Cover Sheet for In-State Institutions
New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	Howard Community College
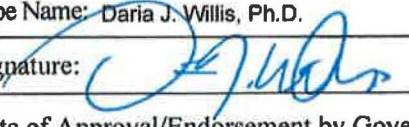
*Each **action** below requires a separate proposal and cover sheet.*

- ⦿ New Academic Program
- ○ New Area of Concentration
- ○ New Degree Level Approval
- ○ New Stand-Alone Certificate
- ○ Off Campus Program

- ○ Substantial Change to a Degree Program
- ○ Substantial Change to an Area of Concentration
- ○ Substantial Change to a Certificate Program
- ○ Cooperative Degree Program
- ○ Offer Program at Regional Higher Education Center

Payment Submitted: ⦿ Yes ○ No	Payment Type: ○ R*STARS # 058616 ⦿ Check # 058616	Payment Amount: $850	Date Submitted: 8/15/23

Department Proposing Program	Workforce, Career, and Community Education
Degree Level and Degree Type	Associate of Applied Science
Title of Proposed Program	Mechatronics
Total Number of Credits	60
Suggested Codes	HEGIS: 5311.00 CIP: 15.0407
Program Modality	⦿ On-campus ○ Distance Education (fully online) ○ Both
Program Resources	⦿ Using Existing Resources ○ Requiring New Resources
Projected Implementation Date (must be 60 days from proposal submisison as per COMAR 13B.02.03.03)	⦿ Fall ○ Spring ○ Summer Year: 2026
Provide Link to Most Recent Academic Catalog	URL: https://howardcc.smartcatalogiq.com/en/2023-2024/catalog/

Preferred Contact for this Proposal	Name: Minah Woo
	Title: Vice President of Workforce, Innovation & Strategic Partnerships
	Phone: (443) 518-4724
	Email: mwoo@howardcc.edu
President/Chief Executive	Type Name: Daria J. Willis, Ph.D.
	Signature: _____ Date: 8/24/23
	Date of Approval/Endorsement by Governing Board:

Revised 1/2021

August 17, 2023

Dr. Sanjay Rai
Acting Secretary of Higher Education
Maryland Higher Education Commission
6 North Liberty Street, 10th Floor
Baltimore, MD 21201

Dear Dr. Rai:

Howard Community College (HCC) requests your approval of a new associate of applied science (AAS) and lower division certificate (LDC) in Mechatronics. These programs are intended to be stackable; students may apply credits from the LDC toward the completion of the AAS degree. These programs will be offered in HCC's new Trades Center building, which is currently in the planning stage.

By offering these new programs, HCC will offer flexibility and opportunity to our students, while maintaining streamlined program oversight, resources, and assessment.

Please contact me if you need additional information or clarification.

Sincerely,

Minah Woo
Vice President of Workforce, Innovation, & Strategic Partnerships
mwoo@howardcc.edu
443-518-4724

A. Centrality to Institutional Mission and Planning Priorities:

1. Provide a description of the program, including each area of concentration (if applicable), and how it relates to the institution's approved mission.

Howard Community College (HCC) is committed to providing educational programs that meet the diverse needs of the community and central Maryland region. The foundation for these programs is a commitment to the HCC education ideal of creating a dynamic and effective learning environment for students.

Central to all academic programs at HCC is their adherence to the college's mission of "Providing pathways to success." The Mechatronics associate of applied science (AAS) degree is designed to prepare students for career entry or career advancement in manufacturing technology. Manufacturing is becoming increasingly technology dependent, requiring highly skilled workers who are familiar with digital tools. The curriculum emphasizes foundational skills in manufacturing technologies including, but not limited to, electrical systems, mechanical systems, pneumatics, hydraulics, programmable logic controllers, and robotics, and incorporates practical, collaborative learning experiences. Students will develop critical thinking, problem solving, and communication skills essential to working in automated manufacturing environments. Students who complete the degree will have access to employment in a variety of technology sectors including electro-mechanical technicians, robotics technicians, manufacturing technicians, programmable logic controller technicians, automation technicians, along with biomedical and electronic equipment technicians.

2. Explain how the proposed program supports the institution's strategic goals and provide evidence that affirms it is an institutional priority.

HCC's Strategic Goals are:

- Student success, completion, and lifelong learning
- Organizational excellence
- Building and sustaining partnerships

This program aligns with HCC's "Student success, completion, and lifelong learning" goal in that the degree prepares students for well-paying careers in the growing manufacturing industry. Students may also continue their education at a four-year institution, where they will continue to hone their knowledge and skills in industry-specific areas of concentration. In addition to industry preparation, general education courses provide skills in critical and creative thinking, scientific and quantitative reasoning, global competency, technological literacy, information literacy, and ethics.

In addition, HCC's president has identified the development of trade programs as an institutional priority.

3. Provide a brief narrative of how the proposed program will be adequately funded for at least the first five years of program implementation. (Additional related information is required in section L).

HCC currently offers an Electronics Technology certificate, a Biomedical Equipment Technology AAS degree, and an Engineering A.A. degree. HCC has invested in laboratory equipment and infrastructure, along with maintenance, to support hands-on instruction in

these degree programs. HCC has a well-equipped engineering lab containing sensors and actuators, as well as a variety of equipment supporting biomedical equipment technology, electrical test equipment, and a Skill Boss trainer for manufacturing. HCC intends to outfit a lab with high-quality mechatronics equipment, including programmable logic controllers and an industrial robot, along with electrical systems, mechanical systems, fluid power, and electro-pneumatic trainers. Additionally, HCC will hire a faculty member with mechatronics expertise to support the program. HCC's president is committed to supporting these additional expenses in HCC's operating budget.

4. **Provide a description of the institution's a commitment to:**

   a. **ongoing administrative, financial, and technical support of the proposed program**

   HCC vigorously supports aligning academic programs to meet state and local workforce needs. As such, this program is directly aligned to those needs and is a part of HCC's high-priority plan to establish a Trades Center. For long-term support, HCC has garnered the commitment of Howard County to partially fund the design of this center and has aligned its operating and capital budget strategies to support this program. Additionally, HCC currently offers several engineering related AAS degrees and an Electronics Technology AAS and certificate program. The college already has some laboratory and faculty resources to support this program. The President is committed to adding one additional faculty member and supplying additional equipment to enable students to gain hands-on skills.

   b. **continuation of the program for a period of time sufficient to allow enrolled students to complete the program.**

   If HCC decides to discontinue the program in the future, the college will establish a teach-out plan, and students will be able to complete the program during a set teach-out period. HCC will support students throughout the completion of the program.

B. **Critical and Compelling Regional or Statewide Need as Identified in the State Plan:**

1. **Demonstrate demand and need for the program in terms of meeting present and future needs of the region and the State in general based on one or more of the following:**

   a. **The need for the advancement and evolution of knowledge**
   b. **Societal needs, including expanding educational opportunities and choices for minority and educationally disadvantaged students at institutions of higher education**
   c. **The need to strengthen and expand the capacity of historically black institutions to provide high quality and unique educational programs**

   The Jacob France Institute (JFI) conducted an analysis of Maryland's manufacturing workforce (JFI Analysis of Lightcast Data, Prepared for the Transforming Maryland Manufacturing Workgroup - Maryland Department of Commerce). JFI's research on

the manufacturing industry identified disparities in gender, ethnic and racial minority demographics for students and faculty, and marginalized student populations living in zip codes with higher poverty rates. Because HCC is an open access institution and provides educational opportunities to students regardless of racial, ethnic, gender, socioeconomic, or educational backgrounds, this program is poised to minimize the disparities in Maryland's manufacturing workforce.

