



CAPITOL TECHNOLOGY UNIVERSITY

1927

September 28, 2017

Bradford L. Sims, PhD
President

Dr. James D. Fielder, Jr.
Secretary of Maryland Higher Education
Maryland Higher Education Commission
6 N. Liberty Street
Baltimore, MD 21201

Dear Dr. Fielder,

Capitol Technology University is requesting approval to offer a **Combination Program PhD in Technology with Master of Science (M.S.) in Research Methods**. The degree curriculum utilizes a significant number of existing courses in our university's curricula and is supplemented by new courses supporting the Combination Program.

The mission of Capitol Technology University is to provide practical education in engineering, computer science, information technology, and business that prepares individuals for professional careers and affords the opportunity to thrive in a dynamic world. A central focus of the university's mission is to advance practical working knowledge in areas of interest to students and prospective employers within the context of Capitol's degree programs. The university believes that a Combination Program PhD in Technology with M.S. in Research Methods is consistent with this mission.

The Combination Program is ONLY for students who desire a Ph.D. in Technology, but do not possess an appropriate Master's degree. The M.S. in Research Methods CANNOT be taken as a stand-alone degree.

High level expertise in technology is a specific need identified by industry and government communities. According to industry experts, high level expertise in technology is a skill set of increasing value to employers. It is desirable across many fields, across a variety of job categories and levels of employment. A critical gap between the supply and demand of technology professionals at the highest level is already reaching crisis proportions. Increasing demand, in turn, translates into a growing need for universities and other academic institutions to develop a program that educates technology professionals at the highest level for all industries.

To respond to industry need, we respectfully submit for approval a Combination Program PhD in Technology with M.S. in Research Methods. The required proposal is attached as is the letter from me as university president confirming the adequacy of the university's library to serve the needs of the students in this degree.

Respectfully,

Bradford L. Sims, PhD



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Dr. James D. Fielder, Jr.
Secretary of Maryland Higher Education
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6 N. Liberty Street
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Dear Dr. Fielder,

This letter is in response to the need for confirmation of the adequacy of the library of Capitol Technology University to support the proposed **Combination Program PhD in Technology with Master of Science in Research Methods**. As president of the university, I confirm that the library resources, including support staff, are more than adequate to support the Combination Program PhD in Technology with Master of Science in Research Methods. In addition, the university is dedicated to, and has budgeted for, continuous improvement of library resources.

Respectfully,

Bradford L. Sims, PhD

PROPOSAL FOR:

- NEW INSTRUCTIONAL PROGRAM**
- SUBSTANTIAL EXPANSION/MAJOR MODIFICATION**
- COOPERATIVE DEGREE PROGRAM**
- WITHIN EXISTING RESOURCES** or **REQUIRING NEW RESOURCES**



**CAPITOL
TECHNOLOGY
UNIVERSITY**

1927

Institution Submitting Proposal

Spring 2018

Projected Implementation Date

**PhD in Technology
M.S. in Research Methods**
Award to be Offered

**Combination Program
PhD of Technology
with Master of Science in Research Methods**
Title of Proposed Program

0999

Suggested HEGIS Code

14.999

Suggested CIP Code

Engineering

Department of Proposed Program

Dr. Helen Barker

VP Academic Affairs,
CAO

Dr. Helen Barker

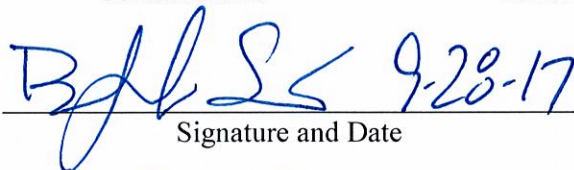
Contact Name

hgbarker@captechu.edu

Contact E-Mail Address

240-965-2510

Contact Phone Number


Signature and Date

President/Chief Executive Approval

9-28-2017

Date

Date Endorsed/Approved by Governing Board

PROPOSAL FOR:

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**Proposed Combination Program Ph.D. in Technology
with Master of Science in Research Methods
Department of Engineering
Capitol Technology University
Laurel, Maryland**

