Marshall University
Marshall Digital Scholar

Recommendations | Faculty Senate

5-7-2004

SR-03-04-47 APC

Marshall University

Follow this and additional works at: http://mds.marshall.edu/fs_recommendations

Recommended Citation
Marshall University, "SR-03-04-47 APC" (2004). *Recommendations*. 515.
http://mds.marshall.edu/fs_recommendations/515

This Article is brought to you for free and open access by the Faculty Senate at Marshall Digital Scholar. It has been accepted for inclusion in Recommendations by an authorized administrator of Marshall Digital Scholar. For more information, please contact zhangj@marshall.edu, martj@marshall.edu.

ACADEMIC PLANNING COMMITTEE
RECOMMENDATION

SR-03-04-47 APC

Recommends that the attached College of Information Technology and Engineering's Intent to Plan statement for a Bachelor of Science in Engineering be approved.

RATIONALE:

Marshall University is required to express to the chancellor an intent to plan a new baccalaureate program (Section 3.7 of WV Higher Education Policy Commission Series 11: *Submission of Proposals for New Academic Programs and the Discontinuance of Existing Programs*). The College of Information Technology and Engineering has presented an intent-to-plan document for the program named above, which the Academic Planning Committee has reviewed. The Committee finds that the proposal meets the requirements of WVHEPC Series 11; will build on Marshall's existing two year engineering program, while complementing and strengthening our MS in Engineering program; and will meet the needs of the local and regional business, industry, and government communities.

FACULTY SENATE PRESIDENT:

APPROVED
BY SENATE: Larry Stickler DATE: 5/7/2004

DISAPPROVED
BY SENATE: _____ DATE: _____

UNIVERSITY PRESIDENT:

APPROVED: _____ DATE: 5/11/04

DISAPPROVED: _____ DATE: _____

COMMENTS: _____

_____

_____

Marshall University
College of Information Technology and Engineering

INTENT TO PLAN

BACHELOR OF SCIENCE IN ENGINEERING
Degree Program

Date of Intent to Plan Submittal	
Institutional Board of Governors	May, 2004
Higher Education Policy Commission	June, 2004
Projected Date to Submit Full Proposal:	September, 2004
Projected Date of Full Implementation:	2005-2006, with phase-in Fall 2004

Executive Summary

In accordance with "Owning the Opportunity: The Strategic Plan for Marshall University, 2001-2010", Marshall University is proposing to plan a bachelor of science degree program in engineering (BSE). The proposed program will build on Marshall's existing freshman/sophomore engineering program in order to reinstate an undergraduate engineering degree at Marshall University, and will complement and strengthen Marshall's Master of Science in Engineering degree program.

Addition of an undergraduate engineering degree will have a number of positive impacts on Marshall University, the regional business, industrial and government communities, and the State. Specifically, the proposed BSE degree at Marshall University will:

- Address an interest that exists among prospective students and employers, especially those in the immediate region served by the university, as evidenced by student surveys, letters from industry and government leaders, input from other programs and units on campus, and continuous inquiries from prospective students.
- Provide a more clearly defined educational/career pathway for students who may otherwise change majors to avoid transferring to another institution after completing their sophomore years at Marshall, which has been a relatively common practice in the past.
- Complement other educational initiatives at Marshall, such as the new Bachelor of Science in Computer Science degree, Master of Science degrees in Engineering and Forensics, and related areas, including current and planned biotechnology education and research.
- Provide additional opportunities for cooperation with other institutions of higher education in the State, including growth of existing articulation/transfer relationships and development of joint programs.
- Enhance recruitment potential of students with high test scores and strong interests in math and science.

- Expand research and economic development initiatives underway or planned by the university and its government and industrial partners, including the Nick J. Rahall II Appalachian Transportation Institute, the Robert C. Byrd Institute for Advanced Flexible Manufacturing, the Institute for the Development of Entrepreneurial Advances, and others.
- Increase and improve the pool of engineering students by providing additional opportunities for expansion of outreach efforts to the state and regional K-12 community.

Since development of the program will involve the addition of only junior and senior level courses for an initial class size not substantially larger than current enrollments in the freshman/sophomore program, start-up costs for the BSE degree will be minimal, as compared to those associated with a wholly new program. Marshall expects to raise a significant portion of these start-up funds from external sources.