2. Provide evidence that the perceived need is consistent with the Maryland State Plan for Postsecondary Education (MSPPE).

"Science, Technology, Engineering and Mathematics (STEM) jobs have grown in importance in the labor market in recent decades, and they are widely seen as the jobs of the future (Black SE, Muller C, Spitz-Oener A, He Z, Hung K, Warren JR. The importance of STEM: High school knowledge, skills and occupations in an era of growing inequality. Res Policy. 2021 Sep;50(7):104249. doi: 10.1016/j.respol.2021.104249. Epub 2021 Apr 2. PMID: 34334836; PMCID: PMC8318355). While many STEM careers are considered to be high-skill jobs, there are also middle-skill STEM jobs. "Recent work suggests that the labor market outcomes of those in the middle of the wage distribution strongly depends on the workers' skills, with more able workers better adapting to the changing labor markets..." (Black). The proposed mechatronics STEM program addresses the need for advancement and evolution of knowledge in the STEM fields. It will also enable graduates to obtain the skills necessary to gain higher wages and adapt in an evolving labor market.

The proposed mechatronics program supports Priority 5 of the Maryland State Plan for Postsecondary Education ("the Plan"). The Plan indicates that "[a]dvances in technology and changes in the economic infrastructure will continue to change the needs of the workforce" and "postsecondary education will need to adapt with these changes." This program will apply academic experiences on real-world equipment using project-based learning to address advances in technology and changing needs of the manufacturing workforce.

C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State:

1. **Describe potential industry or industries, employment opportunities, and expected level of entry (*ex: mid-level management*) for graduates of the proposed program.**
2. **Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new program.**
3. **Discuss and provide evidence of market surveys that clearly provide quantifiable and reliable data on the educational and training needs and the anticipated number of vacancies expected over the next 5 years.**
4. **Provide data showing the current and projected supply of prospective graduates.**

Per the Transforming Manufacturing in a Digital Economy Workgroup (Making It in Maryland) report to the Maryland General Assembly (December 2022),

> [m]anufacturing is an important industry sector in Maryland. Manufacturing accounts for 4.3% of Maryland jobs, but generates

6.4% of Gross Regional Product and 62% of Maryland exports. Each $1 million in Maryland manufacturing activity generates $1.5 million in Maryland economic activity, supports 4.6 overall jobs in the State, and generates more than $56,000 in State and local tax revenues. Manufacturing is also a growing high wage driver of the Maryland economy. With 108,887 manufacturing jobs distributed across all of Maryland's regions; average annual wages of $107,131, well above the State average; and five-year employment growth of 5%, while Maryland private sector employment fell; manufacturing is a key sector of the State's economy. Manufacturing directly accounts for 4% of Maryland jobs and 8% of Maryland economic activity, and when multiplier effects are included, the sector supports 9% of jobs and 12% of economic activity in Maryland.

The workgroup's research indicates that 55% of the State's manufacturing workforce works in Central Maryland (Workgroup Report).

Figure 1: Share of Total Private Sector and Manufacturing Employment by Region
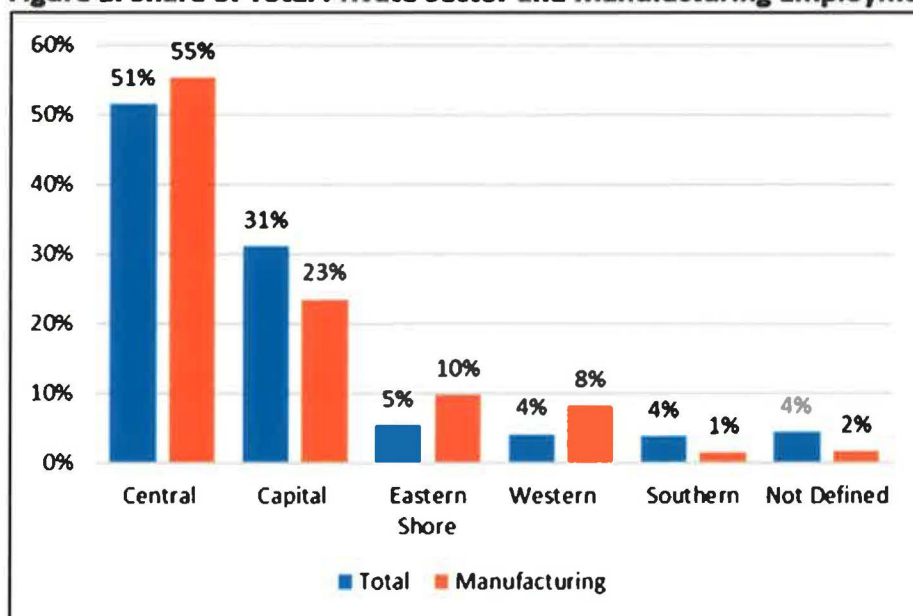
Source: Jacob France Institute

(Workgroup Report)

The U.S. Department of Labor identifies mechatronics as a new and emerging, "green occupation" growth area, and lists the umbrella category of advanced manufacturing as one of 17 in-demand industry clusters. The mechatronics field supports a diversity of production technician occupations (see http://www.onetonline.org/help/green/17-2199.05 and http://www.onetcenter.org/reports/UpdatingTaxonomy2009.html).

Although mechatronics technician is not an identified occupation within the Standard Occupational Classification (SOC), several closely related occupations are electro-mechanical technicians, robotics technicians, electrical and electronics repairers,

maintenance and repair workers, and electrical and electronic equipment assemblers. (Agia, L. Eugenie. (2014). NSC Mechatronics Technology Program Guide. The National STEM Consortium. Retrieved from oli.cmu.edu). The following data is from O*NET:

<u>Electro-Mechanical and Mechatronics Technologist and Technicians</u>
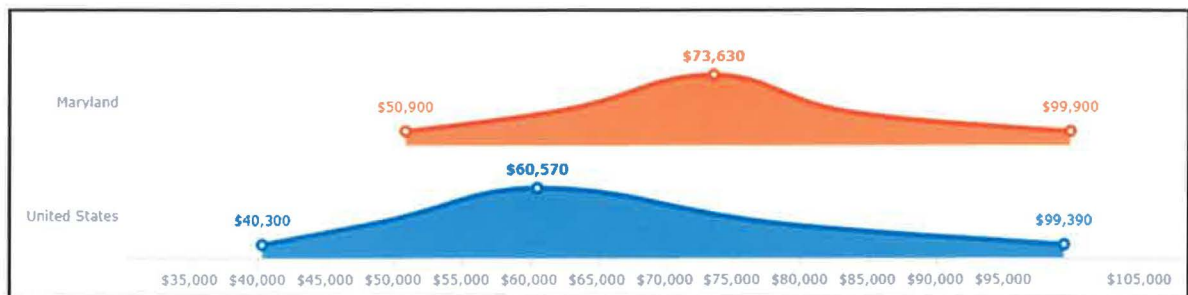SOC 17-3024.00

Wages in Maryland for this position outpace national trends.
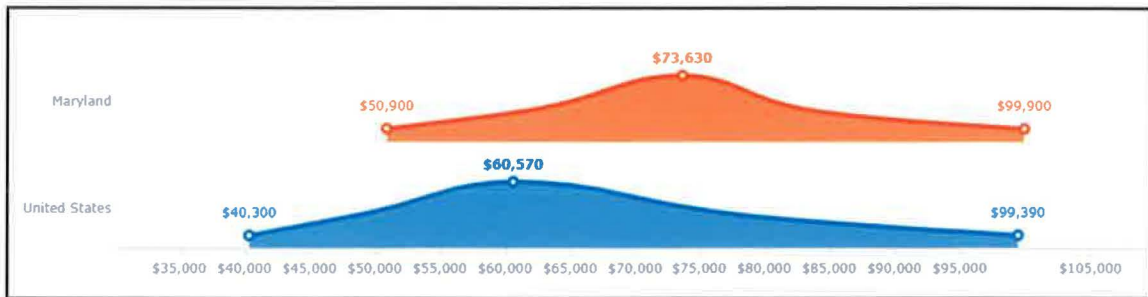
For the Baltimore-Columbia-Towson region, the annual median wage is $79,600. There is a light decline projected with 580 electro-mechanical technicians employed in Maryland in 2030.