A. Centrality to institutional mission statement and planning priorities:

- 1. Program description and relationship to university mission and how it relates to the institution's approved mission.**

Proposed Combination Program PhD in Technology with Master of Science in Research Methods Description:

This is a Combination Program PhD in Technology with Master of Science (M.S.) in Research Methods. The Combination Program is ONLY for students who desire a Ph.D. in Technology, but do not possess an appropriate Master's degree. The Combination Program begins with a M.S. in Research Methods (requiring 30 credits) and continues with doctoral studies leading to a Ph.D. in Technology (requiring an additional 60 credits). The Combination Program requires 90 credits to complete. Upon graduation, the successful student will be awarded a PhD in Technology with M.S. in Research Methods.

The Combination Program is a PhD in Technology with an inseparable programmatic link to a M.S. in Research Methods. The M.S. in Research Methods is an integral step leading to a Ph.D. in Technology. The M.S. in Research Methods CANNOT be taken as a standalone degree; students must be in the Combination Program pursuing a Ph.D. in Technology. Additionally, students in the Combination Program will only be awarded the M.S. degree after completing the Ph.D. in Technology.

The Combination Program provides students with the opportunity to conduct extensive and sustained original research in the fields of technology. Capitol Technology University is in a unique position to provide students with an avenue to pursue a deep proficiency in a field of technology. Graduates will learn how to contribute significantly to their chosen field through the creation of new knowledge and ideas. Further, students will be able to engage in research and publishing using the proper techniques and appropriate methodology.

The Combination Program will prepare the students to take roles as leaders in their chosen field of technology. The student will begin their path to success by building a solid foundation in research methods by learning from experts. Combination Program students begin with graduate-level course work in advanced writing, research techniques, methodology, ethics, qualitative and quantitative research, data collection, applied statistics, data analysis, analytics, and data visualization that prepares them for doctoral studies. Students will then continue their path to success at the doctoral level by working with a research committee from Capitol Technology University to develop a research proposal in their chosen field of technology. Students work independently to conduct the study and produce a meaningful body of original research of publishable quality. In addition to a deep understanding of their chosen field of technology, students will be required to defend their knowledge of the legal, political, ethical, and social dimensions of their field of research. Ultimately, the Combination Program will prepare students

to achieve high-level expertise and a more profound understanding within a specific field of technology.

During the doctoral program, there are two options for completion of the Ph.D. in Technology within the Combination Program:

Dissertation Option: the student will produce, present, and defend a doctoral dissertation after receiving the required approvals from the student's Committee and the Ph.D. Review Board.

Publication Option: the student will produce, present, defend their original doctoral research after receiving the required approvals from the student's Committee and the Ph.D. Review Board. The student must also publish original research in a scholarly peer-reviewed journal of high stature.

Successful completion the Ph.D. portion of the Combination Program culminates in the award of a Ph.D. in Technology with M.S. in Research Methods.

Relationship to Institutional Approved Mission:

The Combination Program is consistent with the University mission to provide educational opportunity to individuals in engineering, computer science, information technology, and business. We provide relevant learning experiences that lead to success in evolving global community. Fundamental to the degree programs in the Department of Engineering are opportunities to pursue cutting edge knowledge in technology. The Combination Program is consistent with that philosophy. This same philosophy is supported by existing degree programs and learning opportunities. The university has a Doctor of Science (D.Sc.) in Cybersecurity and a Ph.D. in Management and Decision Science. The Combination Program is an integral part of the Strategic Plan for FY 2017-2021 and forward. Funding to support the new degree has been included in institutional and departmental budgets for FY 2018-2019 and forecasted budgets going forward.

The Combination Program will be offered in the online format using tools such as Adobe Connect and Canvas. This results in the convenience required by the 21st century learner, and provides interaction with faculty and fellow students critical to the high-level learning experience. The curriculum provides the doctoral student the necessary learning tools the University believes critical to success in the modern business and government environments. The degree is consistent with the interdisciplinary nature of the University.

