



Cybersecurity and Forensics Applied Baccalaureate Degree Program

Program Proposal

Forms C and D

Form C

COVER SHEET
NEW DEGREE PROGRAM PROPOSAL

Program Information

Program Name: Cybersecurity and Forensics

Institution Name: Highline Community College

Degree: BAS Cybersecurity Level: Bachelor Type: Science CIP Code: 11.1003

Proposed Start Date: Fall 2013

Projected Enrollment (FTE) in Year One: 10 At Full Enrollment by Year: 15
(# FTE) (# FTE)

Funding Source: State FTE Self Support Other

Mode of Delivery

Single Campus Delivery Highline Community College main campus, Des Moines

Off-site N/A _____
(enter locations)

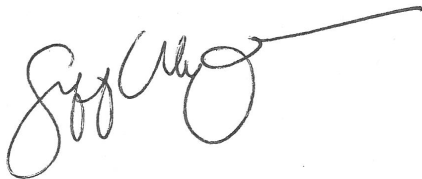
Distance Learning N/A _____
(enter formats)

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Jeff Wagnitz
Chief Academic Officer

Date

NEW DEGREE PROGRAM PROPOSAL

Introduction

The field of computer science and IT has advanced far beyond just programming and code. As mobile devices and their capabilities expand, the need for cybersecurity has risen to address a variety of needs: securing network access, preventing identity theft, providing information assurance, securing databases, conducting investigations and protecting general business operations. Although there is an increasing demand for cybersecurity professionals in many employment sectors, there are not enough professionals to fill this need. Washington State has one of the highest concentrations of such jobs in the nation outside of the nation's capital and surrounding areas, and within our state, jobs in cybersecurity are steadily increasing. This steady increase in jobs is currently not matched by the production of an educated workforce.

A Bachelors of Applied Sciences in Cybersecurity and Forensics will open additional baccalaureate pathways to students and workers in our region. This BAS program has two primary objectives: to provide advanced certificates to those with existing bachelor's degrees and to provide BAS degrees to those with only an AAS degree in a related field.

The proposed BAS degree in Cybersecurity and Forensics emerges naturally from our current AAS degree and builds on our existing strengths. Highline's CIS program offers an especially solid foundation for expansion into baccalaureate-level instruction. Our program has a history of offering high quality degrees, taught by skilled instructors. With our isolated labs, our students can do full installations of functional networks on real hardware, not just virtual machines, and can get hands-on experience in installation, creation of networks, and securing networks and operating systems, along with network router configurations and disaster recovery.

Criteria 1. Curriculum Demonstrates Baccalaureate Level Rigor

1.1 Program Learning Outcomes and Assessment

To meet the demand for cybersecurity professionals, we not only have to produce students and future workers who can program and install hardware and operating systems, but we need to train individuals and to secure information, identify when it has been compromised and track down the perpetrators when it happens. Graduates of the BAS in Cybersecurity and Forensics will be able to

- Secure the commonly used operating systems such as Windows, Linux and Apple at the small office/home office (SOHO) level to the enterprise level.
- Securely install, configure, program and maintain routers, switches and hubs for the SOHO to enterprise level operation.
- Implement cloud security for the variation of cloud environments including public, private and hybrid.
- Implement and maintain mobile security for SOHO to enterprise level operation.
- Install the three popular database products – MySQL, MS SQL Server and Oracle securely on various operating systems. Understand the implications and ramifications of

the various combinations. Be able to design, install and maintain a secure database with each database server on the various operating systems.

- Perform penetration testing on various platforms, applications and network designs. Understand what can be expected and how to deal with situations.
- Perform forensic investigations on mobile devices and networks that support mobile devices.
- Perform effective digital forensics investigations at the device and network level. Be proficient at applying this knowledge to cloud investigations.
- Perform e-discovery tasks and understand the legalities if the company is under a litigation hold for items such as routine purges, deletion of data, etc.

The assessment of the BAS degree in Cybersecurity and Forensics will use the same assessment process as other Highline Community College degrees. At HCC, responsibility for assessment of student learning resides squarely with the faculty. The approach allows faculty to focus on student learning outcomes for a specific course or program that are specifically meaningful to them, using assessments derived from their disciplines and pedagogy. The assessment process is supported and facilitated by the Standards, Outcomes and Competencies Committee (SOCC), a standing faculty committee comprised of divisional representatives and library faculty, with *ex officio* representation from instructional deans and the institutional researcher.

The college's assessment processes, guided by SOCC, facilitate a cycle of continuous improvement. Annual reports on assessment activities are submitted by academic department coordinators at the end of every academic year to the vice president for academic affairs, who reviews them before forwarding them to SOCC. The reports follow a structured, consistent format determined by the vice president. Using a common rubric, SOCC members review and evaluate the departmental reports prior to fall quarter. The evaluations are then sent to the vice president and the academic division chairs, as well as the department coordinators early in fall quarter. Departments meet with members of SOCC to review the evaluations and discuss possible improvements to their assessment activities, as well as planning for the current year's assessments. Follow-up contact between SOCC members and departments is available during winter and spring quarters as departments maintain momentum on their assessment activities.

In 2002, Highline Community College adopted a set of college-wide student learning outcomes (CWOs) that represent an integrated set of foundational knowledge, skills, and attitudes that prepare each learner for future academic and career success. These basic competencies create a foundation for a lifetime of self-directed learning, effective communication, and responsible citizenship. Highline's CWOs are:

Think Critically

The ability to identify and summarize assumptions, issues, and salient arguments, as well as to draw logically valid conclusions from statements, images, data, and other forms of evidence relevant to discipline- or occupation-specific content, and to assess the implications and consequences of conclusions.

Reason Quantitatively

The ability to comprehend, analyze, estimate, use, and evaluate quantitative information arising in a variety of situations and involving a combination of words, data sets, graphs,

diagrams, and symbols.

Communicate Effectively

The ability to read, write, listen, speak and use visual and other nonverbal means of communication with clarity and purpose while being mindful of audience characteristics; to express original thought, to take a position and defend it using solid evidence and sound reasoning; and to recognize and consider the perspectives and contributions of others.

Demonstrate Civic Responsibility in Diverse and Multifaceted Environments

The ability to understand and interact productively and ethically with others in diverse local, national, and global communities with an informed awareness of contemporary issues, their historical contexts, and their personal relevance.

Develop Information and Visual Literacy

The ability to assess the information requirements of complex projects, to identify potential textual, visual and electronic resources, to obtain the needed information, to interpret, evaluate, synthesize, organize, and use that information, regardless of format, while adhering strictly to the legal and ethical guidelines governing information access in today's society.

Highline's college-wide outcomes are directly linked to course level student learning outcomes across the curriculum, including courses specific to the BAS in Cybersecurity and Forensics. Further, program-level outcomes are mapped to both course-level and college-wide outcomes. Continuous assessment of student learning at the course or program level ensures that the CWOs are also assessed regularly, providing the college with data for continuous improvement in all areas.

1.2 Program Evaluation Criteria and Process

Highline has an established process for reviewing AAS degrees that assures comprehensive examination, allows focus on pertinent areas, and requires timely action on recommendations. That process informs the foundation for the institution of regular review of BAS degree programs. A BAS program review will be scheduled every 3 to 5 years. The program review committee includes faculty representation from the department, division, and at large, and the Dean for Instruction for Professional Technical Education. The process includes collaboration with the Institutional Researcher. Unique to BAS degree review is the role of an external reviewer. The committee determines the focus points of the review process which typically include but are not limited to examination of the following information:

- Mapping of degree/program outcomes, college wide outcomes, curriculum and course alignment, and student learning outcomes
- BAS related industry relationships, meeting regularity, program contributions
- Student enrollment, retention and completion
- Surveys and/or focus groups of students determining satisfaction with feedback/recommendations
- Surveys and/or focus groups of BAS alumni determining satisfaction and feedback/recommendations
- Report of student work-based learning/internship opportunities
- Data tracking employment in the industry post BAS graduation

- Employer satisfaction and feedback regarding graduate preparation, advancement opportunities, wage progression
- Opportunities for pathways to related master's degrees and actual student access

The process includes quantitative data collection, employer-industry, faculty, and student interviews, and student and alumni focus groups. The external reviewer conducts student and alumni focus groups and compiles the findings for the review committee.

The program review committee completes a self-study that includes relevant quantitative and qualitative data, recommendations and a time line for implementation. The external reviewer analyses the self-study and meets with the review team for final suggestions prior to report submission to the Vice President for Academic Affairs.

The program review self-study is submitted to the Vice President for Academic Affairs. The VP for Academic Affairs presents the review to the Executive Staff (President and Vice Presidents). The Executive Staff reviews the report, provides feedback and suggestions to be considered, and assists in identifying resources for implementation.

The program courses will be sent out to industry participants for critique and assessment. Many of the members are on the advisory committee. Others are members of groups such as the Agora (a local group of security professionals) and CTIN (Computer Technology Investigators Northwest), the City of Seattle, and Expedia.

1.3 Course Preparation needed by entering students

Entering students must have completed an AAS degree in a related field such as Networking, Network Engineering, Network Security or Digital Forensics. For example, the students at HCC who successfully complete the AAS in Network Specialist or Data Recovery/Forensics would be eligible. Articulation agreements are being worked out with Peninsula CC and their AAS in Cybersecurity and Forensics and with Whatcom CC's Networking degree.

Students must have a background in hardware, operating systems, networks and routers. An introductory class in digital forensics is a recommended for entry; however, students can take CIS 155 – Intro to Computer Forensics prior to taking any classes in the Digital Forensics certificate portion of the degree.