<u>Robotic Technician</u>
SOC 17-3024.01

Wages in Maryland for this position outpace national trends.
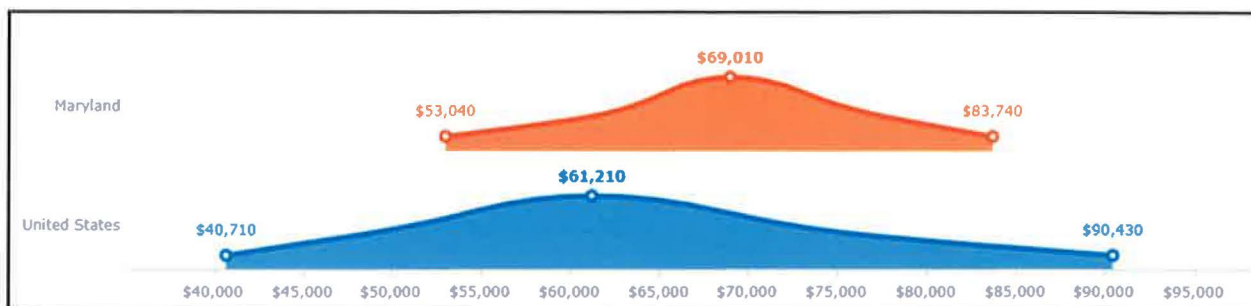

For the Baltimore-Columbia-Towson region, the annual median wage is $79,600. There is a light decline projected with 580 robotics technicians employed in Maryland in 2030.

<u>Industrial Engineering Technician</u>
SOC 17-3026.00

Wages in Maryland are a bit behind the national trends overall at the maximum, but the Maryland median wage is higher than the rest of the United States.

For the Baltimore-Columbia-Towson region, the annual median wage is $71,040. Employment is expected to grow at a rate of 14% with 1,330 industrial engineering technicians employed in Maryland in 2030.

Mechanical Engineering Technician
SOC 17-3027.00

Wages in Maryland are a bit behind the national trends overall at the maximum, but the Maryland median wage is slightly higher than the rest of the United States.

For the Baltimore-Columbia-Towson region, the annual median wage is $61,980. Employment is expected to grow at a rate of 2% with 570 mechanical engineering technicians employed in Maryland in 2030.

Maintenance Workers, Machinery
SOC 49-9043.00

Wages in Maryland are mostly aligned with national trends overall, but the Maryland median wage is higher than the rest of the United States.
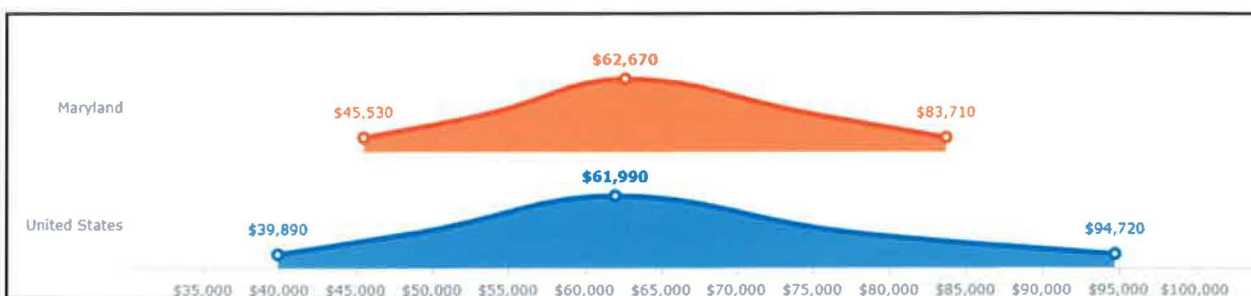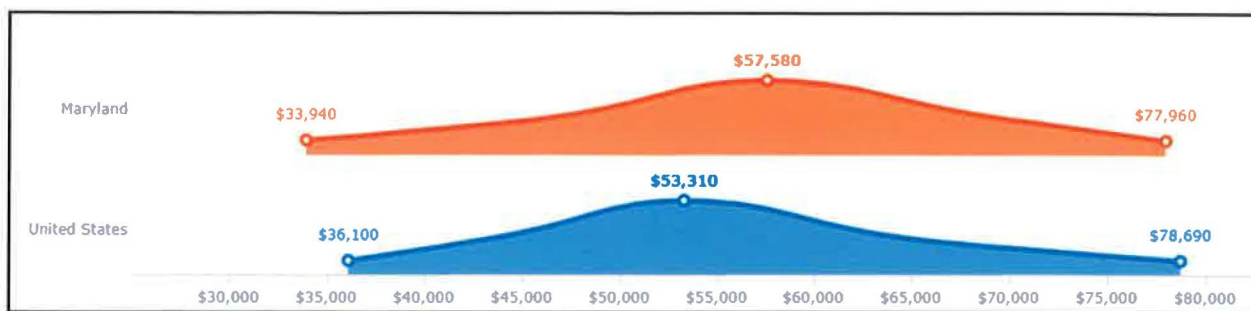
For the Baltimore-Columbia-Towson region, the annual median wage is $58,260. Employment is expected to grow faster than average at a rate of 19% with 1,330 machinery maintenance workers employed in Maryland in 2030.

Maintenance and Repair Workers, General
SOC 49-9071.00

Wages in Maryland for this position slightly outpace national trends.

For the Baltimore-Columbia-Towson region, the annual median wage is $46,740. Employment is expected to grow at a rate of 11% with 25,750 maintenance and repair workers employed in Maryland in 2031.

Electrical and Electronics Repairers, Commercial and Industrial Equipment
SOC 49-2094.00

Wages in Maryland for this position far outpace national trends.

For the Baltimore-Columbia-Towson region, the annual median wage is $75,160. Employment is expected to grow at a rate of 9% with 740 commercial and industrial electrical repair workers employed in Maryland in 2031.