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

Capitol Technology University operates on five strategic goals:

- 1. Elevate Education and Academic Quality:** *The University is an institution that offers career relevant curriculum with quality learning outcomes.*
- 2. Expand Enrollment and Reputation:** *The University will become more globally renowned and locally active through student, faculty, and staff activities.*
- 3. Diversify and Increase Financial Resources:** *The University will enhance its financial resources by expanding the range and amount of funding available to the institution,*

aligning costs with strategic initiatives, and expanding corporate relationships.

- 4. Maintain Institutional Viability:** *The University is committed to providing relevant learning in a quality learning environment.*
- 5. Extend Our Family of Organizational Partners:** *The mission of Capitol Technology University is to provide relevant learning experiences that lead to success in the evolving global community.*

The new Combination Program supports all the university's strategic goals. This approach builds upon the already successful graduate areas of study, such as the Doctor of Science in Cybersecurity, Doctor of Philosophy in Management and Decision Science, Master of Science in Electrical Engineering, Master of Science in Internet Engineering, Master of Science in Cyber and Information Security degrees, Master of Science in Computer Science, and Master of Science in Information Systems Management (which integrates business and technology at the graduate level). In addition, the University has submitted two proposed Technical Master of Business Administration degrees and a Master of Science in Cyber Analytics degree to the Maryland Higher Education Commission (MHEC); those degree proposals are currently out for approval. Capitol Technology University's programs are structured to teach students critical leadership, technical and business skills necessary to meet the needs of a modern technology-dependent society. The university's programs have been preparing professionals for rapid advances in technology, intense global competition, and increasingly complex technological environments for decades. The Combination Program will allow students to increase their knowledge to the extreme limits of technological innovation and proficiency.

The new Combination Program is fully supported by the university's Vision 2025 and Strategic Plan 2017-2021. Funding to support the degree has been included in forecasted budgets going forward.

The university has active partnerships (e.g., Leidos, Patton Electronics, Lockheed Martin, Northrup Grumman, and Cyber Security Forum Initiative, IRS, and SAS) at the private and public level. The Combination Program will provide new opportunities for partnerships as well as research worldwide. While additional enrollment will increase financial resources, additional partnerships and grants in this field of study will help diversify and increase financial resources.

B. Critical and compelling regional or statewide need as identified in the State Plan:

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

- a. The need for advancement and evolution of knowledge.**

Advanced technologies are redefining every facet of business, industry, and personal life at a rapid pace in a highly competitive, global environment. Top level leaders in technology are at the forefront of this evolution in every field. Leaders with a doctorate degree in technology possess the ability to lead, influence, and inspire the technology revolution with the following skills:

- Envision, plan and conduct research and technology development activities;

- Identify, comprehend, analyze, evaluate and synthesize research;
- Evaluate technologies and technology-related programs;
- Assess individual performance with, and understanding of, technology;
- Communicate effectively and employ constructive professional and interpersonal skills; and
- Function in one or more of the technology disciplines.

Maryland has a long history of fostering and encouraging entrepreneurs to launch and maintain technology-based ventures as well as groundbreaking research in technology.

The challenges in creating new technologies as well as within existing technologies are fueling an even greater demand for highly educated technology experts. Forbes.com cites seven areas where technology experts will be making advances in the coming years and beyond:

1. IoT and Smart Home Tech.

We've been hearing about the forthcoming revolution of the Internet-of-Things (IoT) and resulting interconnectedness of smart home technology for years. So what's the holdup? Why aren't we all living in smart, connected homes by now? Part of the problem is too much competition, with not enough collaboration—there are tons of individual appliances and apps on the market, but few solutions to tie everything together into a single, seamless user experience. Now that bigger companies already well-versed in uniform user experiences (like Google, Amazon, and Apple) are getting involved, I expect we'll see some major advancements on this front in the coming year.

