Academic Program Development Process

Letter of Intent for New Academic Program

Program Name: Applied Engineering

Degree Designation: Bachelor of Science

Contact Person: Dr. Tom Rockaway

Department: Department of Applied Engineering (new) – pending approval

School/College: J.B. Speed School of Engineering

Implementation Date: Fall 2023

Accreditation or licensure requirements: ATMAE

Dean's Confirmation and Signature: I, Emmanuel Collins, approve this letter of intent for the creation of a BS in Applied Engineering.

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Emmanuel G. Collins, Ph.D.
Dean, J.B. Speed School of Engineering

I. Program Abstract

We are proposing to develop a Bachelors of Science in Applied Engineering degree program within the J.B. Speed School of Engineering. The industrial base within Kentucky is rapidly expanding and this degree program can help meet the increasing employment demand. Applied Engineering graduates generally fill the gap between traditional four-year engineering and two-year technician programs. The proposed four-year Applied Engineering degree program can develop a skillset focused between these two areas and emphasize applied math and science skills directly relatable to industry. Some common job titles for Applied Engineering graduates include: product development, manufacturing, product testing, technical sales, and field service. These positions would likely appeal to many students who have a keen interest in application-based engineering projects, but less-so in theoretical science, research and design. The University of Louisville currently does not offer Applied Engineering degrees but is uniquely positioned to leverage existing resources to develop a viable program. The J.B. Speed School of Engineering is recognized as generating "industry ready engineers". Through the co-op program and Board of Advisors, the school has established and maintained mutually beneficial relationships with an extensive employer list. These industry relationships are essential as the Applied Engineering curriculum and focus areas are developed.

II. Educational Program Objectives

Problem Statement

Over the next 10 years, Kentucky's employment needs are anticipated to increase two to three percent each year. A critical component that could impede this projected growth is our inability to meet the anticipated workforce demand. According to Indeed.com, about 200 full-time engineer and 140 full-time engineer technician positions in Kentucky are posted every week. In March 2022, there were active hiring posts for 881 full-time engineers and 609 engineer technicians. Kentucky universities and colleges do not currently meet this demand, matriculating only 1,026 engineers (UofL, UK, and WKU), 112 technologists (WKU, NKU and Murray State), and 213 engineering technicians (KCTCS) in the 2019-2020 school year. As these numbers suggest, there is a significant gap between job demand and graduate supply that is at least in the hundreds, and likely in the thousands.

Interestingly, a significant portion of the talent shortfall sits between two-year technician programs and four-year engineering programs. This job sector represents workers who have

the rigor and depth of knowledge that come with a four-year degree, combined with an applied technology program. A four-year Applied Engineering degree program can develop a skillset focused between these two areas and emphasize applied math and science skills that are directly relatable to industry. Some common job titles for Applied Engineering graduates include: product development, manufacturing, product testing, technical sales and field service. These positions would likely appeal to many students that have a keen interest in application-based engineering projects but less so in theoretical science, research and design.

A program at UofL would complement similar programs like one recently started at UK and existing ones at Morehead State and Murray State, but with different industry focuses. Given the extent of the hiring needs, no one institution can completely meet the anticipated workforce demand. Thus, there is a clear need by industry, and a desire by students, to fill Applied Engineering programs.

Vision Statement

We are proposing a four-year Applied Engineering degree program that will develop the skills and experiences employers need to fuel their growing demand. Four features will distinguish this program:

1. The students will complete coursework towards a "general" Applied Engineering degree 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 can be added to the curriculum using existing "Curriculum Approval Process" rather than creating an entirely new degree program. This will shorten the time it takes to respond to future industry needs from years to months.

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.

Educational Objectives

The goal of this program is to fill the gap between the supply of and demand for Applied Engineering talent. In addition to the Cardinal Core, various learning objectives will ensure students are prepared for full-time job placement in order to achieve this goal.

