available for graduate students through Foreign Language and Area Studies fellowships administered by the Center for Global Studies. The VT Department of Foreign Languages and Literatures teaches courses that are appropriate for students who are preparing for

a study abroad program. Among other languages, the department offers instruction in modern Greek, Italian, and Spanish. All of the EU partners provide training in English.

While participating in the exchange at the host institution, each student will be required to continue to study the host language. Both formal and informal language study will be encouraged. At AUA, Greek language courses are offered free of charge on a regular basis at beginners level. There is also the possibility of studying Greek language at National University of Athens (Faculty of Philosophy). At UNIBA, advanced knowledge of the Italian language is not required for foreign students since an Italian language course is provided each semester. The course consists of 100 hours and is organized in three levels: base, intermediate and advanced. UPM provides Spanish courses for foreign students; there are specific courses with emphasis on technical and scientific language. There are also on-line courses. The students must have sufficient knowledge of the Spanish language although some courses could be in English. As described in the evaluation plan, students' language proficiency will be assessed before and after the exchange.

The admissions language requirements of the US institutions are as follow:

At UIUC, exchange students will enroll through either the College of Engineering or the College of Agriculture, Consumer and Environmental Sciences and these Colleges reserve the ability to waive or alter the following requirements according to faculty advice and international consortia agreements. English language proficiency must be demonstrated by **one** of the following: (1) A score of at least 550 (agriculture) or 600 (engineering) on the paper-based (pbt) Test of English as a Foreign Language (TOEFL), 213 (agriculture) or 250 (engineering) on the computer-based test (cbt), or 79 (agriculture) or 100 (engineering) on the internet-based test (ibt); (2) An SAT I critical reading score of at least 560, or an ACT English score of at least 25; (3)

Completion of two academic years of full-time study immediately prior to the proposed date of enrollment in a country where English is the primary language; or (4) Minimum 6.5 total score on IELTS with minimum subscore of 6 on all four modules.

At VT, students whose native language is not English must have TOEFL scores of at least 80, with no section sub-score less than 16, on the Internet-based test. For the computer-based test, scores must be at least 207, and for the paper-based test, scores must be at least 550.

Cultural Preparation

Students will be prepared culturally before the exchange through the following activities.

- Review of materials on culture and society. Each partner, in conjunction with local experts will compile lists of books commonly found in University libraries, websites and reports/pamphlets available for distribution to all partners that will cover introductions to history, society, political system, cultural conventions, academic systems, and principles of law;
- Engaging in international group activities organized by the project. Participants that have applied for mobility support from the project will be integrated into project groups and activities of the host institution, thus developing firsthand experience of social integration and cultural norms; and
- Being linked to relevant student societies on campus.

On arrival, visiting students can attend informal cultural orientation events (e.g. organized by the UCD International Office), make personal contact with student societies and enroll for cultural and language modules available under the UCD Horizons modules curriculum system.

Resources Available for Hosting Foreign Students and Faculty

Each partner institution has an office that provides support services, including educational, cultural, and social activities, for visiting students, i.e., the UCD International office (www.ucd.ie/international), the International Office at UNIBA (www.dardre.uniba.it), UPM (<http://www2.upm.es/portal/site/internacional/menuitem.46c79e9d35e5079f6db24610dff46a8/?vgnextoid=5c5e53ca8c2ed110VgnVCM10000009c7648aRCRD>), the AUA European programs' office, Cranwell International Center at VT (<http://www.uusa.vt.edu/cranwell/cranwell.php>).

Each of these offices provides services such as the following:

- Arrival orientation events at the start of each semester including: onsite reception, assistance with registration, free social events (films, concerts, walking tours, trips), college specific orientation, general introduction to university and introduction to local culture;
- An International Student's Handbook with all necessary information ranging from legal requirements of immigration and registration to dealing with the university system to obtaining necessary services and support such as health and welfare;
- Assistance with finding student accommodation; and
- A checklist to ensure all necessary activity has been undertaken prior to the study phase of the visit.

UPM has some cultural activities prepared for visitors

(<http://www2.upm.es/portal/site/internacional/menuitem.199c9f549df126db8daf8968907c46a8/?vgnextoid=b6af6846cf53f110VgnVCM10000009c7648aRCRD>). UIUC has excellent student support and services for international education. ACES has a strong interest and history of international programs, with a Global Connect International Programs

(<http://global.aces.uiuc.edu/>), ACES Academy for Global Engagement, and ACES Study Abroad (http://students.aces.uiuc.edu/study_abroad).