Students should have completed to a level of Math 111 at a minimum; however, Math 141/142 is preferred. Students also must have completed English 101, college composition, at a minimum and are advised to have taken English 235, Technical Writing. If they have not completed the latter, they can take English 235 while in the program, as it is a prerequisite for English 335, Advanced Technical Writing, which is one of the general education requirements of the BAS degree.

1.4 General Education Components

If the students enter with the equivalent of the general education requirements of the HCC degrees, 40 credits of general education is required for the BAS. Initial industry consultation revealed a lack of skill in professional presentations and professional/personal ethics. Table I below outlines the classes that will be required in this program. The state requires a lab science

and a second natural science. Global Environmental Issues – ENV 301 – will be the required lab science. Students can select any lower or upper division natural science for the other five credits.

Table 1. General Education Requirements for Cybersecurity BAS Degree

Distribution Area	Required Credits	Cybersecurity BAS Gen. Ed. Requirements	Credits
Communication Skills	10 credits	COMST 101/5cr ENGL 101/5 cr.	10 credits
Quantitative/Symbolic Reasoning Skills	5 credits	MATH 111 or MATH 141/5 cr. MATH 346 Statistics- Learning from Data/5cr	10 credits
Humanities	10 credits	PHIL 346 Professional Ethics/5 cr. ENGL235 Technical Writing/5 cr.	10 credits
Social Sciences	10 credits	SOC 115 – Crime and Society/5 cr. PSYCH 120 Human Relations/5 cr	10 credits
Natural Sciences	10 credits	ENV 301_– Global Environmental Issues/ 5 cr. CSCI 100 Survey of Computing or CSCI 142 Java 1	10 credits

		/ 5cr	
Business Skills Course *	5 credits	Project Management /5 cr.	5
Additional General Education	10 credits	COMST 320 Presentation Skills or ENGL 335 Advanced Technical Writing/ 5 cr PSYCH 320 Social Psychology /5 cr.	10
Grand Total of Credits	60		60 to 65

* Required for the degree but not the distribution

In the field of network and cybersecurity, calculus is not heavily used; however, statistics and visualization of data is of highest importance, considering the amount of network traffic that must be analyzed. Because many IT professionals do not have strong business acumen, providing a 300-level project management class that can be directly applied to their field will address this need.

1.5 300 and 400 Level Class Work

As mentioned earlier, allowing students to complete intermediate certificates as they go through the program is one of the objectives of this BAS because these certificates help with job placement. The courses are arranged to meet this goal. And some of these certificates will be tied to industry certifications. As shown in Table II, four certificates are included as part of the degree: Database Security, Penetration Testing, Digital Forensics and Investigations, and Advanced Network Security. This allows students to complete certificates and either obtain a promotion in their current job, gain an internship or continue on with the degree. The key objective is, of course, to provide pathways for students to complete the BAS.

A key item is the 5 credit internship, 150 hours of work experience, which will be required for those students not currently working in the field. While more than a few industry fellows want as much as 6 months of internship, in this economy unless the internship is paid, six months is not a practical solution for our students. Real world experience is critical and this requirement would provide this.

This degree is unique in that it focuses not only on the ability to install, secure, monitor, and maintain the network; students learn how to perform penetration testing and track down how the network was compromised. Students will learn to solve higher level problems, to create or evaluate the best solutions, and to conduct investigations at the device and network level.

Table 2. BAS in Cybersecurity, Courses for Junior and Senior Years

	Database Security Certificate	Class code	credits
Configuration Management	Database Installation &	CIS 310	5
	Database Security & Audit	CIS 312	5
	Advanced Database Security	CIS 314	5
	Digital Forensics and Investigations		
Techniques	Intro to E-Discovery Tools and	CIS 350	5
Investigations	Mobile Forensics &	CIS 360	5
Investigations	Network Forensics &	CIS 370	5
	Advanced Network Security		
Architecture	Secure Router & Switch	CIS 320	5
	Cloud Security	CIS 420	5
	Wireless and Mobile Security	CIS 430	5
	Penetration Testing Certificate		
	Pen Testing I	CIS 450	5
	Pen Testing II	CIS 460	5
	Internship	CIS 480	5
			60

Criteria 2: Qualified faculty

Because the BAS in Cyber-Security and Forensics is built upon the college's longstanding associate-degree programs in Network Specialist and Data Recovery/Forensic Specialist, the program can take advantage of the faculty expertise and energy that already exist within the department. By design, the new upper-division courses and the existing lower-division assignments will be shared among the department members, both part- and full-time. In this way, the program can align its teaching assignments with particular areas of faculty strength and can maintain full integration of upper- and lower-division studies.

Table 3. Program Core Faculty		
Lead Faculty	Credentials	Courses Qualified
Amelia Phillips	BS Astronautical Engineering, Massachusetts Institute of Technology; MBA Technology Management, University of Phoenix PhD, Interdisciplinary –Cybersecurity and Law, University of Alaska Fairbanks	CIS 310, 312, 314, 350, 360, 320, 430, 450, 460
Chun Yu	AA – Transfer, Highline Community College BA- Business Administration, Seattle University MS-Information Security-City University, Seattle , Washington Professional Certifications: CCAI, CCNA, MCSE, A+, Net+, MCP+ Internet	CIS 350, 360, 370, 450, 320, 420, 430, 450, 460, 480
Dan Morrill	BS Information Systems Management, University of Maryland MS E-commerce, University of Maryland ABD Doctor of Management, University of Phoenix Professional Certifications: Certified Ethical Hacker, Amazon Web Services	CIS 320, CIS 420, CIS 430, 450, 460
Ron Godfrey	14 years’ experience in digital forensics at a Fortune 500 company and has taught the AAS forensics series for four years.	CIS 350, CIS 360 In addition to the foundation classes
Terry Lahman	Over 35 years of experience in the field including Microsoft Senior Programmer, Microsoft Principal Test Manager, Software Development Engineer and Chief Digital Forensics Analyst for eForensicsPro; GPS devices and mobile forensics Professional Certifications: Certified Computer Examiner (CCE); Certified Data Recovery Expert, AccessData Certified Examiner (ACE); AccessData Mobile Examiner (AME)	CIS 350 CIS 360 In addition to the foundation classes
Staff	MS or higher in Network Security, Operating Systems, Database design and security, Mobile applications and security	CIS 310, 312, 314,

The staffing plan anticipates two-member core faculty, with specialized coursework offered on an occasional basis by adjunct instructors drawn largely from local industry. In light of the BAS

program's modest cohort size, the resulting 2.5 full-time equivalent (FTEF) staff is sufficient to maintain a student-to-faculty ratio of no more than 20-to-1 in didactic courses and 15-to-1 in applied laboratory sections. The particular distribution of faculty duties can be summarized as follows:

Lead faculty (1.0 FTEF, full-time): Highline's lead instructor in cyber-security is tenured and currently holds the position of chair for the Pure and Applied Sciences Division. A nationally-recognized expert in the field of computer forensics, she is co-author of **Guide to Computer Forensics and Investigations**, one of the standard texts in the field globally. She holds a Bachelor's in Astronautical Engineering from MIT, an MBA in Technology Management from University of Phoenix and has just received one of the country's first Ph.D. degrees in the Cyber-security field, from University of Alaska Fairbanks. She has over 20 years of teaching experience, 11 of it at Highline, and three semesters of that time in Namibia, as a Fulbright Exchange Scholar. Her new textbook **E-discovery: An Introduction to Digital Evidence** was published in August 2013. She was the lead author on this ground breaking topic.

Co-lead faculty (new position, 1.0 FTEF, full-time): To complement the program's lead instructor, the college determined that an additional full-time faculty appointment is required to support the BAS option. The new instructor is Chun Yu, who was actually a Highline Community College graduate many years ago. Chun has earned a Bachelor's from Seattle University and a Master's from City University in Information Technology. In addition he is CISCO-certified, not only as a practitioner, but as an instructor, which will pave the way for the program offering CISCO certification. He has over ten years of teaching experience and brings the perspective of an ESL student to the program.

Adjunct faculty (0.5 FTEF): Adjunct instructors will offer additional specialized courses. The department is fortunate to have a stable, highly-qualified pool of regular adjunct instructors who are willing to share their particular areas of expertise. Dan Morrill has been teaching for the program for three years now, has completed coursework towards his PhD, and is a Certified Ethical Hacker which lends itself well to courses such as Penetration Testing. He is also well versed in securing databases and in cloud security. Ron Godfrey has been teaching the digital forensics series at Highline Community College for the last four years. He has fourteen years of experience at a regional Fortune 500 company. Terry Lahman will begin teaching in the fall as part of the forensics faculty. He brings knowledge of digital forensics from a criminal defense and public defenders perspective. Terry is also well versed in GPS and mobile devices which are a growing discipline in the digital forensics field. In addition, the department will be recruiting from the Master's degree candidates at UW Tacoma, some of whom have already taught for the program.

It should be noted that, in the cyber-security arena, successful practitioners often hold no higher than baccalaureate-level credentials. Because the field is highly technical and highly changeable, certifications are commonly obtained in the workplace or through third-party training. If necessary, Highline is prepared to support degree-completion to at least the master's level for successful faculty candidates as the program continues to grow. Though the field is highly competitive, in the past the college has been able to fill its Computer Information Systems

Department vacancies, part- and full-time, from a number of sources, including local industry, the military and part-time faculty at other institutions.

In addition to the core faculty within the department, the BAS program will engage instructors from Highline’s liberal arts divisions to teach upper-division general-education and support courses. In most cases, these 300- and 400-level offerings will be taught by tenured faculty who have been reassigned to develop and teach the new coursework, with adjunct instructors serving as replacement faculty at the lower-division level.

