BOARD OF HIGHER EDUCATION

REQUEST FOR BOARD ACTION

BHE   BHE 23-20

BOARD DATE: December 13, 2022

APPROVAL OF LETTER OF INTENT OF BRIDGEWATER STATE UNIVERSITY TO AWARD THE BACHELOR OF SCIENCE IN CYBERSECURITY AND DIGITAL FORENSICS AND AUTHORIZATION FOR FAST TRACK REVIEW

MOVED: The Board of Higher Education (BHE) has evaluated the Letter of Intent of Bridgewater State University to award the **Bachelor of Science in Cybersecurity and Digital Forensics** and has determined that the proposal aligns with BHE criteria. Accordingly, the BHE authorizes the Commissioner to review the program and to make a final determination on degree-granting authority pursuant to the Fast Track Review protocol.

VOTED: Motion approved and advanced to the full BHE by the Executive Committee on 12/5/2022; and adopted by the BHE on 12/13/2022.

Authority: Massachusetts General Laws Chapter 15A, Section 9(b), AAC 18-40

Contact: Winifred M. Hagan, Ed.D., Senior Associate Commissioner for Strategic Planning and Public Program Approval

DEGREE TITLE ABSTRACT ON INTENT AND MISSION OF PROGRAM

The proposed B.S. in Cybersecurity and Digital Forensics (CYDF) at Bridgewater State University (BSU) is designed to train students in data, software, and computer system security, and provide them with skills to design systems with safety in mind and respond to cyber risks and threats. The program will be accredited, giving students a foundation in software and system development. Graduates will be employable in and support a vast range of workforce needs, such as finance, education, healthcare, and defense industries.

Given the demand for affordable and quality programs and the state and national need for trained professionals, BSU expects the proposed program to serve as a hub for cybersecurity in MA. The proposed program utilizes institutional strengths, including computer science and criminal justice faculty research and teaching expertise, information technology staff, industry connections, and modern computer and software facilities.

The proposed CYDF is planned to expand equity for underserved students, close gaps, and developing student success programs, institutional research, and assessment tools which provide a student-centered educational experience. BSU reports that because its undergraduates are 51% first generation, 35% low-income students, 27% students of color, and 60% female students, the proposed CYDF will enhance opportunities for underserved STEM students to develop lifelong skills for high-paying careers in MA.

The proposed Bachelor of Science in Cybersecuirity and Digital Forensics was approved by the Bridgewater State University Board of Trustees on June 9, 2022. The LOI was circulated on September 15, 2022. No comments were received.

A. ALIGNMENT WITH MASSACHUSETT'S GOALS FOR HIGHER EDUCATION

Address Gaps in Opportunity and Achievement in Alignment with Campus-Wide Goals

BSU holds that each program in the Bartlett College of Science and Mathematics (BCoSM) and across the University works to ensure accessibility and affordability for all students, close gaps, and improve college completion rates. BSU regularly assesses progress in this work, making reasonable and intentional changes for improvement. The proposal cites that faculty and staff members in the Department of Computer Science are committed to equity with an established record of creating programs which help students find pathways to success in their academic programs and STEM careers. Students participate in outreach activities on campus through the Center for the Advancement of STEM Education and in local schools with opportunities to come to BSU to learn more about science and mathematics. Multiple discreet examples of such programming were provided in detail in the circulated Letter of Intent. Faculty within the college are organized to discuss, create, and implement equitable practices in STEM classrooms and labs. It is planned that faculty and staff members in Computer Science will continue to work with members of the college, across campus, and with local and professional community constituencies, to make BSU engineering programs accessible, affordable, valuable, and achievable.

The proposed new B.S. degree will be the first undergraduate cybersecurity program in the MA State University System. Bridgewater plans that the proposed program will be one of the most affordable programs of its kind and provide a pathway for students from a variety of backgrounds to increase economic mobility. BSU reports that graduates from the program are expected to be able to earn ~$70,000-80,000 in 2022 as a starting salary. The program is expected to create a new range of opportunities at an institution that is teaching-intensive, student-centered, and well-prepared to serve a wide diversity of students while supporting a growing workforce need.