2. AR and VR.

We've already seen some major steps forward for augmented reality (AR) and virtual reality (VR) technology... Oculus Rift was released, to positive reception, and thousands of VR apps and games followed. We also saw Pokémon Go, an AR game, explode with over 100 million downloads. The market is ready for AR and VR, and we've already got some early-stage devices and tech for these applications...you'll need to be ready for AR and VR versions of practically everything—and ample marketing opportunities to follow.

3. Machine Learning.

Machine learning has taken some massive strides forward in the past few years, even emerging to assist and enhance Google's core search engine algorithm. But again, we've only seen it in a limited range of applications...I expect to see machine learning updates emerge across the board, entering almost any type of consumer application you can think of, from offering better recommended products based on prior purchase history to gradually improving the user experience of an analytics app. It won't be long before machine learning becomes a kind of "new normal," with people expecting this type of artificial intelligence as a component of every form of technology.

4. Automation.

Marketers will be (mostly) pleased to learn that automation will become a bigger mainstay...with advanced technology enabling the automation of previously human-exclusive tasks. We've had robotic journalists in circulation for a couple of years now, and I expect it won't be long before they make another leap into more practical types of articles. It's likely that we'll start seeing productivity skyrocket in a number of white-collar type jobs—and we'll start seeing some jobs disappear altogether. When automation is combined with machine learning, everything can improve even faster...

5. Humanized Big Data. (visual, empathetic, qualitative)

Big data has been a big topic for the past five years or so, when it started making headlines as a buzzword. The idea is that mass quantities of gathered data—which we now have access to—can help us in everything from planning better medical treatments to executing better marketing campaigns. But big data's greatest strength—its quantitative, numerical foundation—is also a weakness. ...I expect we'll see advancements to humanize big data, seeking more empathetic and qualitative bits of data and projecting it in a more visualized, accessible way.

6. Physical-Digital Integrations.

Mobile devices have been slowly adding technology into our daily lives. It's rare to see anyone without a smartphone at any given time, giving us access to practically infinite information in the real-world. We already have things like site-to-store purchasing, enabling online customers to buy and pick up products in a physical retail location, but the next level will be even further integrations between physical and digital realities. Online brands like Amazon will start having more physical products, like Dash Buttons, and physical brands like Walmart will start having more digital features, like store maps and product trials.

7. Everything On-Demand.

Thanks to brands like Uber (and the resulting madness of startups built on the premise of being the "Uber of ____"), people are getting used to having everything on demand via phone apps...I expect this to see this develop even further. We have thousands of apps available to us to get rides, food deliveries, and even a place to stay for the night, but soon we'll see this evolve into even stranger territory.

Source: <https://www.forbes.com/sites/jaysondemers/2016/11/16/7-technology-trends-that-will-dominate-2017/#7aa819414a51>

b. Societal needs, including expanding educational opportunities and choices for minorities and educationally disadvantaged students at institutions of higher education.

Capitol Technology University has a long history of serving the minority population. The university has a 51% minority student population with 7% undisclosed. Thirty-four percent of the university's minority population is African American.

Millennials (also known as Generation Y) have been entering the workforce in record numbers for the past ten years and having been coming to terms with the relevance of their

higher education degrees as well as their level of job satisfaction. Forbes.com recently recognized the trend in its article, “4 Reasons To Make A Career Pivot To Tech In 2017.”

Technology fields are a key to success for Millennials

“The number of millennials making the leap from their current field into a technology job is on the rise and for good reason. Job opportunity has and will be exceptional for tech job seekers, along with the ability to expand skills, be challenged, and earn a higher income.”

“...tech is probably the single greatest opportunity that exists for millennials today,” Mark Smukler, General Assembly alumni and Co-Founder of Bixby, a rental management platform. ‘There’s still a large shortage of technical expertise across most industry verticals and a career in tech can be one of the most rewarding jobs in many ways.’”

Employers are scouring universities looking to hire technology

“For millennial professionals who are eyeing up a career change to tech, there has never been a better time to make the leap. Between a shortage of qualified candidates and the competition that naturally comes with job-hoppers, finding a great job in the field has become much easier.”