Applied Engineering Core Objectives
For students to develop college-level creative and critical thinking skills
Training in fundamental processes and attributes of effective public speaking
For students to master basic and advanced algebra, and the application of algebra in Applied Engineering
For students to master trigonometry and geometry, and the application of these in Applied Engineering
For students to have a basic understanding of calculus, including its purpose, use-cases, and application in the field of Applied Engineering

For students to understand the basic principles and applications of statistics, statistical tools, and statistical software used in Applied Engineering
The course is designed to provide a general background for an elementary understanding of chemistry and societal issues related to chemistry
An introduction to the basic concepts and principles of modern chemistry.
For students to understand the basic concepts and methods of physics.
For students to understand how to critically examine and use frameworks for decision-making that incorporate ethical, social, and legal lenses and implications
For students to understand how to read, evaluate, compare, and apply contracts and other legal documents and resources used in Applied Engineering
For students to discover the career options for Applied Engineering
For students to understand the principles and applications of fundamental concepts when critically examining and solving an Applied Engineering problem
For students to understand and apply the legal, environmental, and economic tools and frameworks for resources used in Applied Engineering
For students to understand the basic principles of constructing, evaluating, comparing, and implementing budgets
For students to understand the use and application of modern and industry-standard computer aided graphics software and technologies
For students to learn the use and application of Six Sigma and related tools for productivity and development
For students to understand the advanced tools and frameworks for constructing, evaluating, and implementing budgets, including scheduling and projections
For students to learn the principles and applications of leadership, management, and communication practices for individual; how to support, manage, and lead a team
For students to apply the collection of the Applied Engineering skills in a real-world case sponsored by an industry representative (capstone)

Admissions Requirements

The admissions requirements for the BS in Applied Engineering have been adopted from the same requirements for the BA in Computer Science, since it will recruit for a similar type of student. They are:

Incoming, First-time, Full-time Freshman

- Students with ACT/SAT Scores
    - ACT Composite of 23 or higher, HS GPA of 3.0+.
- Students with no ACT scores
    - HS GPA of 3.0 or better
    - Comprehensive transcript review
        - Strength of high school
        - Highest level courses attempted
        - Successful completion of pre-calculus and chemistry
    - Review of student resume
        - Extra-curricular activities
        - Leadership positions

Transfer Students

- Fewer than 12 credit hours
    - Minimum College GPA of 2.8 or better
    - Evaluated on same metrics as First Time students (see above)
- Between 12 – 23 credit hours
    - Minimum College GPA of 2.8 or better
    - ACT Reading 20+ OR Accuplacer Reading score of 244 OR credit for ENGL 101
    - B- or better in College Algebra (MATH 111 or equivalent)
    - B- or better in Introduction to Chemistry (CHEM 101 or equivalent)
- 24 or more credit hours
    - Minimum College GPA of 2.8 or better
    - B- or better in College Algebra (MATH 111 or equivalent)
    - B- or better in Introduction to Chemistry (CHEM 101 or equivalent)

Graduation Requirements

- 120 credit hours, 52 @ 300+ level
- 1 co-op rotation, 1000 hours in work hours
- Completion of degree flight plan
- Completion of University-wide General Education Program

- GPA of 2.25 or better for all courses used to satisfy degree requirements

Curriculum

Accreditation

The curriculum we have produced would be accredited by SACS (i.e., meeting the Cardinal Core requirements). As this is not an engineering program, we would not be required to receive additional accreditation. However, if we do decide to pursue this, there are options for accreditation from ABET, which already accredits the Engineering programs and which offers a framework specifically for Engineering Technology programs. If pursued, this would be occur after program implementation and be handled similarly to how existing Engineering programs are accredited, just tailored to Engineering Technology outcomes and objectives.

Coursework

Students will complete 120 credits hours to earn a Bachelor's of Science in Applied Engineering. Included in this will be credits that satisfy the Cardinal Core requirements, a Speed School Applied Engineering core curriculum, and the management and mechatronics pathways curricula.

Experiential Education

In addition to the above courses, students must complete 2000 hours of work experience (i.e., one year of full-time work), including a traditional co-op rotation (which counts towards the total 2000 hours). This hybrid approach accommodates the needs of different student groups while also providing enough structure for students to graduate with full-time work experience. In order to allow students time to complete work hours and also graduate in 4-years, we have limited several semesters to minimum requirements for full-time enrollment and utilized summers. By utilizing co-op enrollment status in Spring 3, students will always be able to meet requirements for full-time status.

We will leverage the Speed Schools existing Career Services department to provide students with advising services to facilitate job placement. However, we cannot guarantee placement, and successful placement and completion of the work requirement is ultimately the responsibility of the individual student.

Accommodating Transfer and Adult Learners

We have designated a particular transfer point after Year 2 to create a seamless transfer experience for technical college students. Adult learners will be allowed to use their prior work experience to count towards work/co-op requirements, either in part or in full.