Marshall University already has a significant number of qualified engineering faculty involved in the two-year engineering transfer program, the MS in Engineering degree, and other programs. By using this available talent and other existing resources, it will be possible to keep total five-year start-up costs for additional faculty, administrative and technical support, supplies, and laboratory equipment to an estimated $2.5 million.

Educational Objectives

The primary objective of the proposed new degree program is to provide a rigorous, broad-based, innovative and non-duplicative curriculum that prepares students to meet the challenges and changes inherent in the continually evolving discipline of engineering. The program will equip students with the analytical, communications, and management skills necessary for success in the engineering field and related disciplines and immerse students in a learning atmosphere that emphasizes team work and practical application of basic engineering principles. In addition, continuous and meaningful interaction with industry and working professionals will prepare students for the practice of engineering and illustrate the lifelong learning aspects of engineering and other high technology fields.

Relationship to the Mission of the Institution

Marshall's mission includes a commitment to high quality undergraduate liberal arts education, broadly defined, as well as a commitment to programs such as engineering that are critical to the economic development of the region. An undergraduate engineering degree program will move Marshall University toward more complete fulfillment of its mission by building on Marshall's strong record in student-based undergraduate education to create new opportunities for students interested in completion of an undergraduate engineering degree. The increased availability of engineering and related programs also will enhance the economic vitality of the region by providing additional educational opportunities for employed workers and graduating high school students, which is an important factor in attracting business to the region and providing a more favorable environment for entrepreneurship.

The degree program will be planned and implemented by Marshall's College of Information Technology and Engineering, which currently offers five graduate and three undergraduate programs. The new degree program will take advantage of existing courses, faculty, and research initiatives available in other programs such as the Master of Science in Engineering degree program, the new B.S. in Computer

Science, and the "pre-engineering" program, which provides a full freshman and sophomore engineering curriculum but requires students to transfer to another institution for completion of the junior and senior years. Because the transfer program is not a degree program, it is not accreditable by the Accreditation Board for Engineering and Technology (ABET), but the program is developed and implemented in accordance with ABET criteria, in order to satisfy requirements of the accredited institutions to which students currently transfer to complete their degrees.

The program will build on existing strengths in engineering at Marshall University. Because the institution currently offers the freshman and sophomore years of engineering that are common to most engineering disciplines, implementation of a degree program will require the addition of courses only for the junior and senior years. The College of Information Technology and Engineering now includes 22 full-time faculty positions. Of these, a majority hold degrees in engineering, with the balance in computer science, information systems, and safety technology. Existing faculty members teach in the undergraduate engineering, computer science, and safety technology programs, as well as graduate degree programs in engineering, information systems, technology management, safety technology, and environmental science, and also participate in various externally funded research and project activities. These individuals will be available to participate in the new BSE degree program, as well.

Marshall's engineering programs have a long history of cooperating with other institutions, where feasible and in the best interest of the students, with respect to articulation/transfer agreements, distance learning opportunities, and other endeavors. Marshall has consistently worked with the national and regional engineering communities, professional groups, and K-12 teachers and administrators to increase the number and expand the diversity of students interested in engineering. These outreach efforts are designed to enhance awareness of engineering career opportunities and provide meaningful mentorship through activities such as Marshall's annual Engineering Academy for high school students.

Unique Features of the Institution

Marshall University is uniquely suited to offer a new undergraduate engineering program that has the potential to appeal to a broad range of students and that takes advantage of new directions in engineering education. Perhaps most importantly, Marshall has a pre-existing pool of students for a new engineering program consisting of students currently enrolled in Marshall's engineering transfer program, as well as Marshall students who would choose to enroll in an engineering degree program if available. The following table is an indication of the dramatic increase in interest in engineering among Marshall students. Enrollment in core freshman and sophomore engineering courses has doubled since fall 2000. Furthermore, over the same period, the ability levels of students have improved, as indicated by the number of entering students qualified to take Calculus I, a course that requires an ACT Math score of 27 or above. This trend is expected to continue with the addition of the new undergraduate Computer Science program in Fall 2004.