BSU expects that its history of strong connections to three regional community colleges, with clear articulation agreements in all the science and mathematics disciplines will serve transfer students well. An expansion of existing articulation agreements is underway and will be further

developed once the LOI receives BHE approval. In addition, BSU plans that as the proposed degree program is developed, another pathway will be developed providing an on-ramp for students who complete certificate programs in the BSU College of Continuing Studies to advance toward a 4-year degree at BSU.

Program or Department Supports to Ensure Student Retention and Completion

BSU's Department of Computer Science, which will host the new program, has eight full-time faculty members, each of whom plan to contribute to the cybersecurity program. Current faculty have obtained and retained ABET accreditation for the Computer Science program, the first ABET accredited program at BSU, and have unique understanding of how to obtain it for the proposed cybersecurity program. A key part of ABET accreditation is to ensure a stable and transparent pathway to learning the core material and completing the program.

Alliances and Partnerships with PK-12, Other IHE's, Community Employers

BSU has designed the proposed program such that PK-12 partnerships, articulations to BSU from community colleges, opportunities for regional and employer engagements, and an advisory council are included in the plan. The BSU Center for the Advancement of STEM Education (CASE) coordinates programming and outreach for regional PK-12 students and teachers. The CASE has been increasing its number of workshops and courses in computer science and engineering, and the Department is expected to continue to contribute to offerings. Working articulation agreements with all regional community colleges including a CC2BSU[1] program with local partners and MassTransfer are part of the recruitment, enrollment and completion planning for the proposed BS in CYDF program. Much of the coursework required in the first two years of the degree program is taught at community colleges, including courses in mathematics, and general education requirements, and course-level articulation is well established for these classes. BSU is continuing to work with the Bristol Community College A.S. in Computer Information Systems, Cyber Security and Digital Forensics Concentration, to develop specific transfer pathways for the proposed program. In addition to the academic programming, BSU is in the process of installing on its campus an enterprise cyber range/lab.

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[1] *Community College to Bridgewater State University*

The planned lab will enable students and constituents to practice, hone, and elevate their cybersecurity skills through defending against real cyber-attack scenarios and incidents such as ransomware in a virtualized environment. With funds from the Fiscal Year 2022 Skills Capital Grant Program and the state of Massachusetts (MassTech and the MassCyberCenter), BSU will install a cyber range that has both on-premise and cloud-based components to maximize the availability and accessibility of the range to a variety of constituent groups. BSU is in conversations with multiple partners across the education, health care, technology, and government sectors (many referenced in the circulated LOI) regarding partnerships and trainings in cybersecurity and digital forensics. As well, BSU plans to earn approval from the Accreditation Board for Engineering and Technology (ABET, Inc). BSU's B.S. in Computer Science was recently reaccredited by ABET. BSU plans for an advisory board for the Computer Science and the proposed CYDF as it is a requirement of ABET accreditation.

Relationship to MassHire Regional Blueprints

BSU reports that MassHire Workforce Boards, in a 2020 update for their region, indicate that in southeastern MA in 2018, 536 jobs were exclusively within computer systems and related services, and there were 21,924 jobs within the sector of professional, scientific, and technical services. Approximately 42% of the positions went to workers with a bachelor's or advanced degrees. Of the filled positions, just 763 were held by Black or African American candidates. BSU holds that this underscores the significant need to recruit racially diverse students. In the professional, scientific, and technical services sector there was a 9% growth rate from 2016-2018. The region shows an undersupply of workers in computer and mathematical occupations. Preparing the pipeline and advancing incumbent workers is expected to help to meet the demand of this industry. The LOI included a letter of support signed by all four southeastern MA Workforce Boards for information regarding the critical need for educating this high-demand sector of the regional and state economies. BSU further finds that all economic sectors that utilize computers or Internet of Things (IOT) devices are subject to cybercrime, and therefore all industries are affected by security threats and need critical support in the area of cybersecurity. BSU has a short but strong history of providing workforce in the area of cybersecurity for a variety of companies. BSU alumni are working throughout the

