

FS P&BC Report to FS APC (10/11/2023)
on Proposed new BS in Applied Engineering(BSAE) in SSoE

Overview (taken from Proposal, Budget, & LOI received from OAPA):

This proposes a four-year (120 cr-hr with 1 semester Co-op experience) Applied Engineering BS degree program in the Speed School of Engineering (SSoE) to develop student skills and experiences for high-demand employment in product development, manufacturing, product testing, technical sales, and field service related to engineering technology areas of robotics and “mechatronics.” Unique distinguishing features of this UofL new BS program are:

1. The students will complete coursework towards a “general” Applied Engineering degree (BSAE) program. In addition to the Cardinal Core requirements, the students will undertake a base structure of core coursework, known as the Applied Engineering Core. This will develop a student’s abilities in applied math, science, project management and other skills employers broadly need across a variety of technology sectors.
2. Within the general Applied Engineering degree, students will complete a series of upper-level courses in two industry-recognized pathways: one based on management (e.g., risk management, human development, and process improvement) and the other on mechatronics (e.g., applied programming, digital systems, and robotics). These upper-level courses would comprise 30 credit hours of the degree program. This design of marrying a core curriculum with industry-recognized pathways will allow the Applied Engineering program to quickly respond to industry needs. New elective specialization areas (AE tracks) can be added to the curriculum as these specialization employment areas develop.
3. The ability for students to accumulate relevant work experience in tandem with their academic studies is a fundamental tenant of the J.B. Speed School of Engineering. Similar to current engineering students, the Applied Engineering students will complete the equivalent of one year of work prior to graduation through work-based experiential education opportunities. To accommodate differing financial needs and help promote the academic-industry knowledge transfer, the work experience will be a combination of the traditional co-op experience and accumulated hours of industry employment.
4. The program is designed to integrate efficiently with community colleges and individuals already active in the workforce. The first two years of the program have been developed in concert with the capabilities of regional technical schools. The coursework has been designed to ease transferability in a 2+2 format and remove roadblocks due to scheduling. The second two years of the program have been designed to facilitate students that are also active in the workforce. As this is a new program, class times and durations can be modified to better accommodate non-traditional students.

These four features, working together, will prepare students for full-time job placement in high-need, high-growth occupations immediately following graduation.

This new degree program seeks to specifically recruit from students who are interested in engineering (i.e., enroll in Speed School) but for whom calculus is a potential point of drop-out or transfer (i.e., those who enroll in but do not pass introductory math courses). A large portion of potential students will be drawn from the students already enrolled in other SSoE programs. The number of students meeting this criterion in 2019-2020 was 128; thus, this proposal conservatively estimates that 60 (or less than half) of these students would alternatively enroll in Applied Engineering. This projects enrollment and revenue based on a starting number of 60 students in Year 1, and assumes 2% annual enrollment growth, retention rates of 70%/85%/95% after Years 1/2/3 respectively, and a revenue of \$331 per credit hour tuition-share to SSoE. This proposal also assumes external commercial gifts of \$200,000 per year for each of the first five years after program launch. These commercial gifts are designated to facility upgrades and equipment additions to meet lab needs for new AE courses.

P&BC Questions in Black: SSoE Responses in “Red”

Q1: The BSAE proposal projects Net Program losses through Year 3 even with \$200,000 per year in new commercial gifts. This program does not reach a cumulative net profit of \$1,000,000 until Year 9 which would be “operationally break-even” after accounting for the \$1,000,000 in commercial gifts over the first 5 years of program operations. This represent a high risk that this BSAE program would be a “cost-center” and never achieve a “breakeven or profit-center” status for decades! The SSoE Dean Letter should acknowledge this issue and specify how SSoE will handle this contingency, especially if the full \$1,000,000 commercial gifts are not realized.

“We concur that substantial start-up funds are necessary to initiate the applied engineering program. Our discussions with industry, however, indicate that they are very supportive of this program and willing to invest as their workforce needs are becoming critical. We are currently working with UofL Advancement to secure industry contributions and ensure they are viable and actionable. We do not propose moving forward without clearly identified financial resources. Once funding sources are secured, annual losses are only projected through Year 3 (cumulative net loss of \$41,599 over 3 years). Starting in Year 4, annual and cumulative revenue is projected to be positive (\$263,775 and \$222,176, respectively).

Revenue Projection				
	Revenue	Cost	Net - Annual	et - Cumulative
Year 1	\$497,900	\$443,245	\$54,655	\$54,655
Year 2	\$781,898	\$838,049	-\$56,151	-\$1,496
Year 3	\$1,053,503	\$1,093,607	-\$40,104	-\$41,599
Year 4	\$1,306,317	\$1,042,542	\$263,775	\$222,176
Year 5	\$1,328,443	\$1,044,305	\$284,138	\$506,314
Year 6	\$1,151,012	\$996,403	\$154,609	\$660,923
Year 7	\$1,174,032	\$1,013,804	\$160,228	\$821,151
Year 8	\$1,197,513	\$1,031,553	\$165,960	\$987,110
Year 9	\$1,221,463	\$1,049,656	\$171,806	\$1,158,917
Year 10	\$1,245,892	\$1,068,122	\$177,770	\$1,336,687

Per the committee’s suggestion, we are working to modify the Dean’s support letter to specifically address the financial commitments from industry.”