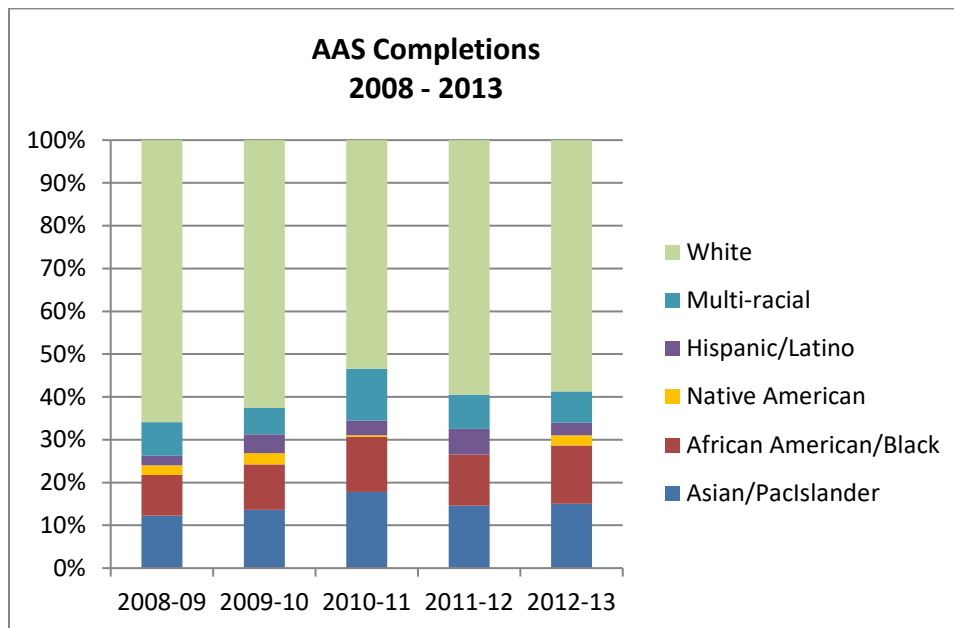
Table 4. General Education Faculty		
Name	Credentials	Courses
Glen Avantaggio	BA, University of Maine; PhD, University of Hawaii	PHIL 346
Woody Moses	BA, Vassar College; MS, Oregon State University	ENV 301
Craig Hurd-McKenney	BA, Texas A&M University; MA, Southern Methodist University; PhD, Texas Tech University	ENGL 335
Vickie Ropp	BA, California State University, Long Beach; MEd, University of Alaska; PhD, University of Washington	CMST 320
Michele Manber	MA, San Francisco State University; PhD, University of Washington	PSYCH 120

Highline is fortunate to have 35 doctorate-prepared faculty among its tenured ranks. They will be given preference for upper-division assignments. In no case will upper-division courses be taught by anyone with less than master’s-level credentials.

Criteria 3: Selective admissions process, if used for the program, consistent with an open door institution.

HCC is committed to open-door general admission, a policy that provides increased access to higher education for those that have been disenfranchised. HCC is the most diverse institution of higher education in Washington State; 70.1% of our student body is comprised of students of color. Almost all our students are first-generation and we serve a community that is economically challenged. As Figure 1 indicates, the diversity of students who have completed our Associate of Applied Science degrees over the past five years has risen steadily from 35% students of color to 41% student of color.

Figure 1. AAS Completions at Highline Community College, 2008-2013



The BAS in Cybersecurity and Forensics will provide students coming from our AAS programs and certificates with the opportunity to continue their education in an institution that has already served them well. Because they provide a pathway for students who have received associate degrees in professional technical fields, BAS programs increase access for historically marginalized populations, which include women, people of color, first-generation students and those with limited financial resources.

One of the best ways to recruit student of color is to provide role models for them. Dr. Amelia Phillips, the division chair of applied sciences and head instructor in this program, is a woman of color who has been in a variety of fields including engineering. Chun Yu, the other key instructor for this program, is a Pacific Rim immigrant who has been successful in the field as well. The students will see first-hand what they can do.

In addition, Highline houses a number of services that support diverse students in their educational endeavors. First, we offer one of the most successful MESA (Math, Engineering, Science Achievement) programs in the area. MESA serves underrepresented students in STEM (Science, Technology, Engineering, and Math) fields with academic support and professional development. MESA offers academic services along with personal, financial aid, and transfer advising. Our MESA Student Center offers students a dedicated space to study, access to computer workstations, industry guest speakers, workshops, advising, and scholarship and internship resources. All MESA students collaborate with the MESA Director on a personalized student success plan to support their success at Highline Community College and beyond. Our goal is for students to excel academically and transfer successfully to four-year institutions as STEM majors. Utilizing the MESA model, Highline will develop similar cohort groups to enable our students of color to excel in the field.

Another program designed to serve underrepresented students is our successful TRIO Program, which is a federal program designed to recognize and deliver services to eligible students from

disadvantaged backgrounds. For students who qualify, our college's TRIO program is targeted to serve and assist low-income individuals, first-generation college students, and individuals with disabilities to progress successfully from middle school to post baccalaureate programs.

Using the cohort groups formed through MESA and TRIO, in addition to other programs, we can attract students of color. We are surrounded by middle and high schools with high diversity. Tukwila High School has been named the most diverse high school in the nation. By providing these students with the support systems engendered by cohort groups, the program will be able to retain them.

Admissions

The selection process, while, not quota based, will be sure not to disallow someone from a disadvantaged situation. We will aim for a balanced classroom that will help make what has been a white male dominated field one that has gender and culture balance. Our plans anticipate modestly-sized cohorts. We will employ a selective admissions process. Our admissions department coordinates will coordinate the admissions processes required for entry into the BAS program. Highline will use minimal admissions criteria, using criteria that ensure students are prepared for upper-division coursework. This reflects our continued commitment to both student access and success.

For the BAS in Cybersecurity and Forensics, the admissions criteria include:

- a. General admission to HCC, which means that students are at least 18 years of age or have completed high school.
- b. Paid admission application fees
- c. Complete application to the cybersecurity program
- d. Completion of an AAS degree
 - from a regionally accredited institution
 - with a 2.5 or better GPA
 - in Network Specialist, Networking, Cybersecurity, Computer/Digital Forensics. Related fields will be considered and the equivalency determined by the program coordinator.
- e. Sign a disclaimer acknowledging that government, law enforcement, military, and Department of Defense-related jobs will require a background check prior to employment.

To meet basic admissions requirements, students must have completed a minimum of a college level math course, the equivalent of ENGL&101, and COMST&101. Prior coursework must include hardware, operating system installation and standard networks. Preferred background for admitted students includes ENGL& 235, MATH& 141, and digital forensics. Students who lack these courses will be required to complete them post-admission. Admitted students will be notified upon evaluation of their transcripts of lower division classes needed to complete general education requirements or those needed as prerequisites for upper division core classes.

Offers of admission will be made to up to 15 eligible candidates who have submitted a complete application by the deadline. To be considered complete, all requirements must be met on or before the deadline. Our initial plan is to admit qualified candidates from each pool on a first-

come, first-served basis. However, if enrollment demand proves overwhelming, we reserve the right to consider alternative admissions processes, including ranking or lottery systems.

Criteria 4: Appropriate student services plan.

For our students in the BAS program, we have employed a full-time director for the BAS programs. His main responsibilities will be to act as a point of contact with students, helping them to navigate the enrollment and funding process. He will work closely with each BAS faculty coordinator and with student services, including admissions, financial aid, advising and registration. The BAS director will also help with outreach to prospective students and prospective employers. In addition to this director, the college will fund an additional half time position in student services in order to provide even more support in admissions and financial aid for BAS students.

Key departments throughout the college, many of which are located in the student affairs division, are prepared to serve our BAS students.

- *Outreach Services*
An active liaison between the college and our community, our Outreach Services department is keenly aware of both our prospective students and the unique needs of our geographic service area. The work of our Outreach Services department involves forming relationships and establishing a presence in our local high schools, employer communities, and community centers. Cultural competency and the intentional building of long-term relationships are emphasized. The efficacy of this approach is evident in the diverse makeup of our campus.
- *Admissions*
Recognizing that admission is a key process that will be experienced by all BAS students, the college involved our Admissions department early in the conversation. Collaborating closely with instructional partners, criteria will be established that are balanced, rigorous and necessary to ensure that BAS candidates are prepared to be successful and earn the degree. The Admissions department has a proven commitment to clear, comprehensive communication and a process that is both transparent and equitable. This department provides high-quality services and a welcoming environment and is committed to ensuring that students successfully transition into the college. In its work creating and maintaining student records, Admissions serves students from entry to exit and beyond.
- *Financial Aid*
Highline will provide a comprehensive financial aid package to all admitted and eligible BAS students. Financial Aid will work to ensure that students have access to as wide a variety of funding options as possible and will consider the unique needs of special populations, such as veterans. Required documents and deadlines will be consistent for all Highline students. Aid will be packaged based on eligibility and availability of funds. The Financial Aid Office will make available orientations, workshops and advisor appointments. The Financial Aid Director and her staff are committed to helping students understand the financial aid application process and guidelines. Our Financial

Aid office is preparing for the unique needs, experiences and situations of the BAS student. Our Financial Aid Office has been in contact with the Department of Education and Department of Veterans' Affairs. We are prepared to submit the required program updates to those entities as soon we receive approval of our Substantive Change Prospectus from the Northwest Commission on Colleges and Universities (NWCCU).

- *Registration & Records*

BAS students will receive attentive registration services and accurate and safe record-keeping from our Registration & Records department. To prepare for our BAS programs, course adoption forms will be authored and submitted, and permissions for programs and degrees obtained. All systems will be updated from degree audit to SMS to ensure that BAS students are served and included. BAS students can go to Registration & Records for any needs related to transcript evaluation, degree posting and transcript generation.