Mechanisms for Staff/Faculty Mobility between Hosting Institutions

Staff/faculty mobility will include the following:

- short, intensive courses delivered by faculty with expertise not replicated in the host (e.g., food integrity). The partners will identify potential topics and experts early in the project and then schedule the mobility trips over the period of the project.
- course development visits as part of general curriculum development
- definition of threads visits to engage in host-centre discussions / workshops with staff / faculty, graduate students and undergraduate students on the common threads of BE
- dissemination visits to promote the activities of the project at host-centres and neighbouring institutions
- localisation of the materials provided in the database of international examples
- short-term research interaction (in conjunction with at least one of the above).

The interaction of host and home staff/faculty will strengthen all programs.

Evaluation Plan

The independent evaluator for this project will be Dr. Michael J. Delwiche, Professor and Chair, Department of Biological and Agricultural Engineering, University of California, Davis. His brief CV and letter of commitment are included in the appended materials. Dr. Delwiche has professional experience in Europe, having spent a sabbatical year at a Belgian university (KU-

Leuven), and the department he chairs is regarded as one of the best in biosystems engineering. He will participate in at least two face-to-face consortium meeting during the project period and visit at least one EU partner and one US partner during the project period. An evaluation report will be submitted annually.

A variety of qualitative and quantitative indicators will be used to measure the success of the project. The measures by which the U.S. Department of Education assesses the FIPSE program include (1) the percentage of FIPSE grantees who report project dissemination to others; and (2) the percentage of FIPSE projects that report institutionalization on their home campuses. With regard to the first measure, we will document project dissemination. At the beginning of each year, we will set goals for dissemination, e.g., presentations, papers, etc. At the end of each year, we will assess if we met our goals for dissemination and then set our goals accordingly for the next year. An important measure of success of our project will be the level of adoption of the materials developed through the project, particularly courses and the examples database. We will survey programs outside the consortium in the 3rd and 4th years of the project to determine the level of adoption of materials.

For measure (2), we will assess institutionalization on our home campuses with respect to percent of staff/faculty using curricular materials from the project, the number of staff/faculty participating in mobility experiences, the level of global awareness among our students. We will administer surveys to all of the students about global awareness and assess the impact of the study abroad experience compared to those who do not study abroad. We will conduct the survey early in the project at all of the partner institutions to set a baseline and then survey over time. Pre- and post-participation surveys will be developed and administered to students who

participate in the mobility experience. The surveys will address a variety of topics including language skills, global awareness with respect to professional, cultural, and societal issues.

Formative evaluation will include providing feedback to students before, during, and after their mobility experience. We will develop some “checksheets” to see how students are doing with respect to academics, socializing, language proficiency, and other aspects of the exchange.

Further details of the evaluation plan and the assessment instruments will be finalized in the first four months of the project (before the first students go abroad in spring 2010). For example, we will develop assessment measures for the curricular development activities.

Dissemination of Project Results

Dissemination of the results of the project will take place through a number of avenues. One major focus area will be the broader BE educational system, including institutions in Europe and the U.S. and globally. Project outcomes will be disseminated via publications, presentations, and the project website. One avenue of dissemination will be through ERABEE-TN which has established a strong synergy with EurAgEng (European Society of Agricultural Engineers) through Vice President and Representative of the Thematic Network Prof. P. Febo who leads both EurAgEng Working Group *‘Education & Communication’* and CIGR Working Group *‘Agricultural Engineering University Curricula Harmonization’*.

A second avenue will be through the American Society of Agricultural and Biological Engineers (ASABE). The Head of the UCD School of Agriculture, Food Science and Veterinary Medicine (home of UCD Biosystems Engineering) is a member of the Department Heads group (ED-210) of ASABE. This group will also be used as a dissemination route for the project. The department heads at UIUC and VT are current members and co-PD Gates is a past member of

ED-210. ASABE Board of Trustees strategic initiatives in 2008-09 include internationalization of the Society's membership and a push to bring more international engagement in peer-reviewed publications and in engineering standards activities (co-PD Gates is a trustee).

Project Sustainability

The strong collaborations enhanced through this project will set the foundation for sustainability. Once the tradition of student exchanges among the partners is established and known among students, the exchanges are likely to continue. The stipends provided through the project will provide incentive to participate; however, once a program is well established, those incentives are less likely to be needed. At the same time, we will pursue other funding options, such as foundations and multi-national companies that might show interest in financing future student exchanges to develop work on specific subjects of their particular interest.

The curricular materials developed in this project will remain available beyond the project period.

The multi-institutional, multi-staff/faculty curriculum development activities will likewise build strong ties. It is anticipated that groups of staff/faculty will pursue other sources of funding to continue curriculum related work.