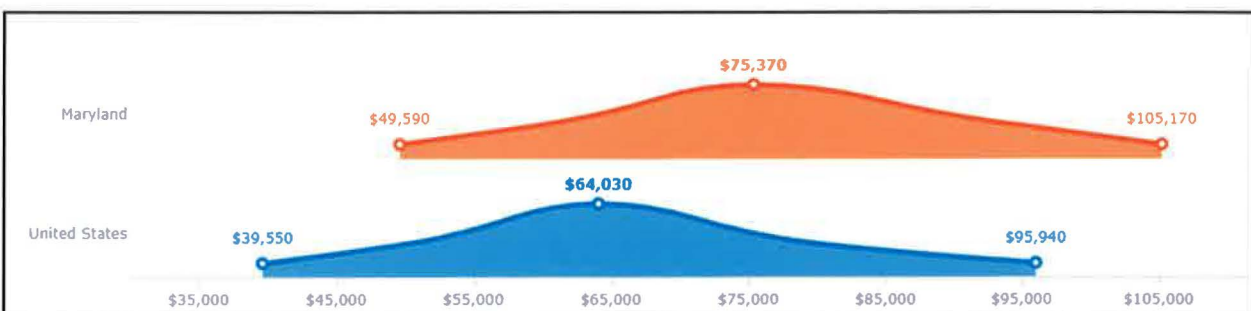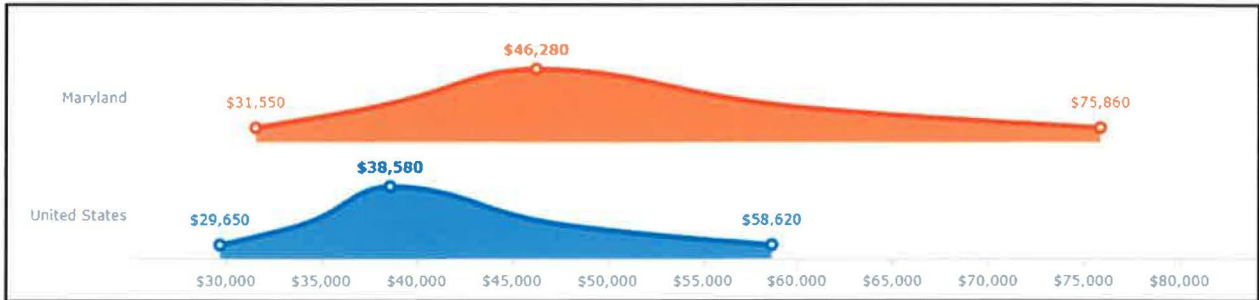Electrical and Electronic Equipment Assemblers
SOC 51-2022.00

Wages in Maryland for this position far outpace national trends.

For the Baltimore-Columbia-Towson region, the annual median wage is $47,460. Employment is expected to grow at a rate of 2% with 3560 electrical equipment assembler workers employed in Maryland in 2030.

Per the National STEM Consortium, "the ubiquity of modern consumer products embedding mechatronics technology, as well as the range of industries employing mechatronics systems, ensures that industry demand for mechatronics technicians is large and geographically dispersed. Mechatronics-related occupations span a variety of industry sectors, including agriculture, aerospace, biotechnology, construction, defense, distribution, electronics, energy, food processing, logistics, medical, petroleum refining, telecommunications, and transportation" (Agia).

Presently, Maryland's demand for skilled manufacturing workers is outpacing the demand for workers in all other industry sectors. In the last five years, Maryland has outpaced the nation in manufacturing employment (JFI Analysis of Lightcast Data, Prepared for the Transforming Maryland Manufacturing Workgroup - Maryland Department of Commerce).

Figure 2: Employment and Manufacturing Sector Growth
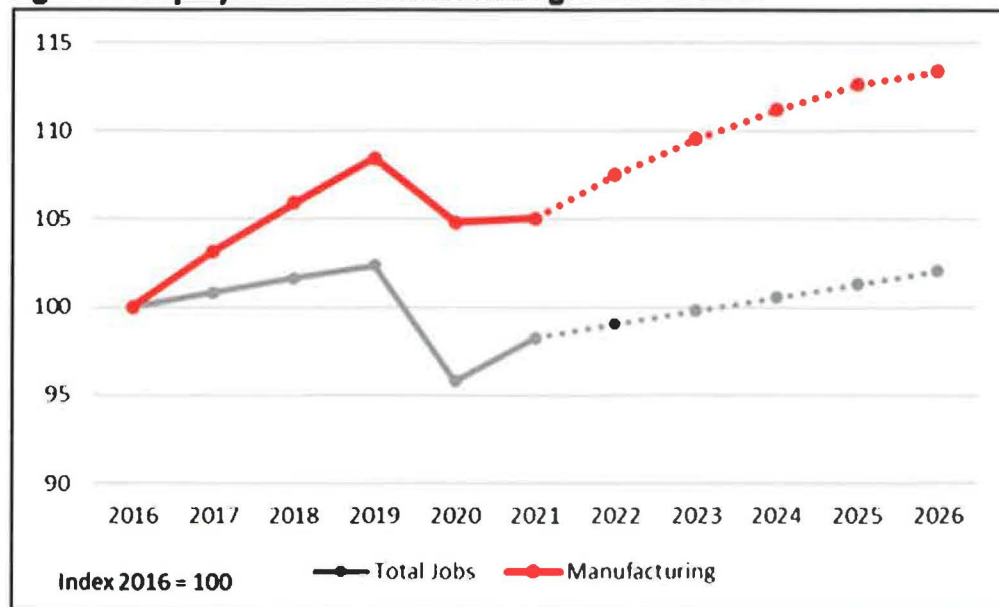
Source: Jacob France Institute

Maryland manufacturing wages are strong and manufacturing jobs provide excellent employment opportunities to earn family sustaining wages with upward mobility (JFI Analysis).

Description	Median Hourly Earnings
First-Line Supervisors of Production and Operating Workers	$33.76
Miscellaneous Assemblers and Fabricators	$17.41
Inspectors, Testers, Sorters, Samplers, and Weighers	$22.95
Packaging and Filling Machine Operators and Tenders	$14.63
Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers	$22.22
Shipping, Receiving, and Inventory Clerks	$17.68
Helpers--Production Workers	$16.57
Industrial Machinery Mechanics	$28.94
Computer Numerically Controlled Tool Operators	$23.12
Machinists	$28.73
Food Batchmakers	$16.45
Production, Planning, and Expediting Clerks	$22.86
Maintenance and Repair Workers, General	$22.55
Production Workers, All Other	$14.38

(JFI Analysis)

Lightcast also predicts an estimated 9,531 annual openings in these professions. Maryland's manufacturing industry wages are the eighth highest in the U.S. providing family sustaining employment opportunities. In Howard County, there are currently 177 job postings in engineering technology professions such as additive manufacturing. The average salary for such positions is $58,661 annually. Lightcast projects the number of these jobs to grow in Maryland. Specifically, in December 2022 there were 822 posted openings for production workers in the State. Lightcast predicts that 3,542 production jobs will be created in Maryland in the next five years.