Engineering Enrollment Patterns

Fall	2000	2001	2002	2003	2000 To 2004 Increase
Entering Students	24	27	43	47	96%
Sophomores	10	10	18	20	100%

Entering Students Taking Calculus I	21%	33%	37%	38%	

Surveys were conducted during the fall 2002 and fall 2003 terms of students enrolled in Introduction to Engineering (ENGR 107), a course taken primarily by entering freshmen enrolled in Pre-engineering. One survey question asked was: "If Marshall University were to offer a BSE degree, how interested would you be in completing your undergraduate degree at Marshall?" The following table summarizes students' responses. Note that nearly half of the students indicated a high level of interest while over 80% had a moderate or high level of interest.

Survey Results to Question Regarding Interest in MU BSE Degree

Response	Fall 2002	Fall 2003	Composite	Percentages
Highly Interested	20	19	39	49%
Moderately Interested	10	16	26	33%
Not Interested At All	3	1	4	5%
Unsure	8	3	11	14%
Total	41	39	80	

Marshall will be developing the proposed program under a new set of accreditation criteria published by the Accreditation Board for Engineering and Technology (ABET) in 2000. These criteria significantly changed the status quo of engineering accreditation standards not only by broadening the outline for undergraduate engineering education and providing institutions more flexibility in developing curricula, but also by providing for increased assessment and documentation. In developing a program around these new criteria, Marshall has an opportunity to make the best use of the changes and move more quickly toward accreditation.

Marshall's traditional student base includes a large number of students from the Huntington and Charleston areas, which have been historically under-served with respect to undergraduate engineering education. A new program will also provide an opportunity to recruit greater numbers of students into engineering and will greatly facilitate recruitment of out-of-state students, especially in the tri-state region.

Finally, Marshall currently offers the freshman and sophomore years of engineering, a Master of Science in Engineering degree program, and will offer a Bachelor of Computer Science degree starting in the fall of 2004. In addition, the institution houses or is affiliated with the Nick J. Rahall II Appalachian Transportation Institute; the Center for Environmental, Geotechnical, and Applied Sciences; the Institute for the Development of Entrepreneurial Advances; and has a close working relationship with The Robert C. Byrd Institute for Advanced Flexible Manufacturing. Resources and strengths from these existing initiatives and alliances will support and complement a new undergraduate engineering program.

Brief Program Description

Upon approval of the Intent to Plan, Marshall University will convene a variety of working groups consisting of engineering faculty and representatives of the engineering community, including industry, government, and consulting firms. These groups will work with Marshall faculty and administration, as well as a consultant experienced in ABET accreditation of engineering programs, to plan an appropriate undergraduate engineering program for Marshall University, a program that reflects current and

predicted needs of the professional community and that results in a quality, non-duplicative, and accreditable program.

Based on preliminary input from the engineering community, Marshall has identified a need for an inter-disciplinary undergraduate engineering degree that provides a rigorous program in basic engineering principles, coupled with an opportunity to pursue more in-depth study in various areas of emphasis in the junior and senior years. These areas of emphasis will be non-duplicative of existing degree programs in the state, will be based on the stated and projected needs of the regional and national engineering communities, and will take advantage of Marshall's existing strengths in other high-technology disciplines.

Preliminary discussions also have identified a need for an undergraduate engineering curriculum that prepares students for the reality of engineering practice and that emphasizes skills and topics such as project management, team-building, communications, entrepreneurship, finance, and the legal and ethical requirements of engineering. This view coincides with recommendations regarding engineering education that are being espoused more and more frequently on the national level [1]. Creating a new BSE degree will provide Marshall the opportunity to be a leader in this arena.

A new engineering degree program at Marshall will also include the required components of the existing Marshall Plan, which mandates, among other things, an integrated science course, a multicultural course, a writing intensive course, and six hours of courses that meet the international studies requirement. In addition, experiential learning will be integrated into the program in accordance with opportunities identified by the working groups and advisory committees.

While a final detailed curriculum will require significant input from the program's advisory board, the following table illustrates what a final course distribution might look like. Such a distribution achieves several objectives:

- satisfies accreditation requirements,
- provides students a high degree of flexibility,
- builds a foundation in core engineering courses,
- allows students to pursue an engineering area of emphasis;
- emphasizes management, business, and effective communication skills, and
- stresses the importance of the humanities and liberal arts.