Flight Plan

The table below is the 4-year flight plan proposal for students:

Flight Plan

YEAR 1			
Fall 1			
ENGR	181	Foundations in Applied Mathematics for Engineering	3
ENGL	101	Introduction to College Writing	3
CHEM	101	Introduction to Chemistry	3
CHEM	103	Introduction to Chemistry Lab	1
AE	101	First-year Experience (FYE)	1
#	#	Social Science I (placeholder)	3
Spring 1			
CHEM	201	General Chemistry	3
CHEM	207	Introduction to Chemical Analysis I	1
ENGR	100	Elementary Calculus	4
ENGL	102	Intermediate College Writing	3
#	#	Humanity I (placeholder)	3
#	#	Social Science II (placeholder)	3
Summer 1			
MATH	180	Elements of Calculus	4
COMM	111	Introduction to Public Speaking	3

YEAR 2			
Fall 2			
ENGR	110	Engineering Methods, Tools, & Practice I	2
MATH	109	Elementary Statistics	3
CSE	311	Ethics, Social, and Legal Aspects on the Electronic Frontier	3
ENGL	306	Business Writing	3
CEE	205	Mechanics I: Statics	3
Spring 2			
#	#	Science Elective	3
CEE	254	Mechanics of Solids	3
CEE	255	Mechanics of Materials Lab	1
IE	370	Engineering Economic Analysis	3
ENGR	150	Engineering Graphics Fundamentals	3
AE	301	Project Management	3
Summer 2			
AE	299	Industry Experience I (500 hour requirement)	1

YEAR 3			
Fall 3			
AE	288	Co-operative Education Seminar Course	1
PHYS	221	Fundamentals of Physics I	4
PHYS	223	Fundamentals of Physics Lab I	1
AE	401	Applied Programming (PLC)	3
AE	402	Basic Circuits	3
LEAD	#	HR/Human Development	3
Spring 3			
AE	289	Co-op Rotation I	1
Summer 3			
AE	302	Process Management (Lean Thinking)	3
AE	303	Safety	3
AE	304	Quality	3

YEAR 4			
Fall 4			
AE	403	Digital Systems	3
AE	404	Robotics	3
AE	405	Automation & Control	3
AE	406	Electricity & Power	3
Spring 4			
AE	399	Industry Experience II (2000 hours total)	1
ENGR	#	Capstone	3
AE	407	Risk Management	3
AE	409	Process Improvement (Six Sigma)	3
AE	410	Advanced Management	3

New Courses: Learning Objectives

Delivery of this degree program will involve the creation of new courses. Below is a list of the new courses and their learning objectives:

- Process Management
    - Understand the tools and principles of different methodologies for problem-solving, project management, and innovation, including design thinking, lean thinking, and Six Sigma
    - Demonstrate knowledge and application of human-centered methodologies
    - Develop and facilitate a session utilizing one or more methodologies for organizing human-centered and manufacturing activities
- Project Management
    - Possess the essential plan reading, quantity takeoff and pricing skills to function as a junior estimator; be able to prepare a project budget, analyze cost reports and make cash flow projections for a project
    - Understand the various factors that affect budgets and resource management
    - Create and interpret project cost estimates
    - Understand the principles and factors that involve managing people and teams, including teamwork, supervision, and leadership
- Safety
    - Understand the principles underlying safety, compliance, and risk related to construction, and how these affect plans like resource management, budgeting projections, and scheduling
    - Create a construction project safety plan, establish and enforce a safety plan, meet specific safety needs, OSHA
- Quality
    - Understand the principles of quality control
    - Understand the methods and instruments involved in quality control
    - Develop and present a plan for measuring quality assurance, including how to respond to quality issues and concerns
- Applied Programming
    - For students to understand the principles and applications of logic, learning, and programming as used in mechatronics
- Basic Circuits
    - For students to advance the basic concepts of electronics learned in Physics
- Mechanics & Dynamics
    - For students to understand the principles and applications of mechanics, hydraulics, and pneumatics as used in mechatronics
- Digital Systems

    - For students to understand the principles and applications of sensors and binary and non-binary systems as used in mechatronics, as well as how to use, interpret, and troubleshoot sensors and digital systems
- Robotics
    - For students to understand the principles and applications of robotics, learning, and automated movement as used in mechatronics
- Automation & Control
    - For students to understand the principles and applications of automation and control, Signal conditioning and interfacing, including feedback and processes, as used in mechatronics
- Electricity & Power
    - For students to understand the principles and applications of how to generate, store, measure, and use power and power-sources used in mechatronics
- Advanced Management
    - Demonstrate capacity to apply Applied Engineering skills previously learned in an individual capacity (budget projections, resource management, problem-solving processes, and sustainable engineering practices) in a collective, collaborative, and inclusive capacity
    - Demonstrate capacity to apply these skills across different professional disciplines, including engineers and non-engineers
    - Understand the principles and factors that affect individual projects and a portfolios of projects
    - Develop and present a plan for managing varying tasks, projects, and portfolios