“‘This market is booming,’ said Eric Haller, Executive Vice President & Global Head of Experian DataLabs, an innovative data analysis company. ‘Finding talent is a challenge and employers are starting to swarm the universities that are producing those they think are trainable or can come in the door ready to work. The supply/demand equation favors those on the supply side right now and it looks to be that way for some time to come.’”

Source: <https://www.forbes.com/sites/kaytiezimmerman/2016/12/20/4-reasons-to-make-a-career-pivot-to-tech-in-2017/#bd145a37b8ec>

“Economic projections point to a need for approximately 1 million more STEM professionals than the U.S. will produce at the current rate over the next decade if the country is to retain its historical preeminence in science and technology.”

Source: President’s Council of Advisors on Science and Technology, *Engage to excel: producing one million additional college graduates with degrees in science, technology, engineering, and mathematics* (Executive Office of the President of the United States, 2012)

The National Science Foundation (NSF) outlined labor growth of 23.1% between 2010 and 2020. Such growth represents 59% of the total growth of US science and engineering jobs¹.

Source: <https://www.nsf.gov/nsb/sei/edTool/data/workforce-03.html>

Fortune magazine, in analyzing available labor market data and employer needs, found that graduate degrees (including the PhD) ranked the highest in pay, satisfaction, and long-term job growth outlook.

Source: <http://fortune.com/2016/03/21/best-worst-graduate-degrees-jobs-2016/>

c. The need to strengthen and expand the capacity of historically black institutions to provide high quality and unique educational programs.

The industry watchdog Diverse: Issues In Higher Education serves as a source of critical news, information and insightful commentary on the full range of issues concerning diversity in American higher education. The group cites recent U.S. Bureau of Labor Statistics information regarding the inequity of high paying jobs in technology. “Yet, women and minorities are not accessing these jobs at anywhere near a proportionate rate. For instance, a report from the Business-Higher Education Forum notes that African Americans and Hispanics represent just 6 and 7 percent of STEM employment, even though they represent more than twice that much of the U.S. population.”

Given the substantial minority population of Capitol Technology University, it is reasonable to assert that the Combination Program PhD in Technology with M.S. in Research Methods will add to this base of minority participation.

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

The 2013-2017 Maryland State Plan for Postsecondary Education articulates six goals for postsecondary education:

1. Quality and Effectiveness
2. Access, Affordability, and Completion
3. Diversity
4. Innovation
5. Economic Growth and Vitality
6. Data Use and Distribution

Goal 1

The Combination Program, with its intense rigor, will produce highly qualified technology professionals for emerging fields of technology and employment. The university has a proven record of quality education. In addition to regional accreditation, the Association of Technology, Management, and Applied Engineering (ATMAE) accredits technology, management, and applied engineering degrees. The Combination Program is consistent with the ATMAE criteria for the delivery of high quality technology, management, and applied engineering education. The Combination Program is consistent with the ATMAE criteria for the delivery of high quality technology, management, and applied engineering education. Faculty and staff are engaged in faculty development to remain current in their field of teaching as well as to expand knowledge across disciplines. The university has in place services and learning tools to guide students to successful degree completion. This applies to all students regardless of mode of course delivery. Capitol Technology University is a transfer friendly institution and participates in multiple programs for government and military credit transfer. The university has multiple transfer agreements with local institutions at all degree levels.

Goal 2

The courses for the Combination Program will be offered in the online format. This provides learning opportunities for students unable or unwilling to attend an on-campus institution of higher education. The University provides a tuition structure that is competitive with its competitors. The University tuition structure does not differentiate between in-state and out-of-state students. Student services are designed to provide advising, tutoring, virtual job fair attendance, and other activities supporting student completion and employment for both on-ground and online students.

Students receive information through admissions regarding the cost to attend the university. The information is also publicly available on the university website. Admissions and financial aid identify for the student potential grants, scholarships, and state plans to reduce potential student debt. The net cost versus gross costs are identified clearly for the student. Students receive advising from financial aid prior to enrolling in classes for the first time. Admissions, student services and departmental chairs advise students as to academic readiness and degree requirements. The specific success pathway is developed for each student.