Commonwealth in companies and research labs, including Draper Labs, Analog Devices, OCD Tech, Citizens Bank, Safety Insurance, Cape Cod Five Cents Savings Bank, and Cofense. These alumni hold positions as security engineers, security analysts, IT security analysts, and chief architects. Job placement for graduates from both Computer Science and Criminal Justice is very high, with graduates going on to careers at a broad range of companies. BSU reports that 93% of graduates secure jobs or enroll in graduate school six months to a year after graduation and 80% of graduates work in fields related to their area of academic study.

Duplication

There are currently three B.S programs in Massachusetts, which are offered by private universities: Bay Path University, Northeastern University, and Wentworth Institute of Technology. Northeastern University's cybersecurity program is the only CAE-CDE designated B.S. program in Massachusetts that has a primary focus on cybersecurity. Currently there are no ABET-accredited B.S cybersecurity program in Massachusetts. The proposed cybersecurity program is uniquely designed in consideration of both ABET accreditation standards and CAE-CDE designation requirements and provides a comprehensive coverage of essential knowledge, technology, and skills in both cybersecurity and digital forensics areas. Several schools (Northeastern, Boston University, Boston College, UMass Lowell, UMass Dartmouth, WPI) have Master's or Ph.D. level programs. The BSU proposed CYDF program is expected to provide a clear pathway to graduate programs in the state.

Innovative Approaches to Teaching and Learning

The proposed CYDF program is a technical program that teaches programming fundamentals, computer hardware, network architecture, intrusion detection, and secure software design. All coursework is planned to be project and lab based, utilizing current and incoming laboratory resources, including three computer labs, an electronics lab, and a new lab currently under design that employs cyber-range software designed to teach threat detection. Project work is expected to include designing and writing a secure operating system or modifying an existing operating system to include security measures; responding to simulated threats using custom

designed software; or designing networked circuits with small, embedded computers in an electronics laboratory.

B. ALIGNMENT WITH CAMPUS STRATEGIC PLAN AND MISSION

Priority Rationale and Support of Strategic Plan and Overall Mission of Institution

The proposed program is well aligned to the BSU Campus Strategic Plan. It is expected to train and educate students to develop careers in the high demand fields of cybersecurity and digital forensic *(Goal 1D, strategic plan)*; to fill a void in public higher education by providing the only B.S program in cybersecurity and digital forensics in Massachusetts. *(Goal 2A, strategic plan)*; to support regional, state and national investments in innovation and research in the area of cybersecurity and digital forensics *(Goal 4A, strategic plan)*; to provide pathways in cybersecurity and digital forensics for students from local educational institutions and community organizations *(Goal 5A, strategic plan); and to p*rovide opportunities in learning cybersecurity, a highly-paid and employable field, to students from disadvantages and underrepresented communities at an affordable state university (Goals 1 and 5 *strategic plan*).

Program Goals and Objectives (Form B)

Program Outcomes: the B.S. in cybersecurity and digital forensics is planned to provide a foundation of essential knowledge and technical skills in the fields of cybersecurity and digital forensics. Graduates will be able to conduct themselves ethically and work towards solutions in cybersecurity and digital forensics fields by integrating broad knowledge and fundamental skills in their technical career. Graduates will be prepared to pursue opportunities for professional development and graduate studies through life-long learning.

Student Outcomes[2]: BSU anticipates that graduates of the program will have an ability to: analyze a complex computing problem and to apply principles of computing and other relevant

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[2] * *Student outcomes are designed to be consistent with ABET accreditation requirements for cybersecurity programs.*

disciplines to identify solutions; design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline; communicate effectively in a variety of professional contexts; recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles; function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline; and apply security principles and practices to maintain operations in the presence of risks and threats.

Assessment of Student Outcomes: BSU plans that outcomes will be assessed using data collected through undergraduate oral and written classwork. The overall assessment plan will follow standard ABET procedures, including archiving of samples of each assignment, and designating assignments for review from each upper-level class tied to specific learning outcomes.