Potential for collaboration

In addition to collaborating with industry, this program includes the potential for collaboration with our two-year college partners. The primary goal is to provide a seamless transfer pathway for students to enroll in the program after Spring 2, in order to be ready for a co-op rotation in Year 3. The strategy towards this goal will be to develop articulation agreements (that begin as memoranda of agreement) to accept transfer credits and to create a pathway that is seamless for students. We have also reached out to CEHD regarding the inclusion of prior learning assessment within this program. We believe prior learning assessment will be integral to engaging non-traditional students, and students actively participating in the work force, in the program.

III. Linkage with Mission and Strategic Plans

University-level

This program supports a variety of components from the University's strategic plan, as discussed below.

This program fills a pedagogical gap in Speed School's curriculum, by teaching those students who are interested in pursuing work within the field of engineering but who have not developed the skills, knowledge, and abilities necessary to succeed in the extant engineering curriculum (in particular, those students for whom calculus is an insurmountable barrier). This supports L1.A1: *Attract and enroll a capable, diverse, and engaged student body responsive to the demographic and workforce needs of the future.*

This program will result in new contracts and funding opportunities from industry and employers, including sponsorship of faculty lines, funding of lab space and materials, and contracting for industry-specific professional development opportunities. This supports L2.A2: *Create a high quality, industry focused core skills certification that students can use as an employment tool alongside their academic credential when they graduate.*

This program is designed around career development, including job preparation within the curriculum through experiential learning opportunities, and has articulated goals related to job placement upon matriculation. These curricular design features and goals demonstrate a link between this proposed program and the University's mission. This directly supports L2.A1: *Establish the components of structured experiential learning opportunities in every unit.*

This program will create more experiential learning opportunities for students studying Applied Engineering, and in particular, for students who would otherwise likely not participate in such an opportunity due to transferring out of Speed School. This ties to L1.A2: *Improve retention and persistence to graduation and ensure progress toward equal outcomes for underrepresented, underprepared, low income student sub populations.*

This proposal includes both a base degree program coupled with options for industry-recognized and supported pathways in mechatronics and management. This design will allow the development of future pathways identified by conversations with industry partners to develop more quickly and more simply. This supports I2.A3: *Develop value added partnerships with business and industry partners.*

Once students have completed their Cardinal Core and program foundation courses, they will then focus on completing industry-recognized pathway courses. These courses may be shorter and offered more frequently than a traditional semester, allowing multiple entry points for students. This will also allow these courses to be taught off-campus and on-site with employers, providing students both experiential learning as well as learning directly from employer partners. While the university will still be involved in managing and

determining the curriculum, employer partners will play the role of delivering this curriculum. In this way, we will bring the campus to people, a hallmark of I3.A2: *Increase number of programmatic offerings and off campus spaces which foster local and global community engagement with the university.*

College-level (J.B. Speed School of Engineering)

This program links to many of the goals of the strategic plan at the college level as well.

The Applied Engineering program will expand the base of students who complete experiential learning opportunities with engineering firms, both in terms of attracting new students to Speed School as well as providing a degree path for students who are interested in engineering but who would otherwise not likely complete an engineering degree due to curricular barriers (i.e., calculus). [L1.A2]

Two features of this degree program will communicate to students that Speed has a welcoming environment. First, it will provide a viable alternative for students interested in engineering but for whom calculus is an insurmountable barrier. Second, the micro-term, modular design of the pathways courses (taken in the final two years of a student's tenure) will allow for multiple on-ramps into courses. This second feature will be more accommodating of adult learners, military learners, and learners with other life obligations (e.g., childcare, full-time jobs). [L1.A2]

This degree program is in response to industry needs related to Applied Engineering talent. The current proposal for an industry-recognized pathway system will future-proof the program by allowing for the iteration of new pathways that can be quickly designed and delivered in response to industry need, as opposed to navigating the development and approval of an entire new degree program. This partnering will ensure graduates are ready to join the current and future workforce. [L1.A1]

IV. Diversity and Inclusion

While any student is welcome to enroll, we have specifically designed this program to accommodate three student groups: adult learners, underfinanced students, and transfer students.