The university's tuition increases have not exceeded 3%.

The university has in place services, tutoring, and other tools to help ensure student graduation and successful job placement. The university hosts a career (job) fair twice a year. The university has an online career center available to all students covering such topics as career exploration, resume writing, job search techniques, social media management, mock interviews, and assistance interpreting job descriptions, offers, and employment packages.

The university works with its advisory boards, alumni, partners, and faculty to help ensure that the degrees offered at the university are compatible with long term career opportunities in support of the state's knowledge based economy.

Goal 3

The Capitol Technology University community is committed to creating and maintaining a mutually respectful environment that recognizes and celebrates diversity among all students, faculty, and staff. The university values human differences as an asset and works to sustain a culture that reflects the interests, contributions, and perspectives of members of diverse groups. The university delivers educational programming to meet the needs of diverse audiences. We also seek to instill those values, understanding, and skills to encourage leadership and service in a global multicultural society.

The university supports various clubs that identify with diverse groups including race, gender, military/veterans, and sexual orientation. The university has a 51% minority student population with 7% undisclosed. The university's Black/African American population is 34% of the student body. The university has military/veteran population of 22%. The university also has a 17% female population, which is significant given that it is a technology university.

Achievement gaps: The university provides leveling courses in support of individuals attempting a career change to a field of study not necessarily consistent with their current skills. There are situations where additional undergraduate and graduate courses best serve student needs in subject areas. The university makes these courses available.

The university engages in diversity training for its institutional population, including students. Diversity and inclusiveness are built in to the curriculum allowing graduates to operate effectively in a global environment. The university supports such things as team projects and grants across degrees. This has proven effective at supporting multiple aspects of diversity.

Goal 4

Capitol Technology University's past, present, and future is inextricably intertwined with innovation. The university has a long tradition of serving as a platform for the use of new and transformative approaches to delivering higher education. New technology and cutting-edge techniques are blended with proven strategies with the goal of enabling student success in the classroom as well as in a successful career after graduation. As a small institution, Capitol can quickly integrate new technologies into the curriculum to better prepare students for the work environment. The university designs curriculum in alliance with accreditation and regulating organizations/agencies.

The university employs online virtual simulations in a game-like environment to teach practical hands-on application of knowledge. The university is engaged with a partner creating high level virtual reality environments for some courses in the degree. This all occurs in parallel with traditional proven learning strategies. These elements of the university learning environment are purposeful and intended to improve the learning environment for both the student and faculty member. In addition, these elements are purposely designed to increase engagement, improve outcomes, and improve retention and graduation rates. The university believes that innovation is the key to successful student and faculty engagement.

Example: The university engages its students in "fusion" projects, which allows students to contribute their skills in interdisciplinary projects such as those in our Astronautical Engineering and Cyber labs where business students become project managers (e.g., to send a CubeSAT on a NASA rocket) and data analysts (e.g., to analyze rainforest data for NASA). We are recruiting partners for this potential degree for which real projects will provide students integrative learning opportunities.

The university supports transfer of a limited number of graduate level courses appropriate to the degree. The university has some agreements with articulation partners for the transfer of graduate work (e.g., National Defense University).

Goal 5

One of the overarching principles of Capitol Technology University's approach to education is to instill a zeal for life-long learning in our students, which promotes economic growth and vitality of the student. Cybersecurity inherently supports a knowledge based economy. University partnerships both current and future will provide economic growth opportunities for its students, the university, and its partners. The university's Ph.D. in Management and Decision Sciences and the D.Sc. in Cybersecurity provide opportunities for undergraduate, masters, and doctoral students to engage in high level research partnerships. The university is

committed to partnering with Maryland institutions to employ our graduates to keep the talent in the state. The university instills in students an entrepreneurial attitude preparing them to bring skills to startup businesses or start a business of their own.