ALIGNMENT WITH OPERATIONAL AND FINANCIAL OBJECTIVES OF INSTITUTION

Enrollment Projections (Form C, Appendices)

BSU maintains that the conservative estimates of growth noted below are based on informal feedback from students and a comparison of demand for B.S. degrees from institutions in our region:

> 2023-2024: 5 majors
> 2024-2025: 15 majors
> 2025-2026: 30 majors
> 2026-2027: 45 majors
> 2027-2028: 50 majors

It is anticipated that the program may slightly decrease the number of majors in computer science but will not significantly draw from other programs. BSU anticipates that as the first B.S program in cybersecurity and digital forensics in public higher education, the proposed

program will attract new students who would not have considered Bridgewater State University.

Resources and Financial Statement of Estimated Net Impact on Institution (Form D)

The proposed B.S. in CYDF program will require resources in personnel, facilities, software, and efforts to develop and maintain connections to regional industries. Offsetting these needs, the program will provide three new revenue opportunities. First, the creation of the first program of its kind at a state university presents new opportunities for serving students and is expected to attract new and qualified students to BSU. Second, cybersecurity and digital forensics are critical areas, supported by a wide network of grant opportunities through the National Science Foundation (NSF), Department of Defense (DoD), and the Commonwealth. Already, BSU was awarded with $250,000 Skills Capital Grant for the development of a cyber simulation center, which expands course offerings in cybersecurity and digital forensics to meet critical workforce needs. Third, the program is anticipated to result in new industry, state, and academic partnerships that will lead to future support to BSU in unique, marketable ways.

STAFF REVIEW AND VALIDATION

Staff thoroughly reviewed the **LOI** proposing full degree granting authority for the **Bachelor of Science in Cybersecurity and Digital Forensics** submitted by **Bridgewater State University.** Staff validate that the **LOI** includes all data required by the Massachusetts Board of Higher Education. Staff recommendation is for BHE authorization for the Commissioner to review the program pursuant to the Fast Track review protocol.

Form A1: LOI Curriculum Outline

Required (Core) Courses in the Major (Total # courses required = 16)		
Course Number	Course Title	Credit Hours
[COMP151]	[Introduction to Computer Science 1]	[4]
[CYDF210]	[Cyber Programming]	[4]
[COMP206]	[Introduction to Computer Organization]	[4]
[CYDF260]	[Introduction to Networking]	[3]
[CYDF350]	[System Security]	[3]
[COMP351]	[Computer Forensics]	[3]
[COMP352]	[Mobile Device Forensics]	[3]
[COMP363]	[Applied Cryptography]	[3]
[CYDF390]	[Network Security]	[3]
[CYDF420]	[Incident Response]	[3]
[CYDF430]	[Security Analysis and Reverse Engineering]	[3]
[CYDF490]	[Cybersecurity Capstone]	[3]
[MATH 120]	[Introduction to Linear Algebra]	[3]
[MATH130]	[Discrete Mathematics I]	[3]
[MATH 161/161E]	[Single Variable Calculus I]	[4]
[MATH 200]	[Statistical Methods I]	[3]
	Sub Total Required Credits	52 Credits
Elective Courses (Total # courses required = 4) *(attach list of choices if needed)*		
[COMP353]	[Multimedia Systems Forensics]	[3]
[COMP431]	[Wireless Networks and Security]	[3]
[CYDF399]	[Topics in Cybersecurity]	[3]
[COMP406]	[Computer Architecture]	[3]
[COMP407]	[Embedded Systems]	[3]