Adult learners

Research demonstrates that adult learners (those over 25, financially independent, and/or have or have had a full-time job) perform best when their learning is relevant to their interests and builds on their prior experiences. First, in offering a choice of industry-recognized pathways, this program will allow students to select course offerings relevant to

their interests. Second, the emphasis on experiential learning opportunities will allow students to bring their professional experiences into the classroom.

Underfinanced students

According to research, financing education presents two challenges to students, for which underfinanced students (in particular, financially independent students) are particularly susceptible. First, limited access to capital during college-going can make students' budgets more susceptible to drop-out. Second, growth in workforce wages can encourage drop-out by increasing the opportunity cost of attending college and not joining the workforce. This program addresses both of these by providing experiential learning opportunities that are paid. In fact, many employer partners offer progressive pay that increases as students advance. Participating in paid, relevant work experiences helps to offset rising opportunity costs associated with pursuing and completing a college degree.

Transfer students

The two obstacles to transfer students currently succeeding at Speed School are (1) meeting the co-op requirement and (2) completing advanced courses that are only offered once a year. Many transfer students struggle to consolidate the timing of transfer with the timing of these requirements. Transfer students too often have to inevitably delay graduation in order to satisfy these requirements. By utilizing summers and providing flexible work requirements, we have designed a program that provides students a seamless transfer experience and ensures that they can still graduate on time.

V. Student Demand

Because this 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), we estimate that a large portion of our pool 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; we have conservatively estimated that 60 (or less than half) of these students would alternatively enroll in Applied Engineering. The table below projects enrollment and revenue based on this starting number of 60 students in Year 1, and includes additional assumptions: 2% enrollment growth, retention rates of 70%/85%/95% after Years 1/2/3 respectively, and a revenue of $331 per credit hour to the Speed School.

	Year 1	Year 2	Year 3	Year 4	Year 5
Full-Time	60	103	141	178	181
Part-Time					

Projected new tuition revenue ($$)	$238,320	$548,930	$760,793	$1,056,655	$1,077,788

VI. Market Demand

Over the next 10 years, Kentucky's employment needs are anticipated to increase two to three percent each year. A critical component that could impede this projected growth is our inability to meet the anticipated workforce demand. According to Indeed.com, about 200 full-time engineer and 140 full-time engineer technician positions in Kentucky are posted every week. In March 2022, there were active hiring posts for 881 full-time engineers and 609 engineer technicians. Kentucky universities and colleges do not currently meet this demand, matriculating only 1,026 engineers (UofL, UK, and WKU), 112 technologists (WKU, NKU and Murray State), and 213 engineering technicians (KCTCS) in the 2019-2020 school year. As these numbers suggest, there is a significant gap between job demand and graduate supply that is at least in the hundreds, and likely in the thousands.

Interestingly, a significant portion of the talent shortfall sits between two-year technician programs and four-year engineering programs. This job sector represents workers who have the rigor and depth of knowledge that come with a four-year degree, combined with an applied technology program. A four-year Applied Engineering degree program can develop a skillset focused between these two areas and emphasize applied math and science skills that are directly relatable to industry. Some common job titles for Applied Engineering graduates include: product development, manufacturing, product testing, technical sales and field service. These positions would likely appeal to many students that have a keen interest in application-based engineering projects but less so in theoretical science, research and design.

Market differentiation and a booming investment economy have driven workforce growth among engineering technologists, which accounted for 379,000 jobs in 2015; growth is projected to continue at a rate of 2-5% per year. Despite this opportunity, many employers are facing aging workforce of their technologists that will lead to a growth in retirement. The combination of market demands, an impending retirement wave, and limited new workers– offer a prime opportunity for a university to collaborate with industry and government to develop new talent pipelines for engineering technologists.

A program at UofL would complement similar programs across the state but with different industry focuses. Given the extent of the hiring needs, no one institution can completely

meet the anticipated workforce demand. Thus, there is a clear need by industry, and a desire by students, to fill Applied Engineering programs.

VII. Employer Demand

See Appendix A for the Employer Demand table.

VIII. Academic Demand

Students graduating from this program will be prepared to enter the workforce immediately.

This program does not replace any existing program, track, concentration, or specializations that exist within the University of Louisville.

Similar Programs

There are two similar Applied Engineering programs in Kentucky: at the University of Kentucky and at Eastern Kentucky University. We spoke with both programs, and received their enthusiastic support for our proposal. Below, we summarize their programmatic offerings and their feedback to our proposal. We have also engaged partners in the Applied Engineering department at Jefferson Community & Technical College (JCTC), who have expressed both their support for our proposal and interest in developing a 2+2 pathway for our students.