Goal 6

Capitol Technology University is committed to data collection and disclosure beyond the requirements of regulations and accreditation. Data is publicly available on the university website. Assessment for the university is the responsibility of the Vice President (VP) of Academic Affairs. Highly skilled personnel are required in a timely manner to accumulate the data, analyze the data, distribute the results, and recommend potential decisions to achieve the desired outcomes. In addition, data is evaluated by the dean, chairs, faculty, advisory boards, trustees, university executives, etc. to make the best decision possible.

C. Quantifiable & reliable evidence and documentation of market supply and demand in the region and State:

1. Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new program.

The World Economic Forum, an international organization for public-private cooperation, defined the pressing need for technology professionals in an article, “8 Jobs Every Company Will Be Hiring for by 2020”:

The report, called “The Future of Jobs,” surveyed executives from more than 350 employers across nine industries in 15 of the world’s largest economies to come up with its predictions about how the labor markets will evolve.

While the job landscape is expected to undergo radical changes over the next few years, the report predicts that there will also be certain occupations that are more in demand. Here’s a look at some of the job categories that are expected to see growth.

1. Data analysts will be in demand.

According to the report, data analysts will become increasingly more important in all industries by 2020. Survey respondents said they expect to have a greater demand for data analysts because they will need help making sense of all of the data generated by technological disruptions.

Employment outlook across job families jobs change in thousands, 2015-2020



Across major economies - see report for full list.
Source: Future of Jobs Report, World Economic Forum

2. In fact, computer and mathematical jobs as a whole will also continue to get a boost.

Jobs that fall under the computer and mathematical occupations will grow. These occupations include computer programmers, software developers, information security analysts, and more.

3. Architects and engineering jobs will remain stable.

During the next four years, the demand for those skilled in architecture and engineering will continue to increase. Specifically, the report states there will be growth for engineers focused on biochemicals, nanotechnology, robotics, and materials.

By 2020, 2 million jobs will be created worldwide that fall under computer and mathematical and architecture and engineering related fields, according to the report.

Source: <https://www.weforum.org/agenda/2016/01/8-jobs-every-company-will-be-hiring-for-by-2020/>

2. Discuss and provide evidence of market surveys that clearly provide quantifiable and reliable data on the educational and training needs and the anticipated number of vacancies expected over the next 5 years.

Eduventures, an independent research and advisory firm, points out the severe deficiency of technology professionals in an April 25, 2017 article. Eduventures points out "...a recent analysis of job posting frequencies by Economic Modeling Specialists International (EMSI) revealed an 18% increase in cybersecurity analyst jobs since 2011, distributed among more than 31,000

companies in the U.S. alone. From 2016 to 2017, there were more than 32,000 unique U.S. job postings added each month.”

Source: <http://www.eduventures.com/2017/04/hacking-cybersecurity-demand-curve/>

In an April 12, 2017 article, the IEEE Cybersecurity Initiative cites the growing shortage of technology professionals:

Cisco estimates that as many as 1 million...openings worldwide are going unfilled. And the 2016 Corporate IT Security Risks report by global cybersecurity company Kaspersky Lab found that nearly half the 4,000 businesses surveyed about their demand for specialists in the field said they were finding it difficult to fill openings.

The talent drought is being felt across the board. Hundreds of thousands of malware intrusions alone are attempted every day, and they're not only impacting tech companies. Institutions with data—whether it's their own, customers' or patients'—need to be concerned about protecting their systems. Nearly 70 percent of the companies surveyed by Kaspersky Lab said they planned to hire full-time cybersecurity professionals in the coming years.

Source: <https://cybersecurity.ieee.org/blog/2017/04/13/the-institute-the-cybersecurity-talent-shortage-is-here-and-its-a-big-threat-to-companies/>

3. Data showing the current and projected supply of prospective graduates.

A survey by TEKsystems ranks workers with combined business skills (strong aptitudes for business, technology, mathematics and statistics, IT) as their highest need. Both leaders and professionals say there is already significant shortage of workers with the skills required. TEKsystems' online survey included more than 1,500 IT leaders and 2,000 IT professionals in the U.S. and Canada. TEKsystems, part of the Allegis Group, is the largest IT staffing firm in the United States.