Manufacturing - Change in Employment by Occupation
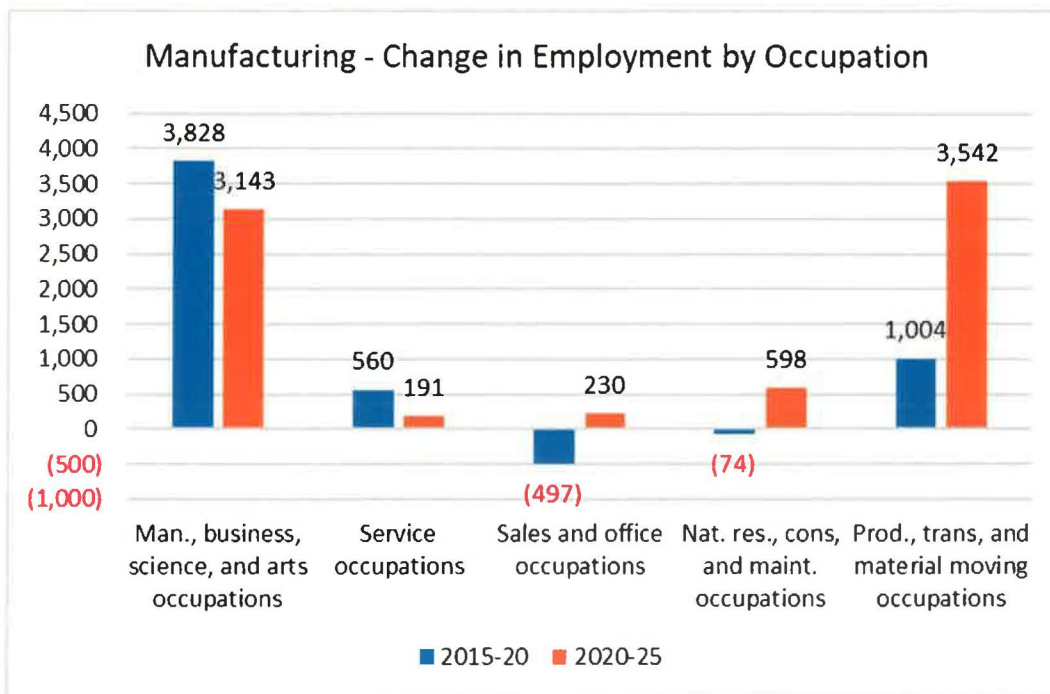
(Workgroup Report)

Data show that the Maryland workforce and talent pipeline is strongly aligned to meet the manufacturing sector's demand for higher skilled occupations. However, the workforce and talent pipeline is not strongly aligned to the sector's demand for production and transportation/material moving occupations. For example, manufacturers accounted for six of the top companies in terms of job openings in 2022. During the same period, the top 20 companies in Maryland account for 50% of all manufacturing openings (JFI Analysis). This program will bolster the talent pipeline to align more closely with the manufacturing sector's demand for higher skilled jobs.

D. Reasonableness of Program Duplication:

   1. Identify similar programs in the State and/or same geographical area. Discuss similarities and differences between the proposed program and others in the same degree to be awarded.

   2. Provide justification for the proposed program.

As discussed above, Maryland's manufacturing workforce and talent pipelines are misaligned with an insufficient workforce to meet the growing number of middle- and high-skilled manufacturing jobs. Regionally, other community colleges have similar programs, but the need for skilled workers is still unmet. Anne Arundel Community College (AACC) offers a Mechatronics AAS and certificate. Harford Community College offers an Engineering Technology AAS, and the Community College of Baltimore County (CCBC) offers an Engineering Technology AAS (Electro-Mechanical Engineering Technology Concentration) both of which contain similar coursework. CCBC's program is specifically designed for individuals who will work under the supervision of an engineer.

In addition to community colleges, the following Maryland universities in HCC's region offer bachelor's degrees in or related to mechatronics:

- Capitol Technology University - Mechatronics Engineering and Mechatronics Engineering and Robotics

- Johns Hopkins University - Mechanical Engineering and Electrical Engineering

- Loyola University - Electrical Engineering

- Morgan State University - Mechatronics Engineering

- University of Maryland Baltimore County - Mechanical Engineering

Within the realm of non-credit, Maryland's 16 community colleges' manufacturing-related programs focus primarily on welding, which is just one aspect of the broad manufacturing sector, and do not prepare workers for the advanced manufacturing of today and tomorrow. As a result, in 2020, Maryland's community colleges only produced 160 manufacturing non-credit certificate completers (JFI Analysis; Maryland Association of Community Colleges, 2019).

There is also relatively small participation in manufacturing apprenticeship programs relative to occupation need in Maryland, with only 27 apprenticeships focused on manufacturing (JFI Analysis). Maryland's workforce and talent pipeline is not presently capable of meeting the high demand for skilled manufacturing workers. This program will enable Maryland to expand its capacity to prepare highly skilled workers for high-wage jobs.

E. Relevance to High-demand Programs at Historically Black Institutions (HBIs)

1. Discuss the program's potential impact on the implementation or maintenance of high-demand programs at HBIs.

The proposed program will not impact the implementation or maintenance of programs at HBIs. This program will complement the University of Maryland Eastern Shore's Bachelor of Science degree in Electrical/Electronics Engineering Technology and could be a feeder into that bachelor's degree program. No other Maryland HBIs offer similar programs.

F. Relevance to the identity of Historically Black Institutions (HBIs)

1. **Discuss the program's potential impact on the uniqueness and institutional identities and missions of HBIs.**

   The proposed program will not impact the uniqueness and institutional identities and missions of HBIs; as stated above, the only Maryland HBI currently offering a related program is the University of Maryland Eastern Shore, which offers a bachelor's degree, and which this proposed program could feed into.

G. **Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes** (as outlined in COMAR 13B.02.03.10):

   1. **Describe how the proposed program was established, and also describe the faculty who will oversee the program.**

      This program was created as a result of the Maryland Department of Commerce Maryland Manufacturing in the Digital Age Workgroup and the Maryland Manufacturing advisory board. Additionally, this program is informed by the work of the National STEM Consortium (NSC), funded by the United States Department of Labor TAACCCT grant. The NSC worked closely with Maryland and national manufacturers to develop a program guide for institutions seeking to implement a mechatronics program. Anne Arundel Community College (AACC) was the project lead. AACC worked with local employers, such as Northrop Grumman, in developing the curriculum. The NSC also aligned its program to industry certifications, including:

      - Siemens Mechatronic Systems Certification Program – Level 1:
        http://www.siemens-certifications.com/content/0/6/7/3389/43/.
      - Manufacturing Skills Stands Council – Certified Production Technician (MSSC-CPT):
        http://www.msscusa.org/production-certification-cpt/.
      - The International Fluid Power Society – Hydraulic Specialist:
        http://www.ifps.org/docs/certification/certifications_offered/fluid_power_specialist/hs/default.aspx.
      - The International Fluid Power Society – Pneumatic Specialist:
        http://www.ifps.org/docs/certification/certifications_offered/fluid_power_specialist/ps/default.aspx
      - SolidWorks – Certified SolidWorks Associate (CSWA):
        http://www.solidworks.com/sw/support/796_ENU_HTML.htm.
      - OSHA – 30-Hour General Industry:
        https://www.osha.gov/dte/outreach/generalindustry/index.html.

      HCC has incorporated certifications alignment in its curriculum.

      Additionally, a program developer for HCC was appointed by the Governor and currently serves on the Maryland Manufacturing Advisory Board (MMAB) and previously served on the Transforming Manufacturing in a Digital Economy Workgroup (Making It in Maryland). Information garnered by the MMAB and the Workgroup was used to align program competencies to manufacturing workforce needs.

The program will be overseen by James Rzepkowski, Associate Vice President of Workforce Development.

While HCC does not currently have any faculty to support this discipline, the college is in the process of hiring an Engineering Technology faculty member. Additionally, HCC will be hiring one additional assistant professor qualified to oversee curriculum and teach courses in the proposed program.