Morehead State University	
Institution:	Morehead State University
Program Name:	Applied Engineering (associate, bachelors)
Comparison of Objectives/Focus/Curriculum to Similar Programs: Explain the differences in curriculum, focus, and/or objectives. If the proposed program curriculum does not differ substantially from existing programs, then describe potential collaborations with other institutions.	Morehead State's Bachelor of Science in Applied Engineering will prepare you for highly specialized technology careers, or to continue your education in graduate school. Tailored to suit your interests, the Applied Engineering program provides you a solid, well-rounded education in

	mathematics, physics, technology classes and general education requirements that will improve your overall skill set. Choose from one of four degree options to specialize your education to suit your interests. This program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE). Morehead's program focuses on electronics and computer engineering, mechanical and manufacturing, and construction management. Ours, alternatively, will focus on robotics, automation, and mechatronics, EV batteries, and surveying and geomatics.
Comparison of Student Populations: Describe how your target student population is different from those at other institutions and explain how your program reaches this new population (e.g. the proposed program is completely online while other programs are face-to-face or hybrid).	Our program differs in three significant ways from Morehead's. First, ours targets a different geographic scope of recruited students, with a great emphasis on out-of-state students and students who live in or near Louisville. Second, our program offers a pathway that is not offered at Morehead St., including in mechatronics. Third, unlike at Morehead St., our program offers a hybrid of distance learning options for some (but not all) of our course offerings.
Access to Existing Programs	The evidence here is that there are more hiring opportunities than available graduates, demonstrated by the employer and market demand tables in this proposal.

Feedback from Other Institutions	*We are awaiting to hear back from colleagues on a scheduling a meeting to collect feedback.*

Murray State University	
Institution:	Murray State University
Program Name:	Engineering Management
Comparison of Objectives/Focus/Curriculum to Similar Programs: Explain the differences in curriculum, focus, and/or objectives. If the proposed program curriculum does not differ substantially from existing programs, then describe potential collaborations with other institutions.	The Manufacturing Applied Engineering program at Murray State University prepares students for careers in manufacturing industries. The program is designed to help students learn industrial design and develop the manufacturing processes, procedures, and equipment that turn design ideas into real products. The students in this program will develop abilities in product design, prototyping, and principles of automated manufacturing systems using the machines and tools available in a number of laboratories. Murray's program focuses on manufacturing. Ours, alternatively, will focus on robotics, automation, and mechatronics, EV batteries, and surveying and geomatics.

Comparison of Student Populations: Describe how your target student population is different from those at other institutions and explain how your program reaches this new population (e.g. the proposed program is completely online while other programs are face-to-face or hybrid).	Our program differs in three significant ways from Murray's. First, ours is an undergraduate program, while Murray's is a master's degree. Second, our program offers courses that are not offered at Murray St., including in mechatronics. Third, unlike at Morehead St., our program offers a hybrid of distance learning options for some (but not all) of our course offerings.
Access to Existing Programs	The evidence here is that there are more hiring opportunities than available graduates, demonstrated by the employer and market demand tables in this proposal.
Feedback from Other Institutions	Our EMT program focuses heavily on PLC programming and has been around since 2000, so we have quite a bit of experience in the area. I am actually a graduate of the program and worked for TVA in controls for 8 years before I pursued teaching. They do take basic ET classes like Circuits 1&2, Fluid Power, Statics and Strengths, Dynamics, etc. They take their first PLC class, which is similar to the PLC classes at community colleges, at the end of their sophomore year. After that, most of the classes they take builds upon that first PLC class until they take Robotics and Motion Controls their senior year. Our regional industry mostly uses Allen Bradley, so we focus on RSLogix, but we also have Siemens PLCs and use other PLCs in some of our student organization projects. They will learn how to program

	SCADA systems, HMI's, PIDs, and connect devices like VFD's, Remote I/O's and robots to the network. They also take C++, Industrial Networking, and CAD classes to give them a well rounded understanding of automation. Hopefully this gives you a good overview of our EMT program. There is a huge need for our graduates in the state, and I know that this is growing. In addition to the battery plant in Etown, there are a couple going in just south of us in TN. If you are interested, there might be an opportunity of a partnership with MSU, UofL, and regional community colleges to expand mechatronic graduates in the state through grants. Not sure if this is something that would interest UofL or not.