- *Instructional Computing*

Recognizing that the right tools are critical for academic success, HCC has invested significant resources in technology. Our college has a dedicated instructional computing department (IC). Separate from our administrative technology department, the focus of IC is centered on the needs of the student. This department ensures that we have quality facilities, technical support, equipment, systems and resources adequate for the high-demand technology needs required for student success. Open extended hours and featuring 15 classroom labs and 3 drop-in labs areas, the Instructional Computing Center makes both computing resources and human expertise readily available to all students. This ICC is in addition to 13 classroom or open labs throughout campus and other satellites both on- and off-campus.

Coupled with the eLearning platform, the integrated myHCC system gives students the mobility they need to work in any location. From financial aid status to educational progress, online services provide transparency and protected access to student record information. Specifically in anticipation of the BAS students and their needs, HCC is preparing by adding additional equipment and resources, including staffing. We are in the process of establishing dedicated labs for Computer Information Services (CIS) programs. BAS will receive comprehensive and extensive technology access and support services from HCC).

- *Access Services*

A core value of HCC is *access* and that is just what BAS students will receive from the skilled staff in this department. Access Services supports and assists students who have disabilities with campus and classroom accommodations. Reasonable accommodations include services like interpreting, transcription, alternate format textbooks and alternative testing.

- *Academic Advising*

Advising availability and accuracy are critical to BAS student success. We have devoted resources to building our advising programs to serve prospective and current students:

- During the academic year, there will be information sessions for prospective BAS students. These faculty-led sessions will cover the admissions requirements for

each BAS program, application deadlines, learning format, funding sources, and other pertinent program information.

- Drawing from what has proven to be a successful strategy with our two-year professional-technical programs; BAS students will be assigned a faculty advisor in the BAS program. Faculty advisors in the professional-technical departments review and approve initial applications for graduation. With a faculty advisor, BAS students will consistently receive the most complete, accurate and current information not only on graduation requirements, but also on industry trends and connections. Further, this faculty-driven advising model leverages classroom relationships between students and their instructors, providing yet another avenue for engagement and retention.
 - Our BAS students will benefit from the seamless support made possible by the Educational Planning and Advising Center (EPAC). While faculty will handle in-program student advising, EPAC will work closely with the instructional department in order to offer advising to students when faculty are away from campus as well as support students who are seeking admission into the program.
- *Academic Early Alert*

Our program design emphasizes close contact between the students and their lead instructors, who will act as the students' academic advisors. At the midterm of the first quarter, a grade check will go to each student and primary faculty advisor. Students who have earned below a 2.5 in any of their core classes will be required to meet with their advisor. An appropriate plan for additional support will be developed between student and advisor. In addition, regardless of their GPA, all students will also be required to meet with their advisor at the end of their first quarter, as well as at their 45-credit threshold, to assess their progress.
 - *Academic Support Center*

The mission of the HCC Tutoring Center is to provide academic support to all students enrolled at Highline Community College. They assist students in numerous academic disciplines through a variety of tutoring techniques, addressing individual needs in a constructive environment. For example, BAS students may use the HCC Writing Center for help with writing in any class or see one of the math support tutors for assistance with quantitative literacy in any of their courses.
 - *Library*

A critical part of student success is access to appropriate and plentiful resources for research. Our library staff and faculty collaborate with students, faculty, staff and the community to achieve their personal, professional and educational goals by providing excellent, innovative library resources and instruction. Our library boasts many features including study rooms, an extensive variety of online databases, an open computer lab, interlibrary loan options and even serves as a Federal Depository Library.
 - *Campus Community*

We are prepared to offer the BAS student an experience that extends beyond the classroom. The co-curricular and extra-curricular activities we offer will work in unison with the classroom experience to ensure BAS student success and retention. Our college

is well-regarded among our peer institutions and recognized as a leader in the area of student leadership and engagement. In our most recent accreditation visit, we received compliments for our innovative and exemplary programming in this area. We are excited to provide this experience to our incoming BAS students and welcoming them into our campus community through opportunities for:

- Service: student governance, advocacy, leadership jobs
 - Engagement: clubs, organizations, Intercultural Center (a physical space with resources to explore and celebrate culture and diversity)
 - Formal Learning: First Fridays Leadership Institute, Winter Leadership Retreat, MLK Week, Unity through Diversity Week, Students of Color Conference
- *Career Advising*

Another aspect of advising that will be of particular interest for BAS students is career advising. Highline is prepared to serve BAS students with resources and guidance to support their transition. The college has committed resources and our advising programs serve not just prospective and current students but also near- and recent-graduates:

 - Our Transfer Center will identify appropriate resources for BAS candidates whose intentions are to continue further on their academic path, including bridges to Masters level programs. This center will serve as a resource for BAS students who are exploring options for future graduate studies. The Center will identify appropriate resources for BAS students whose intentions are to continue further on their academic pathway, including bridges to Masters-level programs.
 - Highline's BAS faculty will develop articulation agreements with specific graduate programs and communicate the information to the Transfer Center.
 - To successfully assist program graduates with placement, our counseling center is acquiring resources about placement opportunities relevant to these new career pathways. These resources will be available in individual sessions and in curriculum for career exploration courses.

Criteria 5: Commitment to build and sustain a high quality program.

As noted earlier in this application, Highline Community College has kept sustainability at the center of its BAS development. The institution's plans are intentionally modest and conservative. The college's goal is to offer the BAS opportunity to a limited number of students in a manner that is highly efficient, making extensive use of existing infrastructure, faculty expertise, and curricular resources of the longstanding AAS-level Data Recovery/Forensic Specialist program within the Computer Information Systems Department.

Financial projections: The college's financial model for its BAS programming is built on a projecting funding mix of roughly 50-percent tuition income and 50-percent institutional base-budget investment. Currently, BAS tuition rates in Washington average roughly \$7,500 per annual full-time equivalent (FTE) student, a planning figure that Highline intends to match locally dollar-for-dollar, bringing the annual support to \$15,000 per FTE. This 50-50 funding ratio roughly approximates the institution's current mix of state and local funding streams for its other, existing programs and arguably represents a generous allocation of base-budget funds, given the heavy dependence on tuition revenue at the state's other baccalaureate institutions.

Target enrollments have been set conservatively at 15 FTE, yielding a modest overall program budget of \$225,000 annually (15 FTE enrollments at \$15,000-per-FTE).

Because the program can utilize the existing laboratory facilities and instructional technologies associated with the existing AAS-level curriculum — and because the organizational home for the degree will remain within established departmental structures — the projected, new expenditures for the BAS option are almost entirely in direct-service personnel. The bulk of this new investment will be in one additional full-time faculty position (\$80,000 annual salary and benefits, projected), along with a half-time position in Student Services (\$26,000 annual salary and benefits, projected). The remainder of the program’s expenditures will primarily be in additional paraprofessional lab assistants, part-time faculty, supplies and materials, marketing, and professional development. Effective July 2013, Highline appointed a full-time, mid-level manager (\$90,000 annual salary and benefits) to oversee the start-up administration of the college’s four planned BAS offerings. For budgeting purposes, that position’s costs have been distributed proportionately (0.25 FTE each) among the suite of BAS programs.

Table 5 provides a detailed five-year projection of expenditures and revenues for the BAS start-up phase.

Table 5. Financial Projections for BAS in Cybersecurity and Forensics

Highline Community College BAS Financial Projections					
	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
<u>Revenues:</u>					
State Support	\$ 75,000	\$ 78,833	\$ 77,700	\$ 77,700	\$ 77,700
Local Support	\$ 188,875	\$ -	\$ -	\$ -	\$ -
Tuition	\$ 78,600	\$ 143,350	\$ 164,250	\$ 164,250	\$ 164,250
Total Revenue	\$ 342,475	\$ 222,183	\$ 241,950	\$ 241,950	\$ 241,950
<u>Expenditures</u>					
Full-time faculty position	\$ 60,000	\$ 60,000	\$ 60,000	\$ 60,000	\$ 60,000
Part-time Faculty	\$ 11,100	\$ 22,000	\$ 22,000	\$ 22,000	\$ 22,000
BAS Director (.25 of 1.0 FTE)	\$ 15,225	\$ 15,225	\$ 15,225	\$ 15,225	\$ 15,225
Student Services support position	\$ 19,250	\$ 19,250	\$ 19,250	\$ 19,250	\$ 19,250
Paraprofessional Lab Assistant	\$ 16,000	\$ 16,000	\$ 16,000	\$ 16,000	\$ 16,000
Benefits	\$ 39,975	\$ 44,075	\$ 44,075	\$ 44,075	\$ 44,075
Professional Development	\$ 1,500	\$ -	\$ 1,500	\$ -	\$ 1,500
Supplies	\$ 6,500	\$ 6,500	\$ 6,500	\$ 6,500	\$ 6,500
Library Materials	\$ 4,375	\$ 4,375	\$ 4,375	\$ 4,375	\$ 4,375
Equipment	\$ 2,450	\$ 2,500	\$ 2,500	\$ 2,500	\$ 2,500
Marketing	\$ 2,100	\$ 2,100	\$ 2,100	\$ 2,100	\$ 2,100
Equipment Replacement Reserve	\$ 164,000	\$ 30,158	\$ 48,425	\$ 49,925	\$ 48,425
Total Expenditures	\$ 342,475	\$ 222,183	\$ 241,950	\$ 241,950	\$ 241,950

Because the planning effort has been integrated with routine processes and governance structures of the college, no other significant expenditures have been associated with the development of the new degree.