2. **Describe educational objectives and learning outcomes appropriate to the rigor, breadth, and (modality) of the program.**

   Upon completion of this program, students will be able to:

   1. Apply safety standards and protocols.
   2. Operate, install, and troubleshoot electronically-controlled fluid power systems.
   3. Isolate problems on a variety of industrial systems involving electronics, mechanical systems, sensors, actuators, fluid mechanics, instrumentation, and controls.
   4. Program, install, and troubleshoot programmable logic controllers (PLCs) in mechatronics systems.
   5. Interpret technical documentation such as data sheets and specifications of mechatronic system components.
   6. Apply communication skills needed to work collaboratively within a technical organization.
   7. Understand and apply ethical reasoning in the context of the manufacturing industry.

3. **Explain how the institution will:**

   a. **provide for assessment of student achievement of learning outcomes in the program**

      Program and course reviews are completed according to the schedule provided by HCC in collaboration with faculty members, department chairs, academic deans, the eLearning department, and the office of learning outcomes assessment (LOA).

   b. **document student achievement of learning outcomes in the program**

      Artifacts for the assessment of outcomes are collected and shared through HCC's learning management system, Canvas. Course and program reviews are completed with support from the LOA office. Once an assessment is completed, an action plan will address findings as part of the outcomes assessment process.

4. **Provide a list of courses with title, semester credit hours and course descriptions, along with a description of program requirements.**

   Mechatronics A.A.S. Degree (Career)

The Mechatronics degree is designed to prepare students for career entry or career advancement in the manufacturing industry. Manufacturing is becoming increasingly technology dependent, requiring highly skilled workers who are familiar with digital tools. The curriculum emphasizes foundational skills in manufacturing technologies including, but not limited to, electrical systems, mechanical systems, pneumatics, hydraulics, programmable logic controllers, and robotics, and incorporates practical, collaborative learning experiences. Students will develop critical thinking, problem solving, and communication skills essential to working in automated manufacturing environments. Students who complete the degree will have access to employment in a variety of technology sectors including engineering technicians, electro-mechanical technicians, robotics technicians, manufacturing technicians, programmable logic controller technicians, automation technicians, and biomedical and electronic equipment technicians.

Suggested Semester 1		
Course Number	**Title**	**Minimum Credits**
ENGL 121	College Composition	3
MATH 141	College Algebra (or higher core course)	4
ELEC 107	Introduction to Electronic Circuits	4
ENGT 100	Fundamental Skills for Technology and Engineering	4

Suggested Semester 2		
Course Number	**Title**	**Minimum Credits**
CADD 101	Introduction to Computer-Aided Drafting and Design	3
ENGT 110	Electronic Control Systems	4
ENGT 111	Mechanical Systems	4

Gen Ed Core	Information Literacy Core	3

Suggested Semester 3

Course Number	Title	Minimum Credits
ENGT 210	Pneumatics & Hydraulics	4
ENGT 211	Metrology and Calibration	4
PHYS 101	Technical Physical Science	4
Gen Ed Core	Social & Behavioral Sciences - Global Competency Core	3

Suggested Semester 4

Course Number	Title	Minimum Credits
ENGT 150	Professional Skills for Trades and Manufacturing	1
ENGT 212	Robotics	4
ENGT 213	Quality Control for Manufacturing Technicians	2
PHIL 103	Introduction to Ethics	3
Gen Ed Core	Oral Communication Core	3
Elective	General Elective	3

TOTAL CREDIT HOURS: 60

Course Descriptions

CADD 101 Introduction to Computer-Aided Drafting and Design - 3 credits
This course introduces students to the Computer-Aided Design system. Students will learn how to adapt basic technical drafting and three-dimensional design techniques to computer-generated drawings of the various design disciplines. Students will receive hands-on training and will develop the techniques that are essential in today's job market.

ELEC 107 Introduction to Electronic Circuits - 4 credits
Upon completion of this course, students will have a thorough understanding of fundamentals of electronics. Students will study passive components and their behavior in DC circuits as well as in AC circuits. Students will learn fundamental laws that govern the electronics circuits such as Ohm's law, Kirchhoff's current/ voltage laws, and Thevenin's Theorem. Analysis of electric circuits with computer techniques will be covered as part of laboratory experiments. Basic electronics safety will be stressed. Students will have hands-on experience and a good understanding of laboratory test instruments and basic troubleshooting techniques.

ENGL 121 College Composition - 3 credits
This course teaches students to develop and apply rhetorical knowledge for creating effective text-based communication. Students develop critical inquiry and multi-stage writing processes in order to contribute productively, effectively, and ethically to the social and collaborative practices of academic and other discourses. Coursework guides students toward understanding themselves as authors of texts that hold meaning, and students successfully completing the course will be able to compose texts of at least 1,000 words, demonstrating knowledge of conventions and manuscript presentation relevant to varying rhetorical situations. ENGL 121 transfers as university-parallel freshman English. Students must earn a final grade of C or better to pass this course.

ENGT 100 Fundamental Skills for Technology and Engineering - 4 credits
This course prepares students for success in an Engineering transfer program or Technology program with basic electrical and mechanical knowledge and experiences such as collecting and interpreting data, using appropriate units, basic troubleshooting, and reverse engineering. Students will use mathematical functions and graphs to model and analyze data collected from physical systems, and will get started in the physical world through general shop safety training and measuring with a carpenter's square, calipers, and micrometer. In addition, students will gain fabrication and assembly experience with hand and powered tools. Students will get started in the electronics world measuring voltage, current, and resistance, and will begin building breadboard circuits. Study may begin specialization in topics such as programming, refrigeration, pneumatics, and fluidics.

ENGT 150 Professional Skills for Trades and Manufacturing - 1 credit
This course is designed to develop or refresh knowledge and skills required for technical positions in advanced manufacturing and technical trades fields and will focus upon professionalism, critical thinking, communication and workplace success.

ENGT 110 Electronic Control Systems - 4 credits
This course will explore the basic digital logic and programmable logic controllers (PLCs) in a

mechatronics system using the automation system. Includes basic PLC functions and testing; identification of malfunctioning PLCs; and troubleshooting techniques and strategies to identify and localize PLC hardware generated problems. Writing small programs and problem-solving using computer simulations is emphasized. Prerequisite ENGT xxx (Introduction to Electronic Circuits)

ENGT 111 Mechanical Systems - 4 credits
This course introduces students to principles and concepts needed to safely maintain and troubleshoot a variety of mechanical system components found in industry including bearings, conveyor belts, chain drives, and sprockets. Demonstrate comprehension of preventive maintenance, installation, repair/replacement, and safety procedures using hands-on labs. Build a mechanical systems project utilizing skills learned to complete a final course challenge.

ENGT 210 Pneumatics and Hydraulics - 4 credits
This course will introduce the basics of pneumatic, electro pneumatic and hydraulic control circuits in a complex mechatronic system. Master the functions and properties of control elements based upon physical principles, and the roles they play within the system. Use and interpret technical documentation and perform measurements on the pneumatic and hydraulic control circuits. Apply troubleshooting strategies to identify, localize and correct malfunctions and practice preventive maintenance and safety. Prerequisite: ENGT xxx (Introduction to Electronic Circuits)

ENGT 211 Metrology and Calibration - 4 credits
This course will discuss the fundamentals of metrology, the study of measurements, as it relates to calibration. Explore the processes, equipment, math, and required reporting for proper industrial electronic equipment calibration. Demonstrate the proper use of calibration tools, processes, and reporting through hands-on labs. Prerequisite ENGT xxx (Introduction to Electronic Circuits)

ENGT 212 Robotics - 4 credits
This course will explore the basic principles of robotics, such as mechanical construction, electronics, sensors, motors and robot programming. This course uses a hands-on approach to introduce the basic concepts, focusing on the construction and programming of autonomous mobile and Industrial robots. Works in groups to build and test increasingly more complex robots, culminating in an end-of-semester robot project.