University of Kentucky	
Institution:	University of Kentucky
Program Name:	Bachelor of Science in Lean Systems Engineering Technology, Bachelor of Science in Computer Engineering Technology

Comparison of Objectives/Focus/Curriculum to Similar Programs: Explain the differences in curriculum, focus, and/or objectives. If the proposed program curriculum does not differ substantially from existing programs, then describe potential collaborations with other institutions.	The Department of Engineering Technology provides two four-year undergraduate degrees: Lean Systems Engineering Technology and Computer Engineering Technology. Graduates of this program will be trained in the latest technologies and equipped with the practical skills and hands-on experience necessary for thriving in advanced technology industries. Students can enjoy an integrated education with a unique technology pathway that features participation in extensive industrial practicums.
Comparison of Student Populations:	Our program differs in two significant ways from UK's. First, our program focuses on mechatronics and management, while UK offers pathways to lean systems and computer engineering technology. Second, our program will recruit students from ECTC and JCTC, as well traditional high school applicants. UK's program, alternatively, is exclusively partnered with BCTC. As such, our recruiting pools are complementary but differentiated.
Access to Existing Programs	The evidence here is that there are more hiring opportunities than available graduates, demonstrated by the employer and market demand tables in this proposal.
Feedback from Other Institutions	Dr. Nelson Akafuah, chair of the Department of Engineering Technology and creator of this program, has been highly supportive and encouraging of this proposal for a similar program at UofL. In addition to providing strategic feedback on implementation (e.g., best practices for

	forming an industry advisory board), he has also advised on how to prime components of the degree program for a professional development opportunity for those already in the workforce. In sum, UK is supportive of our efforts and looks forward to working with us as partners similarly dedicated to preparing students in Kentucky for high-growth technology positions.

IX. Funding Sources

Additional Faculty Hires

This proposal includes adding three new faculty lines: one full-time chair position that we expect to be tenured or tenure-track, and two full-time term instructors. Additionally, we have budgeted for a pool of $40,000 for contracting adjunct faculty.

Faculty Workload

Most of the courses will be taught by new instructional faculty and paid for by new enrollment.

Budgetary rationale

The financial vision for this program is that, year-over-year, it is revenue-positive, with any annual deficits offset by preceding years of budget surpluses. The proposed budget produces this vision. While some years are revenue-negative (i.e., Years 2 and 3), overall, this budget achieves and maintains a revenue-positive status. This revenue-positive status will allow for future program growth by diversifying and specializing into different industry-recognized pathways; a portion of leftover funds will be used to support the start-up costs associated with adding these new pathways.

To achieve this, revenue will be drawn from two sources: student credit hours and external donations. The student credit hours will fund the sustaining costs of the program, including costs associated with programming (e.g., recruitment) and faculty and staff lines. The external donations will fund one-time costs, such as buying equipment and building lab space for delivering courses. We have met with companies like MHS, GE Appliances, and Ford Motor Company, among others, who have committed to supporting these resource needs. Based on their interest and feedback from employer meetings, we expect to raise at

least $1 million over the first 5 years. That industry partners have shown us support for these numbers and continue to engage us on developing this program demonstrates their commitment to supporting the program. Because the program has not received full approval from the University, acquiring commitment in writing is not feasible at this time. Once approval is achieved, we can move forward with developing memoranda of understanding and formal contracts with these industry partners.

A full budget is attached with this proposal. The table below includes the overall revenue, cost, and net revenue over 10 years:

Revenue Projection				
	Revenue	**Cost**	**Net – Annual**	**Net - Cumulative**
Year 1	$438,320	$426,445	$11,875	$11,875
Year 2	$748,930	$821,213	-$72,282	-$60,407
Year 3	$960,793	$1,076,734	-$115,941	-$176,349
Year 4	$1,256,655	$1,025,631	$231,024	$54,675
Year 5	$1,277,788	$1,042,356	$235,432	$290,108
Year 6	$1,099,344	$994,416	$104,928	$395,036
Year 7	$1,121,331	$1,011,817	$109,515	$504,550
Year 8	$1,143,758	$1,029,565	$114,192	$618,743
Year 9	$1,166,633	$1,047,669	$118,964	$737,707
Year 10	$1,189,966	$1,066,135	$123,831	$861,537

Program Expenditures

Below are descriptions of major program expenditures.

Marketing & Recruitment

Additional funding will be provided in order to recruit new students, towards a yield goal of 60 (i.e., 60 students actually enrolled) in Fall 2023. This funding will be used towards a .5 FTE staff member, hired and supervised at the determination of the admissions director and the Applied Engineering program director. An additional line of funding for marketing materials has been included, at $15,000 a year with a 2% annual adjustment.