Q2: The BSAE proposal projects establishment of a new academic department with a Department Chair and new faculty additions in Year 2 and later. These are projected to be full-time tenure-track positions which cannot easily be reduced if the enrollment and gift projections do not materialize as projected. What is the contingency plan for this possibility (and maybe more than 50% likely) situation since economic and industrial situations and thus employment needs usually change over a decade or less.

“The industry demand for AE graduates is increasing, and with the projected development in the region, the AE program is expected to have long-term growth. As the AE program is rolled out, the “gifts” received are primarily devoted to laboratory development. The number of experimental stations and equipment can thus be sized appropriately with respect to the funds received.

For the Applied Engineering faculty, it is anticipated that initially only the chair would be a tenure track position. As the departmental faculty would be teaching focused, without research obligations, their positions are more appropriately classified as “term-faculty” with a teaching emphasis. For the teaching faculty, we envision starting with one-year term contracts, and then expanding to three-year contracts once competencies and enrollment stability are established.

The faculty and staff salaries are paid only based on tuition credit revenue and not industry donations or gifts. Hiring will be based on enrollment numbers from years 1 and 2 so new AE faculty will be prepared to teach specific topic courses in years 3 and 4. In the unlikely event student enrollments are not realized, new faculty and staff can be delayed. If enrollment trends fluctuate significantly in the initial years, then faculty would have the skillset to be temporarily utilized within our existing Mechanical or Electrical Engineering departments, or our AMIST and LARRI research centers.”

Q3: The Enrollment Tab in the Budget Projections show each Student Cohort taking 78 cr-hrs for which SSoE would receive Tuition-Share for SSoE-taught courses. Some of these SSoE courses are taught by non-AE-dept faculty/depts in SSoE but all of the tuition-share is applied to AE dept costs. The “increased load” in non-AE-depts in SSoE would potentially represent increased costs in those depts, especially with an AE projection of 60 students in the first year. This means that the actual tuition-share revenue to SSoE to cover “new” costs in the “new” AE dept is “overstated” to make it likely that this new BSAE program will be a “cost-center” over much of the first decade. Is there an alternative explanation or a contingency plan for this?

“All credit revenue reflected in the budget (including the Budget Template for Proposals, Overview, and Enrollment) is based on revenue derived from SSoE-taught courses. By design we have worked to leverage existing Speed classes as part of the AE curriculum. This helps integrate the AE student into our current student population and provides significant efficiencies regarding teaching effort.

The incremental cost of adding students to existing courses or adding extra sections is substantially less than developing a new class for a very similar topic. This follows the model of our “Engineering Fundamentals” department which is responsible for providing introductory courses for multiple engineering departments. However, to support additional student loads, we have included teaching assistant positions within the budget. These positions can be deployed throughout the curriculum as needed. If additional sections are necessary to support student loads, adjunct faculty can be hired for approximately \$8,000 per semester. These additional costs can be absorbed by the school. Ultimately, the Dean of Engineering allocates financial resources to the departments and funding is based on multiple factors, one of which is credit hours taught.”

Q4: The BSAE proposal states a graduation requirement of “1,000 work hours” experience on pg 7 but “2,000 work hours” experience related to the “flight plan” on pg 9 of the approved LOI. The Completed Proposal Template specifies “2,000 work hours including a 1-semester Co-op.” The “Flight Plan” indicates AE 287 Industrial Experience for every semester except Year 3 Spring which has AE 289 Co-op. It is not clear how AE will record, track, and assess the quantity and quality of the “2,000 work hour experience” as a graduation requirement. *“Adult learners will be allowed to use their prior work experience to count towards work/co-op requirements, either in part or in full (pg 11 Proposal).”* How will this be evaluated to ensure it meets the qualifications/standards of acceptable work experience

“The student co-op experience and the academic integration with industry has always been a pillar within the JB Speed School of Engineering. As an example, for the traditional 4-year engineering program, as a formal degree requirement we require three co-op rotations, equal to one year of work experience (2000 work hours).

When developing the AE program, it was important to preserve the industry partnership, however, it was realized that the students drawn to AE would have different work and financial backgrounds from the traditional 4-year engineering student. Thus, to integrate the work experience, we opted for slightly less formal work experience than provided by a traditional co-op. As the intent is to foster the academic industry relationship, we believe that the AE students can achieve this balance through a combination of part time work and a single co-op rotation. Our vision is that students would complete the following;

750 hours part time work experience within years 1 and 2.