ENGT 213 Quality Control Metrology for Manufacturing Technicians - 2 credits
This course teaches basic quality assurance components as they apply to a manufacturing environment. This course introduces the basic engineering principles and technical skills in support of engineers and other professionals engaged in maintaining consistent manufacturing standards. Students are introduced to quality tools, basic statistics and control charts, blueprint reading, geometric dimensioning and tolerancing, measurements, problem solving, and system auditing.

MATH 141 College Algebra - 4 credits
Topics include functions, mathematics of finance, matrices, and linear programming. Emphasis will be placed on solving problems algebraically and modeling applications involving business, financial literacy, and global awareness. Appropriate technological tools used in business and the social sciences will also be introduced. All sections require the use of the interactive

computer program that comes with the software code and a graphing calculator (TI-84 recommended; TI-89 not permitted).

PHYS 101 Technical Physical Science – 4 credits
This physical science course covers basic introductory physics and chemistry and is designed for Allied Health program majors (RadTech and Cardiovascular), technology majors (BMET, Computer Support, and Electronics) and other non-science majors. It consists of basic scientific mathematics and an integrated sequence of physical science and chemical principles. This course will enable students to become aware of, to identify, and to evaluate situations and/or problems in contemporary physical science which include: science measurement and dimensional plus statistical analysis techniques. Special emphasis is placed upon learning physics principles and solving mathematical problems in density/specific gravity, gas laws, solutions, pressure, fluids, basic electricity, magnetism, sound and light waves, and the atomic structure of matter. The laboratory program will allow the student to develop an understanding of the fundamental principles of the above mentioned areas, including problem solving, and their application to physical phenomenon observed.

5. Discuss how general education requirements will be met, if applicable.

Students at HCC meet general education requirements by completing a minimum of 18 credits of approved courses that meet the Code of Maryland (COMAR) regulations, and which include the following goals:

- Critical and Creative Thinking
- Global Competency
- Information Literacy
- Technological Literacy
- Scientific and Quantitative Reasoning
- Written Communication
- Oral and Expressive Communication

Students will be required to complete coursework determined by faculty and approved by the general education subcommittee. Once assessment is complete, an action plan will address findings as part of the ongoing general education assessment process.

6. Identify any specialized accreditation or graduate certification requirements for this program and its students.

N/A

7. If contracting with another institution or non-collegiate organization, provide a copy of the written contract.

N/A

8. **Provide assurance and any appropriate evidence that the proposed program will provide students with clear, complete, and timely information on the curriculum, course and degree requirements, nature of faculty/student interaction, assumptions about technology competence and skills, technical equipment requirements, learning management system, availability of academic support services and financial aid resources, and costs and payment policies.**

HCC will provide students with timely and accurate information on all curriculum requirements, course offering methodology, Canvas, academic support services, financial aid services, and policies regarding costs and payment by making the information easily accessible to students on HCC's website, in the college catalog, schedules of classes, and admissions and orientation materials.

9. **Provide assurance and any appropriate evidence that advertising, recruiting, and admissions materials will clearly and accurately represent the proposed program and the services available.**

All advertising, recruiting, and admissions materials will be clear and accurate in the representation of the proposed program and services available to students.

H. **Adequacy of Articulation**

1. **If applicable, discuss how the program supports articulation with programs at partner institutions. Provide all relevant articulation agreements.**

N/A

I. **Adequacy of Faculty Resources (as outlined in <u>COMAR 13B.02.03.11</u>).**

1. **Provide a brief narrative demonstrating the quality of program faculty. Include a summary list of faculty with appointment type, terminal degree title and field, academic title/rank, status (full-time, part-time, adjunct) and the course(s) each faculty member will teach (in this program).**

While HCC does not currently have any faculty to support this discipline, the college will be hiring one additional full-time assistant professor qualified to oversee curriculum and teach technical ENGT courses in the proposed program. The faculty member's qualifications include a minimum of an associates degree in mechatronics, electricity, electronics, industrial maintenance and automation, or other similar related degree from an accredited school plus 10 years of experience in the field of mechatronics, electricity, electronics, industrial maintenance, or another comparable field.

Additional coursework will be taught by adjunct faculty experienced in teaching general education and technical courses within the program.

2. **Demonstrate how the institution will provide ongoing pedagogy training for faculty in evidenced-based best practices, including training in:**

a. **Pedagogy that meets the needs of the students**
b. **The learning management system**
c. **Evidence-based best practices for distance education, if distance education is offered.**

HCC provides continuous teaching improvement and ongoing training for full- and part-time faculty year-round in distance education, the learning management system (Canvas), and other pedagogical-related topics, with concentrated training available during professional development periods in May, August, and January, which always include sessions on learner-specific needs and universal design.

J. Adequacy of Library Resources (as outlined in COMAR 13B.02.03.12).

1. **Describe the library resources available and/or the measures to be taken to ensure resources are adequate to support the proposed program. If the program is to be implemented within existing institutional resources, include a supportive statement by the President for library resources to meet the program's needs.**

The James Clark, Jr. Library offers a wide array of print and online resources that are adequate for the proposed program. From the library's website, individuals can search the online catalog for approximately 68,000 items, including books, e-books, and audiovisual titles. Library resources may be used or borrowed by current HCC students, faculty, and staff using their HCC ID card. The library also provides access to e-journals through online database subscriptions. Off-campus access to databases, e-journals, e-books, and online course reserves is available to the college community via a current HCC login and password.

Research assistance is available at the library service desk, by appointment, and via email. Classes and online learning objects for information literacy instruction are regularly offered. Open seven days a week in the fall and spring semesters, the library is outfitted with group study rooms, quiet zones, silent areas, and seating areas for comfortable reading. Computers are available for research and writing and there is wireless connection and power outlets for mobile devices.

Program faculty may recommend materials for the library collection. First priority will be given to those materials that support the instructional program. Orders for previewing of high-cost video and multimedia items may be arranged through the library. Specialized materials not available in the library and not appropriate for purchase for the College's collection may be requested by faculty through interlibrary loan.

HCC's president affirms that the college's existing library resources will meet the needs of the proposed program.

K. Adequacy of Physical Facilities, Infrastructure and Instructional Equipment (as outlined in COMAR 13B.02.03.13)

1. **Provide an assurance that physical facilities, infrastructure and instruction equipment are adequate to initiate the program, particularly as related to spaces for classrooms, staff and faculty offices, and laboratories for studies in the technologies and sciences. If the program is to be implemented within existing**

institutional resources, include a supportive statement by the President for adequate equipment and facilities to meet the program's needs.

The facilities for the program will be located in a new lab in a new planned building at HCC. These facilities include an engineering laboratory. The laboratory houses engineering equipment including sensors and actuators, and has a variety of equipment supporting biomedical equipment technology, electrical test equipment, and a Skill Boss trainer for manufacturing. HCC intends to outfit a lab with high-quality industrial-sized equipment, including programmable logic controllers and an industrial robot, along with electrical systems, mechanical systems, fluid power, and electro-pneumatic trainers.