The institution's non-tuition initial investment —\$263,875 annually — will be drawn from local reserves in Year 1. With recent restorations in state funding, the college has identified sufficient opportunities for base-budget reallocations, going forward, to fund the \$77,000-\$79,000 institutional contribution by Year 2. The long-term budgetary and financial implications for the entire institution are therefore expected to be minimal.

Criteria 6: Program specific accreditation.

Currently, the Network Specialist and Data Recovery/Forensics Specialist AAS degrees are certified under the NSA's Committee on National Security Systems (CNSS) 4011 and 4013e specifications. In addition, the college is a Center of Academic Excellence Two Year (CAE2Y) under that same program, which is valid through 2015.

Because of advancements in technology, the National Institute for Standards and Testing (NIST) has created the NIST NICE Framework (NICE: National Initiative for Cybersecurity Education). The curriculum developed for the 300 and 400 level classes will use the NIST NICE Framework as a guide so that when the Knowledge Units (KUs) are finalized, we will be prepared to apply for the new certifications at both the AAS and BAS levels.

One of the head instructors, Chun Yu, is certified in CISCO routers. This puts us in a position to become a CISCO Academy and have the Local Area Network (LAN) and Wide Area Network (WAN) classes certified by CISCO, whose equipment is used globally. The upper level network security classes may also fall under this category.

Criteria 7: Pathway options beyond baccalaureate degree.

Based on conversations with industry and other local educational institutions, there are three pathways for graduates of the BAS in Cybersecurity and Forensics:

1. Move directly into the workforce,
2. Obtain a promotion at their current place of employment, or
3. Obtain a Masters or PhD in cybersecurity.

The industries and educators in the South Puget Sound region met during spring of 2013 to determine how to best establish this region as a cybersecurity hub. There are several challenges that must be addressed as we move toward this goal. The first challenge is that there simply are not enough people in the region with the needed skill set to fill the current or projected jobs. New graduates need a firm foundation in security. In addition, industry employers would like to see classes available for their current employees to enhance their skills.

Graduating candidates with a Masters or PhD in Cybersecurity will help the region address the needs for research and qualified instructors who hold such degrees. Graduates with Masters

degrees are needed, at a minimum, to fill the projected instructor positions in this field. PhD graduates in this region are needed not only for teaching, but for the growing research focus in this field.

In order to serve the place bound BAS students, our program is looking at online and regional masters programs. There is an existing articulation agreement between HCC and Champlain College in Vermont with regards to our AAS in Data Recovery and Forensics moving students into their BS in Computer Forensics. Like their BS, their Masters of Science in Digital Forensics Management and Digital Forensics Science are completely online. Several graduates of our program have applied to their BS degree for this reason. We are in the process of negotiating an articulation agreement with them. We are also in contact with the University of Maryland University College (UMUC) for an articulation agreement into their Masters of Science in Digital Forensics and Cyber Investigations and their Masters in Cybersecurity.

For students who prefer face-to-face classes or whose jobs can accommodate this course delivery, the University of Washington Tacoma (UWT) campus has a Master's program in Cybersecurity Leadership, and they are also a Center of Academic Excellence under the NSA. This allows the students to apply for scholarships with the Department of Defense (DoD) and work for the same amount of time as payback to the government.

Two of the faculty of UWT have reviewed the curriculum and we are working towards an articulation agreement. Currently they accept both the AAS degree in Networking and Data Recovery & Forensics into their Bachelor's program provided the students have taken MATH& 142 and 143 (pre-calculus) and CSCI 142 (Java I). With a BAS, our students could potentially move into their Masters in Cybersecurity and Leadership.

Criteria 8: External expert evaluation of program.

The proposed classes were initially presented to industry professionals, both in groups and individually. Several pointed to the necessary skill of conveying technical concepts in professional presentations. As a result, the class COMST 320, Professional Presentations, was created. David Matthews, former deputy CISO of the City of Seattle currently employed at Expedia stated, "I think you've gotten everything in here that belongs in this type of degree. I especially like that you've included project management and presentations. Those are both important skills that tend to be forgotten."

For more in-depth reviews of the proposed degree programs, we turned to professors at local four year institutions with graduate programs. As noted in Criteria 7, one of the pathways is to transfer for a Masters or PhD in a related field. The reviewers are from the institutions that Highline interacts with regularly – these institutions would also serve as ideal transfer programs for students who want to pursue advanced degrees. The three reviewers were Dr. Corey Schou, founder of the National Information Assurance and Education Center (NIATEC); Dr. Yan Bai of University of Washington Tacoma (UWT); and Dr. Sam Chung, also of UWT. Each of the reviewers had praise and suggestions for the proposed program, which are discussed in the paragraphs below.

Dr. Corey Schou, as can be seen from his resume in Appendix B, is one of those individuals who has been a leader in security education for almost two decades. He founded and is the director of

NIATEC and was one of the founders of the Colloquium for Information Systems Security Education (CISSE), which is in its seventeenth year. He is also a professor at Idaho State University, where NIATEC resides. In his review, Dr. Schou made the following comments of note:

- The proposal provides an interesting window on the curriculum. In my university I have to work with large numbers of BAS students. Many come from our internal college of technology programs. I wish most of them were as well prepared as it would appear yours will be. The students from this program would come well prepared to enter our program; however, they would need to be dedicated to increasing their breadth.
- We require all students to complete the Security+ and SSCP certifications Systems Security Certified Practitioner
- This represents a strong, integrated program. It clearly meets the needs of industry and is a good cornerstone for students seeking advanced degrees. Basing it on certificates gives students a good way to complete the program incrementally. It does provide breadth; however, there are some specifics that might need to be developed over time.
- If one were to make professional ethics pervasive in the curriculum it may free up additional credits. If one is to have a stand-alone ethics class, then by all means make it applied and tightly coupled to their curriculum.
- I cannot over emphasize the importance statistics in this profession. The course should exceed the basic descriptive statistics seen in most undergraduate programs. It should include a broad capability with sampling, hypothesis testing, and regression/multiple regression.
- Idaho State University and the NIATEC would find these students interesting for both our masters programs. I am willing to work out an articulation agreement when your program is in place.

Dr. Schou also remarked on the importance of project management, writing, and presentation skills in the curriculum. Students transferring to the Idaho State program would be encouraged to take the Security+ and SSCP exams beforehand or be studying for them. The good news is that he feels the students would be well prepared for the program at his university.

The second reviewer, Dr. Yan Bai, is an associate professor at UWT and an accomplished and active member in the field. She teaches undergraduate and graduate classes in network security and digital forensics. She also serves on several committees and conferences that support the efforts in the field of cybersecurity—these activities are listed in her biography in Appendix B. Dr. Bai specifically asked for course descriptions, which we have provided in this proposal. Her comments again are also favorable:

- The Bachelor of Applied Science (BAS) in Cybersecurity and Forensics at HCC provide students with the knowledge, experience and skills they'll need in the Master's program in Cybersecurity Leadership (MCL) at University of Washington Tacoma (UWT).
- As the operation and management of virtual environments are becoming more and more important as the development of web and cloud computing technologies. Deploying a cloud-based system lab and providing students an opportunity to learn practical cloud computing will be a plus.

Dr. Bai especially liked the 5 credit internship with 150 hours of work experience that will be required for those students not currently working in the field (pp.8). She also liked the strategies of attracting students of color (pp.12-13) and complemented the fact that our curriculum design is based on NIST NICE Framework (pp.19-20)

Our third reviewer, Dr. Sam Chung, is chair of Information Systems and Information Security at the UWT as an Associate Professor. He is also Director of the Cyber Physical Systems of the Center for Information Assurance and Cybersecurity (CIAC) at the UW. His background foregrounds the work he has put into the programs at UWT. His comments were also favorable::

- My study of the Bachelor of Applied Science Degree in Cyber Security and Forensics at Highline Community College has made a very good impression on me. Program Design: since the current AAS degree programs in network and forensics are used as the strong basis of the 300 level and 400 level courses, the design of this BAS degree program provides the students with a nice, attainable flow in the achievement of their degree.
- Prep for MS Program: the master's degree in Cybersecurity and Leadership (MCL) ...The graduates of HCC BAS in Cyber Security and Forensics can apply for this MS program.

Dr. Chung was concerned at the lack of a 200-level database administration course. He also stressed that instead of focusing Data Base (DB) Security with specific DataBase Management Systems (DBMSs), we should use more general titles such as DB Security, DB Audit, and Advanced DB Security. In these courses, we had initially chosen specific DBMSs according to current industry trends, but at his suggestion, we revised toward more general application.

All of the comments have been used to improve the proposed curriculum. Dr. Schou's suggestions for the supporting classes (like the statistics course) will certainly be used. As a direct result of the comments made by Dr. Chung, the classes in the database certificate were modified to be more easily adaptable to quickly changing technology. These courses will be based on concepts, rather than vendor specific software applications, while still providing students with hands on experience of applications. In addition, the 200 level Database Security course will be modified to include more management and administrative modules in order to better prepare the students for the upper division courses.

The reviews have laid the groundwork for articulation agreements with these institutions. Currently the NIATEC graduate students under the supervision of Dr. Schou annually create and build the scenario for the Pacific Rim Collegiate Cyber Defense Competition (PRCCDC) event that is held at Highline Community College. Having an articulation agreement will strengthen that relationship.

Appendix A – Course Descriptions

Database Security Certificate:

The goal of this certificate is to give students a solid foundation in the security issues encountered in the installation, maintenance and use of three of the most common databases used in industry. Database breaches happen on a daily basis. Students will install the databases on Linux and Windows platforms and explore the challenges presented with each. They learn how to secure each database application on the two most common platforms. The certificate can be taken as a standalone certificate or as part of the Cybersecurity and Forensics BAS degree. All classes require the signing of an ethics agreement, which is enforced.