750 hours full time work during third year co-op rotation

500 hours part time experience within years 3 and 4.

Tracking will be conducted every semester in the placeholder course “AE 287: Industry Experience I”. Because the course will be Pass/Fail and non-credit bearing, career/academic advisors within the co-op office will meet with the students to review the quality of the work experience and track student hour progress. It is anticipated that the existing co-op tracking system will also be utilized to track the work progression of the AE students. The proposed budget includes funds to support additional career/advising personnel.”

Q5: “This new degree program seeks to specifically recruit from students who are interested in engineering (i.e., enroll in Speed School) but for whom calculus is a potential point of drop-out or transfer (i.e., those who enroll in but do not pass introductory math courses).” The proposed BSAE has a core requirement of Engr 100 “Differential Calculus” which the title suggests at least involves differentiation and integration concepts (and formulas?) How will Engr 100 be modified or taught to allow these high-risk “math-averse” students to succeed in the required Engr 100 in the BSAE program when they can’t succeed in “introductory math courses” for other SSoE programs?

“The traditional math sequencing for 4-year engineering students is to complete four semesters of math starting freshman year in Calculus 1 (ENGR 101). As an increasing proportion of the traditional incoming cohort are underprepared in math, they are given the opportunity to switch to ENGR 100 as a preparatory course for ENGR 101. After successful completion of ENGR 100, the student would then enroll in ENGR 101 for the subsequent semester to continue through the calculus sequence.

In recent years, as insufficient math preparation has become even more pronounced, Speed School identified a need for a course the precedes ENGR 100 as well. Starting Fall 2022, students who are not prepared for ENGR 100 are able to instead start in ENGR 181 to gain the necessary foundations to succeed in future math courses.

For the Applied Engineering program, these courses will remain available (and appropriate) for students based on their math placement scores, and early course assessments. Additional components (such as extra tutoring, PAL and/or SLA sessions, and recitation sessions) have also been added for students to obtain more assistance outside of the classroom. Though many of the students who begin one of the traditional Engineering programs struggle with the Calculus sequence, that sequence starts with ENGR 101. This course, ENGR 100 precedes ENGR 101, making it a course in which a greater percentage of students are able to succeed.”

Q6: The proposal (pg 5) cites historical barriers based on race and gender negatively impact student sense of belonging and academic achievement. How will this proposed program support diverse identities either through additional academic and/or support services to improve retention. If the program will provide such services, associated cost(s) will need to be in the budget.

“The SSoE currently has several initiatives and student organizations that support the success of diverse student populations. Most notably, the SSoE has a dedicated FYE (First Year Engineering) coordinator and has established a LLC (Living Learning Community) within university housing. We also have belonging components embedded in the first year courses, ENGR 110 and ENGR 111, Engineering Methods, Tolls, & Practice I and II. And finally we have implemented the Speed Connectors Network (see <https://engineering.louisville.edu/experiencespeedschool/first-year-experience/connectors-network/>), which allows students the opportunity to earn a scholarship by simply becoming engaged with programs already designed to help them succeed.

Students are encouraged to participate in at least one Speed School’s student organization, which include NSBE (National Society of Black Engineers), SWE (Society of Women Engineers), and Spectrum. The established student organizations will be welcoming of the AE students. In

addition, the departments interact with students through lunches and other extra-curricular events. These activities are designed to provide a sense of belonging between students, their departments, and Speed School.

The proposed AE flight plans have been developed with consideration of the needs of working adults. We have worked with our regional technical colleges (JCTC and ECTC) to provide opportunities beyond a 2-year degree through a structured 2+2 program. Additionally, in some classes, we are proposing 8-week intensive units, half-day scheduling, or online formats where practical. We fully understand that many of our potential students may be struggling to balance family, financial, and academic obligations. Where possible, we are adjusting the traditional university academic environment to be more flexible and accommodating to differing needs.”

P&BC Assessment:

In general, the program proposers have answered P&BC questions (e.g., they are working with Development for the lab support donors). However, P&BC has a concern about the future quality of the proposed program.

Although this concern is not related to budgetary viability, P&BC is concerned about building a new academic program on extremely contingent staffing (Adjuncts, and 2 term appointments who begin with a one-year contract). P&BC recognizes that it is precisely because of budgetary limitations that contingent faculty are being used, but this does not bode well for program continuity and growth. Although contingent faculty teach many courses, they usually do not contribute to a program in any other way (service, student engagement etc.), which is most important for program quality. These other program aspects will fall on one tenure-track position which is also the Chair of a new department with all of the attendant administrative responsibilities. In addition, this raises the question as to whom the SSoE can recruit to be the department chair of a department with no tenure-track faculty! All of this raises a likely quality issue about a precarious program continuity.

Pat

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