Academic Advisors

An academic advisor line has been included in the budget, with a goal of adding an advisor for every 100 enrolled students: one advisor in Year 1 and a second advisor in Year 3. The budget also provides funds for hiring a part-time advisor or a graduate assistant in Year 2, who will serve as a bridge between the two years: this person will offset the additional advising burdens as enrollment grows towards 100 students, while keeping costs low and

delaying the liability of hiring an additional academic advisor until we are more certain that Year 3 enrollment targets will be hit. The pace of enrollment and retention will determine whether a second advisor is hired sooner or later, though we project that hiring to occur in Year 3.

Financial Resources and Program Impact

Projected Revenues	Year 1	Year 2	Year 3	Year 4	Year 5	Five-year Total
General Funds (internal reallocation)	$0	$0	$0	$0	$0	$0
Grants or Gifts, list each one	$200,000	$200,000	$200,000	$200,000	$200,000	$1,000,000
Other revenues (tuition)	$238,320	$548,930	$760,793	$1,056,655	$1,077,788	$3,682,487
Total Projected Revenues	$438,320	$748,930	$960,793	$1,256,655	$1,277,788	$4,682,487

New Resource Requirements

Projected Expenses	Year 1		Year 2		Year 3		Year 4		Year 5		Five-year Total	
	#	Cost $	#	Cost $	#	Cost $	#	Cost $	#	Cost $	#	Costs $
Faculty Lines (full-time)	1	$160,625	3	$467,997	3	$477,357	3	$486,904	3	$496,642		$2,089,525
Graduate Assistant Positions	0	$0	1	$38,628	3	$118,202	3	$120,566	3	$122,977		$400,372
Library Support												
Facilities, technology or equipment		$178,440		$225,460		$272,486		$205,298		$205,616		$1,087,301
Staff Lines (full-time)	1.5	$87,380	1.5	$89,128	3.5	$208,690	3.5	$212,863	3.5	$217,121		$815,181
Total Projected Expenses		$426,445		$821,213		$1,076,734		$1,025,631		$1,042,356		$4,392,380

X. Online Delivery

Many Cardinal Core and Speed courses are already available online and can be taken by students in a variety of formats. For new Applied Engineering courses, the program will provide a fund to support online course development. The funds can be used for the Delphi Center and other approved opportunities in order to effectively deliver, teach and improve a course in an online and/or hybrid format.

Yes	No	Online Program Best Practice
X		8-week courses For undergraduate programs, this would be major classes at a minimum although also recommended for general education classes
X		Allow part-time enrollment
X		Admit students at least two times/year
X		Asynchronous classes (no regular required meeting times)
	X	100% online (in-person experiences that can be done off-site do not affect this factor, meaning it would still be considered 100% online even if the student has to do in-person assignments where they live)
N/A		Graduate-level programs will not require the GRE, GMAT or other standardized tests for admission

For the criterion marked "No": Our best effort will be made to provide online and hybrid options, although the upper-level courses that involve a lab and equipment component will only be able to be offered in-person. Beyond this, we expect to meet all other best practices related to online delivery.

XI. Appendix A: Employer Demand

Type of Job	Regional Avg Wage	Regional # of openings	Regional Growth Projections (%)	State Avg Wage	State # of openings	State Growth Projections (%)	National Avg Wage	National # of openings	National Growth Projections (%)
Land Surveyor				$58,014	48	0.15% (10-yr)	$65,590	4,000	2% (10-yr)
Construction Engineering Inspection				$55,083	113	3.15% (10-yr)	$62,860	14,300	-3% (10-yr)
Engineering Design				$46,944	191 (annual)	2.25% (10-yr)	$54,080	6,500	2% (10-yr)
Construction Management Technology	$63,573	61	0.35%	$57,951	225	0.47%	$67,221	38,900	0.8%
Electric & Electronic Engineering Technologist	$60,961	23	0.22%	$63,278	74	0.09%	$67,550	11,000	0.2%

Electric Vehicle Battery positions: According to the BLS database of occupational data on electric vehicles, "BLS does not currently have wage data specific to the electric vehicle industry." Occupations are projected to include vehicle manufacturing, electrical vehicle maintenance, infrastructure development, and sales and support. Specifically within manufacturing,

occupations include electric and electronic equipment assemblers, electromechanical equipment assemblers, computer-controlled machine tool operators, and machinists.