Additionally, computer labs are used to support the computer-aided design of the items to be printed.

HCC's president affirms that the existing and planned resources are adequate to meet the needs of this AAS degree.

2. **Provide assurance and any appropriate evidence that the institution will ensure students enrolled in and faculty teaching in distance education will have adequate access to:**

   a. **An institutional electronic mailing system, and**

      All students who register for a credit course at HCC receive an HCC student email account.

   b. **A learning management system that provides the necessary technological support for distance education**

      HCC's office of student computer support (SCS) provides Canvas and Google Apps training and support for HCC students at locations on campus, in classrooms, and online. Technology workshops and "Ask an Expert" sessions are held at various hours and locations each semester. Students can access Canvas through HCC's website. Canvas is the learning management system through which course information and content is provided to students in online and hybrid courses, and faculty can communicate supplemental course material to students in face-to-face classes.

L. **Adequacy of Financial Resources with Documentation** (as outlined in <u>COMAR 13B.02.03.14</u>)

   1. **Complete <u>Table 1: Resources and Narrative Rationale</u>. Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year. Also provide a narrative rationale for each resource category. If resources have been or will be reallocated to support the proposed program, briefly discuss the sources of those funds.**

      The calculations below represent estimated tuition, consolidated fees, and course fees, based on the estimated number of students in the program each year. No resources will be reallocated to this program.

TABLE 1: PROGRAM RESOURCES					
Resource Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1. Reallocated Funds	$0	$0	$0	$0	$0
2. Tuition/Fee Revenue (c+g below)	$66,531.60	$82,492	$106,943.60	$123,616.20	$135,750.60
a. Number of F/T students	8	10	13	16	18
b. Annual Tuition/Fee Rate	$5,110.20	$5,171.20	$5,232.20	$5,293.20	$5,354.20
c. Total F/T Revenue (a x b)	$40.881.60	$51,712	$68,018.60	$84,691.20	$96,375.60
d. Number of P/T students	10	12	15	15	15
e. Credit Hour Rate	$171	$171	$173	$173	$175
f. Annual Credit Hour Rate	15	15	15	15	15
g. Total P/T Revenue (d x e x f)	$25,650	$30,780	$38,925	$38,925	$39,375
3. Grants, Contract & Other External Sources	$0	$0	$0	$0	$0
4. Other Sources	$125,000[1]	$0	$0	$0	$0
TOTAL (Add 1-4)	$191,531.60	$82,492	$106,943.60	$123,616.20	$135,750.60

All tuition and fees are based on in-county tuition rates.

[1] Note that this revenue is part of the FF&E funds associated with the new workforce development and trades center building for new equipment.

2. Complete <u>Table 2: Program Expenditures and Narrative Rationale</u>. Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year. Also provide a narrative rationale for each expenditure category.

TABLE 2: PROGRAM EXPENDITURES					
Expenditure Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1. Faculty (b + c below)	$98,051	$98,051	$100,993	$100,993	$100,993
a. Number of FTE	1	1	1	1	1
b. Total Salary	$75,611	$75,611	$77,880	$77,880	$77,880
c. Total Benefits	$22,440	$22,440	$23,113	$23,113	$23,113
2. Admin. Staff (b + c below)	$0	$0	$0	$0	$0
a. Number of FTE	0	0	0	0	0
b. Total Salary	$0	$0	$0	$0	$0
c. Total Benefits	$0	$0	$0	$0	$0
3. Support Staff (b + c below)	$0	$0	$0	$0	$0
a. Number of FTE	0	0	0	0	0
b. Total Salary	$0	$0	$0	$0	$0
c. Total Benefits	$0	$0	$0	$0	$0
4. Technical Support and Equipment	$125,000[1]	$7,500	$7,500	$7,500	$7,500
5. Library	$0	$0	$0	$0	$0
6. New or Renovated Space	$0	$0	$0	$0	$0
7. Other Expenses	$1,000	$1,000	$1,000	$1,000	$1,000
TOTAL (Add 1-7)	$224,051	$106,551	$109,493	$109,493	$109,493

[1] Note that this expenditure for new equipment is part of the FF&E funds associated with the new workforce development and trades center building.

The program expenses will be sustainable with tuition and fees by year four.

M. Adequacy of Provisions for Evaluation of Program (as outlined in <u>COMAR 13B.02.03.15</u>).

1. Discuss procedures for evaluating courses, faculty and student learning outcomes.

The proposed program will be part of the established institutional assessment process at HCC. Courses are assessed on an ongoing basis. Faculty are evaluated on an annual basis, as part of HCC's routine process.

2. **Explain how the institution will evaluate the proposed program's educational effectiveness, including assessments of student learning outcomes, student retention, student and faculty satisfaction, and cost-effectiveness.**

Programs are assessed as a whole every five years. Program assessment includes student learning outcomes, retention, and student satisfaction. HCC uses the IDEA survey to monitor student satisfaction. Faculty satisfaction is reviewed annually as part of the faculty evaluation process. Cost effectiveness is reviewed each year as part of the budget development process.

N. **Consistency with the State's Minority Student Achievement Goals** (as outlined in COMAR 13B.02.03.05).

1. **Discuss how the proposed program addresses minority student access & success, and the institution's cultural diversity goals and initiatives.**

HCC values diversity and recognizes the critical role of an educational institution in preparing its students, faculty, and staff to become contributing members of the global community. HCC's Diversity, Equity, and Inclusion Committee promotes conversation, exchange, and an increased awareness of diversity issues affecting the college community. HCC acknowledges that diversity is recognizing, appreciating, respecting, listening to, and learning from the unique talents and contributions of all people.

Faculty and staff of HCC are committed to the success of each student. HCC values and has clear policies on diversity, which are followed by all employees. Employees are required to complete online training modules focused on FERPA rights and responsibilities, harassment awareness and avoidance, safety, and emergency operations, and the College Vision, Mission, Values, Beliefs, and Strategic Initiatives. Refresher training models are required at intervals determined by HCC's president's team.

HCC recognizes the importance of addressing the issue of minority student achievement, as evidenced by our Silas Craft Collegians (SCC) program, Ambiciones program, and Howard P.R.I.D.E. program. The SCC program focuses on recent high school graduates whose academic achievement does not reflect their true potential. The program attempts to close this gap by maximizing academic achievement, retention, graduation, and transfer. The Ambiciones program builds community among Hispanic/Latino students by providing networking opportunities, educational and recreational activities, and workshops with other Hispanic/Latino students and campus organizations. In addition, students can receive specialized guidance with campus services such as advising and financial aid. Howard P.R.I.D.E. encourages the continued academic, professional, and personal development of black and minority male students via tutoring, mentoring, service learning, leadership seminars, and individual academic advising and career plans.

O. **Relationship to Low Productivity Programs Identified by the Commission:**

1. **If the proposed program is directly related to an identified low productivity program, discuss how the fiscal resources (including faculty, administration, library resources and general operating expenses) may be redistributed to this program.**

   The proposed program is not related to an identified low productivity program.

P. **Adequacy of Distance Education Programs** (as outlined in COMAR 13B.02.03.22)

1. **Provide affirmation and any appropriate evidence that the institution is eligible to provide Distance Education.**

   This program is not being proposed as a distance education program.

2. **Provide assurance and any appropriate evidence that the institution complies with the C-RAC guidelines, particularly as it relates to the proposed program.**

   N/A