Subject Area	**Total Credits Required (%)**
Mathematics	16 (12%)
Science	15 (12%)
Humanities	19 (15%)
Core Engineering Courses	38 (29%)
Engineering Emphasis	21 (16%)
Approved Electives	9 (7%)
Management & Communications	12 (9%)
Total	**130**

Marshall currently offers the freshman and sophomore years of engineering, which consist of approximately 70 credit hours of coursework. These hours include core courses in mathematics, chemistry, physics, computer programming, economics, English, and core engineering science courses such as statics, dynamics, circuits, materials, and thermodynamics. It is projected that a new

undergraduate engineering degree program will require the addition of approximately 60 hours to this curriculum, including about 30 credits of new engineering courses. The degree will require a total of about 60 credit hours in core engineering science, engineering design, and emphasis courses. Since 40 credit hours of relevant engineering courses are already listed in Marshall's undergraduate catalog, it is anticipated that only 12 to 15 new courses (30 to 40 credits) will be required in order to offer a BSE degree.

Cooperation with Other Institutions

The proposed program described above could be accomplished at Marshall University according to the schedule described herein without cooperation from other institutions. However, Marshall's preference is to design the program in cooperation with West Virginia University, through its accredited engineering programs at the main campus in Morgantown and regional campus at West Virginia University Institute of Technology in Montgomery. Such an arrangement would make the wisest use of tax-payer resources, prevent unnecessary overlap, and would take effective advantage of strengths at all three institutions.

Marshall, and WVU, and WVUIT currently enjoy a good working relationship under the state-wide engineering articulation agreement for transfer students, which could be expanded to offering joint courses or even a joint engineering degree program in Huntington. In addition, a stronger relationship with WVU Tech would create necessary momentum and critical mass for expanding the availability of engineering courses in the Charleston area. Marshall plans to pursue this option before completing plans for the BSE degree, but is committed to designing and implementing the program on a schedule that best serves currently enrolled students.

Finally, in recognition of the fact that some students may wish to complete engineering degrees in specific disciplines offered by other institutions, Marshall University will maintain its existing articulation/transfer agreements with WVU, WVUIT, and various other institutions that have accepted Marshall's transfer students in the past and express willing to continue to do so.

Assurance of High Quality Standards and Assessment

As stated above, a committee consisting of several working groups will be assembled to undertake the planning of this proposed degree program. The committee will include representatives from the academic and professional engineering communities, and these individuals will remain active members of an advisory committee upon program implementation. This advisory committee will be used to continually assess program effectiveness and efficacy.

A consultant with expertise in ABET accreditation will be involved from the earliest planning stages, to ensure compliance with current standards for undergraduate engineering education. Marshall will review accredited engineering degree programs from across the country as part of the planning process.

CITE's Engineering Division has an assessment plan that is updated annually and that has been effective in identifying strengths and weaknesses of the program, and that has resulted in both short- and long-term curricular and course content revisions to enhance program effectiveness and quality. Moreover, CITE is in the process of undertaking a comprehensive process to develop new assessment methodologies to support its undergraduate programs in safety, computer science, and engineering. The

proposed new process will incorporate both quantitative and qualitative feedback measures from students and employers. The assessment plan will comply with rigorous ABET assessment requirements, which are applicable to the existing ABET-accredited program in Safety Technology and to the planned computer science and engineering programs.

Uniqueness of Program

A Bachelor of Science degree in Engineering will be the only such degree program in West Virginia, and one of approximately thirty such programs accredited nationwide by ABET[2]. (ABET listed over 1600 accredited undergraduate programs as part of its accreditation cycle ending September 30, 2003.) The areas of emphasis offered through the program will be non-duplicative of existing programs available in the region and state and will make maximum use of existing strengths, resources, and funding sources.

According to its on-line catalog, West Virginia University currently offers Bachelor of Science degrees in the following: Aerospace Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Mining Engineering, and Petroleum & Natural Gas Engineering. WVU Institute of Technology offers Bachelor of Science degrees in Chemical Engineering, Mechanical Engineering, Electrical Engineering, and Civil Engineering.

Marshall's proposed program also will be unique as one of a small number of programs planned and developed after the adoption of the 2000 accreditation criteria by ABET, which made significant changes in ABET's traditional approach to undergraduate engineering. As such, the program will have the flexibility to employ an innovative approach to curriculum development without the limitation of pre-existing structures and other internal and external constraints.