CIS 310 – Database Installation & Configuration Management

This course provides a foundation in the installation and configuration of popular database systems such as MySQL, SQL Server, Oracle and Postgres. Students will explore the issues encountered on both Windows and Linux operating systems. They will test and document the ways in which database systems are breached from the installation, maintenance, and administrative aspects and how these breaches can be avoided, mitigated, or detected. Installations will take place on physical and virtual environments. When appropriate, cloud services will be used for testing.

CIS 312 – Database Security & Audit

This course builds on the foundational knowledge from CIS 310. Students will deal with design issues, along with user interface vulnerabilities and how these can be avoided, mitigated or detected. Learning modules will address web interfaces, cloud services and mobile application database vulnerabilities. Students will use tools to perform database audits and create policies and procedures to augment the same. The audits taught in this course pertain to both the database and operating system levels. Hands-on projects will take place in physical and virtual environments.

CIS 314 – Advanced Database Security

This course is the final one in the Database Security Certificate. While the students will continue with the industry standard databases, they will be exposed to the new ones coming on the market such as non-SQL (non Sequential Query Language). Students will learn encryption methodologies for databases, query analysis, load issues, data redaction and other topics. Hands-on projects and assignments will take place in physical and virtual environments. When appropriate, cloud services will be used for testing.

Digital Forensics and Investigations Certificate

The goal of this certificate is to explore advanced topics in the field of digital forensics and evidence. The classes assume that the student has had at least an introductory course in digital forensics, if not a full series. The topics include the investigation of mobile devices, network intrusion, and e-discovery. The certificate can be taken as a standalone certificate or as part of the Cybersecurity and Forensics BAS degree. All classes require the signing of an ethics agreement, which is enforced.

CIS 350 – Introduction to E-Discovery Tools and Techniques

E-Discovery is becoming more and more commonplace as 90% of all documents are electronic. In this course, students learn the methodology behind e-discovery including documents, mobile devices, email and logfiles. Proper procedures such as the Electronic Discovery Reference Model (EDRM) are covered. Popular commercial tools such as Sherpa Software, iPro and Summation are examined along with shareware/freeware. Students learn the laws that may affect them as network administrators during a litigation hold and how to develop procedures for various legal situations that may affect the digital data they maintain. This is a hands-on class in which they will use the techniques introduced.

CIS 360 – Mobile Forensics and Investigations

This course takes students deeper into mobile forensics. Mobile devices are an intrinsic part of everyday life and are now part of any investigation from business problems to domestic disputes. Students learn how approach a new mobile device and obtain the needed data with a forensically sound approach. The devices include cell phones, palmtops, smart phones, iPhones, iPads, digital cameras, pagers, etc. Students will be exposed to commercial and shareware applications that can be used.

CIS 370 – Network Forensics and Investigations

This course focuses on tracking down network intruders or at least ascertaining how they got in and what they did. Intruders can be internal or external attackers. When, what, where, and how they were able to gain access gives a network administrator clues to design flaws in the network architecture and shortcomings in policies or procedures. An introduction to investigations in the cloud is included along with the legal aspects of network investigations. This is a hands-on class in which students test network forensics tools and how to use them in internal or external investigations.

Advanced Network Security

The goal of this certificate is to take students to the next level in securing the 21st century network. Wireless, mobile and the cloud components are commonplace in most networks today. A class that focuses on these topics allows students to be more effective in the workplace. The certificate can be taken as a standalone certificate or as part of the Cybersecurity and Forensics BAS degree. All classes require the signing of an ethics agreement, which is enforced.

CIS 320 – Secure Router and Switch Architecture

This course is a hands-on and career-oriented learning solution with an emphasis on designing and securing routed and switched networks. CIS320 lays the foundation for the next two classes in the certificate program. Students gain practical experience about Cisco router and switch basics and IOS configuration. The curriculum helps them develop specialized security skills to advance their careers and academic achievement. In addition, this course helps prepare Cisco certification exams such as CCNA and CCNA Security. Students will design and implement network architectures that they will then test against standard attacks, including new forms that may appear in the news while class is in session. The main focus of this course is to deliver 21st century learning experience to help students develop the foundational information and communication

technology skills needed to design, configure, build, troubleshoot and secure the network architecture. This class focuses on the physical aspects of network security.

CIS 420 – Cloud Security

This course focuses on how to secure cloud servers and data in the cloud. Students will examine the various contracts available from cloud service providers; explore what it entailed in creating their own private clouds; and what is involved in securing both. Students will have to design a secure network that includes a cloud component. They will then test this against standard attacks, including new forms that may appear in the news during class. This class focuses on the cloud aspects of security and monitoring. The prerequisite to this is CIS 320.

CIS 430 – Wireless and Mobile Security

This course focuses on how what is involved when wireless and mobile devices are incorporated on a network. BYOD (Bring Your Own Device) is extremely popular in the 21st century. Both employees and visitors attach a variety of devices to a network – with such broad access, how does one protect the crucial elements of the network? In the case of a hospital, how does this workplace allow emergency medical equipment and visitors onto the wireless? Students will design and test their architecture against standard attacks. The prerequisite to this is CIS 320.

Penetration Testing Certificate

This certificate is the culmination of the other three. The classes assume that the student has a solid understanding of the intricacies of network security, network architecture, and network intrusion. The curriculum is designed for students to be able to test their own network or those of their employers for vulnerabilities, weaknesses and potential threats. The certificate can be taken as a standalone certificate or as part of the Cybersecurity and Forensics BAS degree. All classes require the signing of an ethics agreement, which is enforced.

CIS 450 – Pen Testing I

This course is Penetration Testing I and is modeled after the curriculum from the Mile2.com's Certified Penetration Testing Engineer course. Students begin with the five fundamentals: information gathering, scanning, enumeration, exploitation and reporting. They will examine actual exploitation techniques and the business practices needed to prevent the same. This course goes beyond network intrusion and shows how to stop malicious intruders.

CIS 460 – Pen Testing II

This course is Penetration Testing II and is modeled after the curriculum from the Mile2.com's Certified Penetration Testing Consultant course. The course focuses on the penetration testing of large network infrastructures with layer 2 and layer 3 attacks. Students will use basic tools to examine packets and network traffic. Students will be exposed to service provider level attacks – including VPN and SSL attacks -- and learn how to detect/defend against them.

CIS 480 – Internship

The internship is to provide students with real world experience before graduation. If the student is currently working in this field of study, this class can be waived. For this waiver, 30 hours of work equal 1 credit hour. Students are required to take 5 credits individually or all at once. Site visits and reports from the supervisor and student are required to obtain a grade.

Appendix B – Doctoral Evaluations and Backgrounds

Corey Dwight Schou

B.S. Rollins College, Bio/Chem

M.S./MBA/M.A. Florida State, IR

University of Delaware, Oceanography

PhD/EdD Florida State University, International Policy

Columbia University, International Law

Biographical Sketch Corey D. Schou, PhD.

Schou is The University Professor of Informatics, Professor of Information Systems, and Professor of Computer Science at Idaho State University. He is Director of the Informatics Research Institute (IRI) and Director of the National Information Assurance Training and Education Center (NIATEC). While at Idaho State University he has received the following awards and distinctions 2010 –Lifetime achievement award, 2004 – Designated University Professor of Informatics, 2002 – Outstanding Public Servant of the Year, 2001 – Tipton Award, Outstanding contribution to computer security profession, ISC²; 2001 – Distinguished Public Servant; 1999 – College Outstanding Researcher; 1998—College Service Award; 1992 – College Researcher of the year. He currently serves on the editorial board of two Information Assurance journals and is the Series Editor for the McGraw Hill computer security series. He is an affiliate curator at the Idaho Museum of Natural History

A. Professional Preparation

Rollins College Bio/Chem BS, 1968

Florida State University Political Science MS, 1970

Columbia University International Law (W. Friedman) 1970-1971

Florida State University International Law/ Political Science PhD, 1977

B. Appointments

Idaho State University Associate Professor/ Professor 1985 – present

University of Central Florida Assistant Professor Information Systems 1978 – 1984 (Tenure)

Sandia Labs Vector Processing Facility

Florida State University Instructor/Assistant Professor 1974 – 1978

AFWL Cyber 205 and Cray Image Processing and Benchmarking

Florida Parole Commission Senior Statistician 1972 – 1974

C. Significant Consultancies

McGraw Hill Information Assurance Series Editor 2005 – Current

United States Senate Information Assurance Planning 2006 – 2007

Department of State APEC/OECD computer Security Policy 2000 – 2002

Microsoft Research Security and Academic Programs 1998 – 2004

D. PUBLICATIONS SUMMARY:

Published, in press, or submitted (authored and co-authored): Three books, edited 4 books, 12 monographs, 2 edited volumes, 3 edited journal focused editions, produced and edited two DVDs on flint knapping, and over 300 articles, papers and professional reports.

(I) Five Publications most closely related to the proposed project

- Betts, Matthew W., Herbert D. G. Maschner, Schou Corey D., Schlader Robert, Holmes Jonathan & Clement Nicholas. *Vzap: an online comparative collection for archaeofaunal Research*. Paper presented at the 11th International Council for Archaeozoology. Paris, France.
- Betts, Matthew, Herbert Maschner, Corey Schou, Robert Schlader, Jonathan Holmes, Nicholas Clement, Michael Smuin. 2011. Virtual zooarchaeology: building a web-based reference collection of northern vertebrates for archaeofaunal research and education. *Journal of Archaeological Science*. Volume 38, Issue 4, April 2011, Pages 755.e1-755.e9
- Lohse, E., Schou, C., The Columbia Plateau-Snake River Region Cultural Sequence, *Projectile Point Sequences in Northwestern North America*, edited by Roy Carlson and M.P.R Magne. Canadian Archaeological Association. Archaeology Press, Publication No. 35; 294 pages
- Maschner, Herbert D. G., Matthew W. Betts, and Corey D. Schou. Virtual Zooarchaeology of the Arctic Project (VZAP). SAA Archaeological Record, January 2011, Pp. 41-43.
- Schou, Corey D, “Are you Interoperable,” Defence Management Journal, 37 July 2007 77-80 – Shared Database and Security

(II) Five other significant publications – Research focused on information sharing and integrity.