[COMP461]	[History of Computing]	[3]
[COMP462]	[Distributed Systems]	[3]
[COMP320]	[Unix/Linux System Administration]	[3]
[COMP390]	[Software Engineering]	[3]
[COMP405]	[Introduction to Database Systems]	[3]
[COMP470]	[Introduction to Artificial Intelligence]	[3]
	Sub Total Elective Credits	[12]
Distribution of General Education Requirements Attach List of General Education Offerings (Course Numbers, Titles, and Credits) BSU's Core Curriculum requirements are available at https://catalog.bridgew.edu/preview_program.php?catoid=8&poid=1987		# of Gen Ed Credits 43 credits or more (# varies)
Core Skills: - ENGL 101 Writing Rhetorically (3 credits); - ENGL 102 Writing Rhetorically with Sources (3 credits); - COMM 102 Introduction to Public Speaking or THEA 210 Oral Interpretation of Literature (3 credits); - PHIL 111 Foundations of Logical Reasoning or MATH 180 Transition to Advanced Mathematics (3 credits); - and Foundations of Mathematical Reasoning (several courses possible) (3 credits).		[15]
Arts: Several courses possible		[6]
Humanities: Several courses possible		[9]
Natural Sciences: Several courses possible		[7]
Social and Behavioral Sciences: Several courses possible.		[6]
BSU's Core Curriculum also requires that students take courses to fulfill requirements in Writing/Speaking, Global Culture, Multiculturalism, Quantitative Skills, and US and Massachusetts Constitutions. Total number of credits will vary, depending on the student's choice of courses.		varies
	Sub Total General Education Credits	43 or more, # varies
Curriculum Summary		
Total number of courses required for the degree	40 3 credit courses (or equivalent)	
Total credit hours required for degree	120	
Prerequisite, Concentration or Other Requirements:		

Form B: LOI Program Goals and Objectives

Goal	Measurable Objective	Strategy for Achievement	Timetable
Provide a solid foundation of essential knowledge and technical skills in the fields of cybersecurity and digital forensics	**Graduates will:** 1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. 2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline. 3. Communicate effectively in a variety of professional contexts. 4. Recognize professional	The program is designed to meet the ABET cybersecurity standards. The program will be submitted for ABET accreditation as soon as is possible. Each objective will be satisfied by at least one required course in the curriculum. Faculty will collect student coursework and peer faculty will assess whether it meets the learning outcomes, with each objective reviewed every two years.	Assessment of coursework will start from the first semester the program is offered. Accreditation can only be applied for after students graduate from the program.

	responsibilities and make informed judgments in computing practice based on legal and ethical principles. 5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline. 6. Apply security principles and practices to maintain operations in the presence of risks and threats. *https://www.abet .org/accreditatio n/accreditation- criteria/criteria- for- accrediting- computing- programs-2019- 2020*		
		Industry, student, and alumni advisory boards will be formed to evaluate the program and provide feedback.	

Form C: LOI Program Enrollment

	Year 1	Year 2	Year 3	Year 4	Year 5
New Full-Time	5	15	30	45	50
Continuing Full-Time	0	20	40	60	85
New Part-Time					
Continuing Part-Time					
Totals	5	35	70	105	135

* assuming approximately an 80% retention rate based on computer science experience

Form D: LOI Program Budget

One Time/ Start			Annual Enrollment				
	Cost Categories	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
	Full Time Faculty *(Salary & Fringe)*	*120,000*	*240,000 (two new full time positions)*	240,000	240,000	240,000
	Part Time/Adjunct Faculty *(Salary & Fringe)*	*5,600 (3 credits)*	*5,600*	*5,600*	*5,600*	*5,600*
	Staff	60,000 (maintain cyber range)	60,000	60,000	60,000	60,000
	General Administrative Costs					
	Instructional Materials, Library Acquisitions					
	Facilities/Space/Equipment	1,500,000 (from state grants as stated below)	200,000	200,000	200,000	200,000
	Field & Clinical Resources					
	Marketing	1,000	1,000	1,000	1,000	1,000
	Other (Specify)					

One Time/Start-Up Support			Annual Income				
	Revenue Sources	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
	Grants	1,750,000	1,000,000			

	Tuition/Fees	50,000 (based on	350,000	700,000	1,050,000	1,350,000

		estimated enrollment @ $10k / student)				
	Departmental					
	Reallocated Funds					
	Other (specify)					
	TOTALS					