Needs to be Met

As part of the preliminary consideration of an undergraduate engineering degree program, Marshall has solicited input from the regional engineering community in the form of employer focus group meetings and letters. Overwhelmingly, these regional engineering and professional organizations have expressed support of a potential undergraduate engineering degree program at Marshall University. In their letters and other comments, these engineering and business leaders have noted the importance of degree availability in fields such as engineering to the continued growth and economic viability of the region. In addition, many alumni of Marshall's former undergraduate engineering degree program have credited the availability of a BSE program for their original interest and subsequent careers in engineering, and have pledged to support a new undergraduate engineering program at Marshall University.

A study commissioned by the former University System of West Virginia, and jointly funded by West Virginia University and Marshall University in February, 2000, showed a consistent need for increased availability and accessibility of undergraduate degree programs, especially in the Huntington region. This study, conducted by MGT of America, Inc., and entitled "Charleston/Huntington Area Engineering Education Needs Assessment", included survey results from approximately 60 regional engineering employers, and personal interviews with 27 employers.

Marshall University regularly receives requests concerning the availability of an undergraduate engineering degree from potential students who express an interest in engineering and are being recruited by various special programs on campus, including honors, athletics, and ROTC. Every year, many of these students choose not to attend Marshall because of the lack of a four-year engineering degree program. In addition, many students who enter Marshall's current freshman/sophomore program (40+ students per year) choose to change majors rather than transfer to another institution at the beginning of the junior year. For many of these students, such a move is infeasible due to family and work responsibilities, or unacceptably disruptive to relationships and routines developed at Marshall, so they ultimately are forced to change majors rather than disrupt their lives in an undesirable manner.

With the continued implementation of the Promise scholarship program, increasing numbers of qualified students will be seeking in-state degree programs. The availability of a quality, convenient, and practical undergraduate engineering degree program at Marshall will help to ensure that students in the region and state can take full advantage of the significant benefit that the Promise program offers to West Virginia's working families. In addition, an undergraduate engineering degree program will enable Marshall to be much more competitive with potential out-of-state students in the border region and beyond.

Upon approval of the intent to plan, Marshall intends to complete further studies on the sustained need for new undergraduate engineering degree programs in the region, including the areas of emphasis and student populations that are currently the most under-served. Based on current enrollment in the freshman/sophomore program and the needs identified above, Marshall anticipates an enrollment of approximately forty to fifty new students per year into the program. Students currently enrolled in Marshall's freshman and sophomore programs will be eligible to complete their engineering degrees at Marshall if the planning and implementation process proceeds according to the currently projected schedule. Given current nationwide trends and statistics in engineering student attrition rates, we would expect to graduate approximately 20 to 25 students per year in the early years of program implementation. For the past two years, Marshall has admitted approximately 40-50 new students into the existing engineering transfer program.

Additional Resources Needed

The degree program will be housed within the existing College of Information Technology and Engineering, and will make full use of existing administrative staff and facilities, and some use of current faculty and classroom resources. The program will use existing freshman and sophomore level engineering courses.

To fully develop and implement the junior and senior years of an undergraduate engineering degree program, Marshall will need two additional full-time engineering faculty members, or the equivalent (although required faculty involvement will be heavily dependent on areas of emphasis selected for the program). Additional technical and administrative support will also be required, and more space will be needed to implement laboratory courses. However, current plans envision extensive use of computer simulations, bench-scale equipment/software units, and laboratories at local industry to minimize the need to create extensive new engineering laboratory facilities. This approach will also result in more student interaction with regional industry and the professional engineering community. This real-world experiential learning has been identified by employers as an important component of a new engineering degree program. Marshall will also vigorously pursue gifts and grant funding to support the undergraduate engineering program.

Assuming the reallocation of a portion of Marshall's existing engineering resources, and taking into account additional library acquisitions, equipment, accreditation, faculty/staff, classroom and related expenditures, a start-up cost of approximately $1,425,000 will be required during the first two years of implementation. Assuming that the program develops as projected, approximately $335,000 will be required to operate the program in each of the next three to five years. The total five-year startup costs are projected to be approximately $2.5 million. However, future decisions regarding areas of emphasis and other curriculum issues will affect the projected cost.

References

[1] Williams, Rosalind, "Education for the Profession Formerly Known as Engineering", *The Chronicle of Higher Education*, January 24, 2003, pp. B12-B13

[2] Newberry, Byron, "A Look at the Past and Present of General Engineering and Engineering Science Programs", *Journal of Engineering Education*, Vol. 92, No. 3, pp. 217-226