- Schou, C., Armistead, L, Ryan, Julie. International Academic Standards: A new approach to Information Operations for interoperability. *Journal of Information Warfare*. January 2010
- Corey D., Shoemaker, Daniel; Information Assurance for the Enterprise: A Roadmap to Information Security, McGraw Hill, January 2007
- Schou, Corey D., Kuhel, D., “Information Operations Education: Lessons Learned from Information Assurance”, *Information Warfare Separating Hype from Reality*, Edited by Edwin L. Armistead, Potomac Books, Washington DC, 2007
- W. V. Maconachy, Schou, C., “Information Assurance Education: The way ahead in a network-centric environment”, *Proceedings of the 11th Colloquium for Information Systems Security Education – Boston*, June 2007
- Schou, C and Frost, J. Homeland Security and Information Assurance in Biomedical Informatics Systems, *IEEE Engineering in Medicine and Biology*, January/February 2004

E. Synergistic Activities

- Director, Informatics Research Institute (IRI) Responsible for developing interdisciplinary programs involving faculty and students from a broad spectrum of disciplines.
- Affiliate Curator, Idaho Museum of Natural History
- Fellow and board advisor to the (ISC)² (International Information Systems Security Certifying Consortium). This is the largest professional organization that certifies computer security professionals.
- Referee: 14 different professional associations and journals.
- U.S. Department of State APEC Information Assurance task force portion of APEC-TEL

F. Collaborators & Other Affiliations

(I) Collaborators and Co-Editors

Maconachy, W. V. Capitol College; Armistead, E.L., GoldBelt Hawk; Ryan, Daniel J. National Defense University; Frost, James C. Idaho State University; Willis, Robert Hampton University; Ryan, Julie George Washington University; Maschner, Herbert Idaho State University; Betts, Matthew Ontario Canada

(II) Research Directed:

Specialized Research Program Students past 3 years – I have supervised 66 specialized Information Assurance Research students during the past 3 years.

Overall Summary

The proposal provides an interesting window on the curriculum. In my university I have to work with large numbers of BAS students. Many come from our internal college of technology programs. I wish most of them were as well prepared as it would appear yours will be. The students from this program would come well prepared to enter our program; however, they would need to be dedicated to increasing their breadth.

I have carefully examined catalog copy for each course comparing goals/objectives to determine how they match traditional certifications and other curricula.

Our program takes highly motivated students and puts them into a full two year masters program where they study information assurance and receive an MBA in two years of full time study. We require all students to complete the Security+ and SSCP certifications during their first year and when they complete their MBA they take the CISSP. We use these scores as external assessment of their advancement.

Where possible, I would encourage you to make sure your students have breadth.

A Recommendation on Breadth

The following is from a forthcoming ACM paper. It reflects some of my thinking about increasing breadth in information assurance programs. Breadth does not damage employability of students from strong programs –it gives them a career path.

Breadth or depth, which is correct? The right answer is: yes. We should not sacrifice depth and specialization since security is a complex discipline; however, to have a resilient holistic education process, participants must have breadth that affords them a different perspective. Select only on quality.

Security is a symphony. It is executed by an orchestra with many players – each in his time playing many parts. The ensemble certainly has accomplished soloists – it contains many instruments that, when played in concert, produce wonderful music. I doubt that Ode to Joy would sound so sweet were it played by the 100 best bass drum soloists.

Nearly 150 years ago, John Stewart Mill made the argument for breadth at his inauguration at St. Andrews University.

Men are men before they are lawyers, or physicians, or merchants, or manufacturers; and if you make them capable and sensible men, they will make themselves capable and sensible

lawyers or physicians. What professional men should carry away with them from an University, is not professional knowledge, but that which should direct the use of their professional knowledge, and bring the light of general culture to illuminate the technicalities of a special pursuit. Men may be competent lawyers without general education, but it depends on general education to make them philosophic lawyers--who demand, and are capable of apprehending, principles, instead of merely cramming their memory with details. And so of all other useful pursuits, mechanical included. Education makes a man a more intelligent shoemaker, if that be his occupation, but not by teaching him how to make shoes; it does so by the mental exercise it gives, and the habits it impresses.

— J. S. Mill, Inaugural Address at St. Andrews

For nearly a generation we assert we have been working on this part of the problem; so, in my normal manner, here are some questions for us. Have we moved far enough and fast enough? Have we addressed the right problems in the right order? Do we have the right focus (foci)? Do we tend to build a monoclonal set of answers? Does the system produce enough skilled technical individuals? Do we educate enough individuals who choose to address fundamental “DARPA Hard” problems?

None of these are ‘or’ questions. They are fundamental questions that we must address; until then, my answer is: ‘NO’.

The original thinking behind the Scholarship for Service program was to jump-start the professorate and, incidentally, to produce highly skilled security professionals for the United States Government. The SFS program has been producing skilled professionals but should we fail to increase both the quality and quantity of the professorate, we shall not have met the underlying need for an improved security education process.

Just as security must be designed in from the beginning – it must not be an afterthought; it must be systemic – a process. Similarly, security education is a process that we keep patching; is the process broken ... it is up to us

Specific Commentary

This represents a strong, integrated program. It clearly meets the needs of industry and is a good cornerstone for students seeking advanced degrees. Basing it on certificates gives students a good way to complete the program incrementally. It does provide breadth; however, there are some specifics that might need to be developed over time.

Professional Presentations and Communications		
or Advanced Technical Writing	COMST 3xx or Eng 3xx	5
Professional Ethics	Phil 3xx	5
Business Statistics	BUSN 3xx	5
Project Management	BUSN 3xx	5

These four courses are truly essential to make your excellent security and forensics program work.

Writing

Placing as much emphasis on writing and presenting increases the value of the student. Encourage your faculty to make these courses very rigorous. This will not be popular with the students but they should be encouraged to write-write-write not only in the Eng classes but throughout the curriculum. They must also be comfortable presenting their results and activities on a day-to-day basis.

Ethics

There is an extensive literature discussing the placement of ethics in the scientific and engineering curriculum. Opinions range from curriculum integrated ethics (pervasive) to stand-alone-courses. Both are acceptable to ABET. I have found making ethical behavior an element of every course to be successful. Security and forensic professionals have more access to organizational assets than anyone else. They must realize that their professional behavior sets a standard and that they will be challenged frequently. If one were to make professional ethics pervasive in the curriculum it may free up additional credits.

If one is to have a stand-alone ethics class, then by all means make it applied and tightly coupled to their curriculum. Constantly provide the students with ethical dilemmas and make them solve the problem in individualized writing assignments. The instructor must understand the special needs of security professionals.

Statistics

I cannot over emphasize the importance statistics in this profession. The course should exceed the basic descriptive statistics seen in most undergraduate programs. It should include a broad capability with sampling, hypothesis testing, and regression/multiple regression. These are fundamental tools of the profession for finding problems and testing solutions. The GAISE (Guidelines for Assessment and Instruction in Statistics Education) can be used for producing course processes. Note that this approach requires that students be given data and be able to respond about what tests are appropriate and how interpret the results. This should not be a turn the crank type of course. Use software – MiniTab is an inexpensive tool that solves most of the problems on a moderate scale.

Project Management

As an information assurance professional, one's life is dominated by managing others and keeping projects on time. This course should emphasize not only standard project management approaches but also those from software engineering including *Spiral*, *Agile*, and *Scrum*. These are close to how one interfaces with the software individuals in modern organizations.

Additions

If one were to have extra credits available, I might suggest that students find time for a managerial/cost accounting course focused on technology. In the final analysis their projects will live and die by the student's ability to explain to management why projects are over-budget and late.

Changes

Survey of Computing	CSCI 100	5
Intro to Logic or basic Programming	Phil 120 or CSCI 116 or CSCI 142	5
Intro to Communications	CMST& 101	5
English Composition I	ENGL& 101	5
Research and Persuasive Writing or Technical Writing	ENGL& 205 or ENGL& 235	5
Human/Labor Relations	BUSN 160	5
College Algebra	Math 111	5

Logic/Programming

I would encourage students to develop programming skills. I love logic courses; however, in your curriculum the student will be more apt to need to program a switch or other device using a programming or scripting language.

College Algebra

This is great; however if a student can stretch a bit, I would encourage them to substitute a 'lightweight' calculus course. In the long run they will need some of the topics and certainly it instills a certain discipline which is always needed.

Overall Additions

I would like to see some integrative activity in/between blocks of courses. Both my graduate and undergraduate programs have been improved by having activities that require teamwork and inter-team cooperation. (Competition happens naturally)

General Advice

Stay on top of assessment. Assess anything that moves otherwise the system will tend to get out of control. Cooperative assessment of courses in other programs is problematic – Make it Happen

Cooperation

Idaho State University and the NIATEC would find these students interesting for both our masters programs. I am willing to work out an articulation agreement when your program is in place.

Reviewer's Qualifications

Name: Yan Bai

B.S. Guangxi Normal University, Physics

M.S. Sam Houston State University, Physics

PhD University of British Columbia, Electrical and Computer Engineering (Computer Engineering specialization)

Yan Bai is an associate professor with the Institute of Technology at University of Washington Tacoma (UWT) and one of the founding members of the Bachelor's degree in the Information Technology and Systems program at UWT. She has taught undergraduate and graduate level courses in information assurance, network security and privacy, digital forensics, and networking and distributed systems. She has published more than 50 refereed papers in the areas of cyber security and computer networking on peer-reviewed journals and conference proceedings.

She also served as program committee for several prestigious conferences, such as IEEE International Workshop on Computer Forensics in Software Engineering (2010-2012), International Conference on Privacy, Security, Risk and Trust (PASSAT) (2011-2013), IEEE International Conference on Multimedia and Expo (ICME) (2012-2013), IEEE International Conference on Cloud Computing Technology and Science (CloudCom'13), IEEE International Conference on High Performance Computing and Communications (HPCC'13), and IEEE International Conference on Internet of Things (iThings'13).

Overall Summary

Please provide an overview of your opinion of the proposed BAS. Be sure to include whether or not the graduates of the program would be good candidates for your Masters or PhD programs. This should be ½ to 1 page in length.

Highline Community College (HCC) proposed an Applied Baccalaureate Degree program in Cybersecurity and Forensics, teaching network security and digital forensics elements. It will focus on building students' ability to install, manage, and secure the network, as well as identify, react to and recover from a cyber attack. Twelve courses were developed, covering four areas: database security, penetration testing, digital forensics and investigations, and advanced network security. The program also provides an intermediate certificate and prepares students for jobs in the above four areas.

The Bachelor of Applied Science (BAS) in Cybersecurity and Forensics at HCC provide students with the knowledge, experience and skills they'll need in the Master's program in Cybersecurity Leadership (MCL) at University of Washington Tacoma (UWT). The MCL degree program at UWT is designed for the students who hold a bachelor's degree and are interested in pursuing their career in cyber security technology and management leadership. The curriculum consists of two main components: a technically-oriented curriculum focused on understanding the basic operations and functionality of cybersecurity systems and information assurance and a more behaviorally-oriented curriculum focused on the management of technical professionals and organizational leadership.

Both degree programs share the same goal in the context of technically-oriented curriculum. The BAS degree at HCC offers a number of important cyber security courses, such as network forensics & investigations, secure router & switch architecture and penetration testing. These courses provide students with fundamental and practical knowledge about information assurance and cyber security and undoubtedly help them successfully complete the graduate level technically-oriented coursework at UWT.

Specific Commentary

In this section please provide feedback, specifying page and paragraph of items you like

Especially like

- Four certificates closed to industry certification are included as part of the degree:

Database Security, Penetration Testing, Digital Forensics and Investigations, and Advanced Network Security (pp.8-9) so as to enhance students' qualification of finding/advancing job.

- 5 credit internship, 150 hours of work experience, which will be required for those students not currently working in the field (pp.8).

- Strategies of attracting students of color (pp.12-13)

- Curriculum design based on NIST NICE Framework (pp.19-20)

Would like to see changed

Add the course descriptions of junior and senior-level courses

Additions you think would enhance the program

Although experience with "real" device and networks are essential for students to gain practical experiences in securing and protecting cyber systems, operation and management of virtual environments are becoming more and more important as the development of web and cloud computing technologies. Deploying a cloud-based system lab and providing students an opportunity to learn practical cloud computing will be a plus.

Doctoral Review

Reviewer's Qualifications

Sam Chung

B.S. Kyung Pook National University in Taegu, Korea, Computer Engineering

M.S. Korea Advanced Institute of Science & Technology, Seoul, Korea, Computer Science

M.S. George Washington University, Washington, D.C., Computer Science

PhD University of South Florida, Tampa, Florida, Computer Science

Please provide a brief biography highlighting your expertise in this field. Two to four paragraphs.

Sam Chung, Ph.D., is an Endowed Chair Professor of Information Systems and Information Security at the University of Washington (UW) Tacoma Institute of Technology. Dr. Chung is also an Associate Professor at the Institute and the Director of Cyber Physical Systems of the Center for Information Assurance and Cybersecurity (CIAC) at the UW. Dr. Chung started his tenure-track assistant professorship at the UW Tacoma in 2001 and helped to the new start-up programs in BS in Computer Science (CS) and MS in CS. Before joining the UW Tacoma, he taught Computer Science as assistant professor at Pacific Lutheran University in Tacoma, WA and the University of Texas of the Permian Basin in Odessa, TX.

In Autumn 2006, UW Tacoma accepted new freshmen for the first time, thus initiating development of new programs for the freshmen class. Responding to this demand for growth, Dr. Chung founded the Information Technology and Systems Program at the UW Tacoma in 2007 and has improved the quality of education through curriculum development, degree program design, many independent study courses, and undergraduate research. Dr. Chung led the proposal development activity and submitted the final proposal to the Washington State Higher Education Coordinating Board (HECB) in February, 2009. Approval was granted on August 2009 with 30 FTEs enrolled. The Association of Computing Machinery (ACM) Computing Curricula 2005 was used as the basis for ITS curriculum development. The American Board of Education Technology (ABET) self-evaluation was used to assess the ITS curriculum.

Since July 2009, Dr. Chung has overseen development of a total of 26 new courses with ITS faculty. With both undergraduate and master level graduate students, his Smart and Secure Computing Research Group (SSCRG) focuses on making service-oriented cyber physical systems in a cloud environment smart and secure from internal or external attacks. Dr. Chung currently supervises the NSF Scholarship for Services (SFS) program at UW/CIAC (2011-2015). The alumni of the SSCRG founded a start-up company, are working at the Boeing, Microsoft, Avanade, MITRE, etc. Also, they have been admitted to MS or PhD programs at UIUC, MIT, and DGIST. Currently, all members are taking their summer internships at DHS, MITRE, PNNL, Avanade, City of Seattle, City of Tacoma, and UW IT Department.

Overall Summary

Please provide an overview of your opinion of the proposed BAS. Be sure to include whether or not the graduates of the program would be good candidates for your Masters or PhD programs. This should be ½ to 1 page in length.

My study of the Bachelor of Applied Science Degree in Cyber Security and Forensics at Highline Community College has made a very good impression on me. Program Design: since the current AAS degree programs in network and forensics are used as the strong basis of the 300 level and 400 level courses, the design of this BAS degree program provides the students

with a nice, attainable flow in the achievement of their degree. The 300 and 400 level classes were also designed by referencing the NIST NICE Framework. Also, the first two years of each program provides foundation of advanced topics in database security, digital forensics, advanced network security, and penetration testing. In addition, the fact that the students enter with the equivalent of the general education requirements of the HCC degrees (40 credits) shows that this 4 years degree program has some level of breadth in addition to specialty in Cybersecurity and Forensics.

Assessment: it is evident that HCC has invested a lot of time and study in the planning of this program. Both Networking and Data Recovery/Forensics programs for AAS degree are mapped and certified under NSA's CNSS 4011 and 4013e requirements. HCC has hosted PRCCDC several times and a Center of Academic Excellence Two Year (CAE2Y). These experiences helped HCC to be well positioned to develop this new applied degree program.

Current trends in the field: several sources in the proposal show the strong demands of cybersecurity workforce - approximately 140,000 new jobs in networking by 2016, a growth of 350,000 jobs in information security by 2012, etc. Also, the recognition of HCC's activities and participations in the Puget Sound area is a great plus to the program.

Resources: the faculty is well qualified for this program. Many have industrial experience and/or have taught courses in the IT area for several years either at HCC or other universities. The established budget seems adequate to support this program. Also, this program's instructors can teach the Local Area Network (LAN) and Wide Area Network (WAN) classes certified by CISCO, which is a good plus to the network security specialty.

Prep for MS Program: the master's degree in Cybersecurity and Leadership (MCL) at UW Tacoma will provide "a thorough knowledge base for managers and technology leaders concerned with the design, development, implementation, operation, and management of cybersecurity systems, and the protection of an organization's information assets," according to the UW Tacoma. The graduates of HCC BAS in Cyber Security and Forensics can apply for this MS program.

Specific Commentary

In this section please provide feedback, specifying page and paragraph of items you

Especially like

Criteria 6: Program specific accreditation in Cybersecurity and Forensics Applied Baccalaureate Degree Program Proposal Forms C and D "Currently, the Network Specialist and Data Recovery/Forensics Specialist AAS degrees are certified under the NSA's Committee on National Security Systems (CNSS) 4011 and 4013e specifications. In addition, the college is a Center of Academic Excellence Two Year (CAE2Y) under that same program, which is valid through 2015."

This paragraph shows how this program could be streamlined with previous efforts. The quality of courses and computing facility could be prepared in advance even before this new applied degree program was proposed.

Would like to see change

Additions you think would enhance the program

HCC students need to be familiar with database before studying DB security. However, no 100 or 200 level database administration course is shown. Instead, CIS 230 Database Security is shown.

Non Certificate Courses Class code Credits

Database Security CIS 230 5

Also, DB Security is taught with three different DBMSs.

Database Security Certificate Class code Credits

MySQL Security CIS 310 5

SQL Server Security CIS 312 5

Oracle Security CIS 314 5

Instead of focusing DB Security with different DBMSs, more general titles are recommended such as DB Security, DB Audit, and Advanced DB Security. In these courses, specific DBMSs are used according to industry trends.

Non Certificate Courses Class code Credits Comments

Database Administration CIS 230 5 Required

Database Security Certificate Class code Credits

Database Security CIS 310 5

Database Audit CIS 312 5

Advanced Database Security CIS 314 5

This section can be as long as needed

N/A