Source: <http://www.staffingindustry.com/Research-Publications/Daily-News/Big-data-important-but-there-s-a-shortage-of-skills-survey-finds-27366#sthash.VKsfVzf2.dpuf>

Inside Higher Ed, a leading digital media company serving higher education, recently defined the pressing need for technology professionals in an April 26, 2017 article:

The projected global demand...talent will climb to six million by 2019, but there will be an expected shortfall of 1.5 million professionals, according to Foote Partners, which tracks information technology jobs across all skill levels. This new intersection of business and higher education is not a nice to have—for many in corporate recruiting, it's become a need to have.

A recent Boston Globe article cited the shortage of skilled technology workers...as the No. 1 issue for many companies. Cyberattacks increased by 48 percent in 2014, according to the accounting and consulting firm PwC, and are expected to increase as more personal computing devices become connected to the internet. And yet, the talent isn't there to support the demands of this rapidly growing industry.

Source: <https://www.insidehighered.com/digitallearning/views/2017/04/26/cybersecurity-faces-shortage-15-million-workers>

D. Reasonableness of program duplication:

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

Johns Hopkins University (JHU) has a Doctor of Philosophy in Computer Science, Doctor of Philosophy in Electrical and Computer Engineering, and a Doctor of Philosophy in Mechanical Engineering. The University of Maryland (UMD) has a Doctor of Philosophy in Information Studies. The University of Maryland Baltimore County (UMBC) has a Doctor of Philosophy in Computer Science. Morgan State University (MSU) has a Ph.D. in Engineering. Those universities may not be the only institutions of higher education in Maryland that have terminal degrees in engineering; however, there are no other programs in Maryland with a Combination Program Ph.D. in Technology with M.S. in Research Methods.

Capitol Technology University's Combination Program **Ph.D. in Technology with M.S. in Research Methods is unique in its focus on earning an M.S. in Research Methods en route to doctorate through deep research in a field of technology and the subsequent publication of the material in high level peer-reviewed scholarly journal. The university's Combination Program does not follow the normal doctoral model.** Instead, the doctoral student is required to be an expert in a field of technology who does not possess an appropriate Master's degree.

The Combination Program requires 90 credits to graduate. The closest curriculum to Capitol Technology University's program is UMD's Doctor of Philosophy in Information Studies. However, UMD's program is geared more towards information systems.

Capitol Technology University's Combination Program is delivered online (using the Learning Management System called Canvas as well as Adobe Connect). The programs at UMD, UMBC, and MSU are offered on campus. JHU's programs are offered via a mix of online and on campus classes.

- 2. Provide justification for the proposed program.**

The program is strongly aligned with the university's strategic priorities and is supported by adequate resources. The Combination Program will strengthen and expand upon existing graduate degree programs at the university. The degree will represent study in a rapidly changing and expanding discipline. Research shows a current and growing shortage of highly capable leaders in all current fields of technology. There is a thorough discussion of the need in sections B and C of this document.

E. Relevance to high-demand programs at Historically Black Institutions (HBIs):

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

The university is not aware of any similar high-demand programs at the Maryland HBIs.

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

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

The university is not aware of any impact on the uniqueness and institutional identities and missions of Maryland HBIs.

G. Adequacy of curriculum design and delivery to related learning outcomes consistent with Regulation .10 of this chapter:

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

Program description, as it will appear in the catalog:

This is a Combination Program PhD in Technology with Master of Science (M.S.) in Research Methods. The Combination Program is ONLY for students who desire a Ph.D. in Technology, but do not possess an appropriate Master's degree. The Combination Program begins with a M.S. in Research Methods (requiring 30 credits) and continues with doctoral studies leading to a Ph.D. in Technology (requiring an additional 60 credits). The Combination Program requires 90 credits to complete. Upon graduation, the successful student will be awarded a PhD in Technology with M.S. in Research Methods.

The Combination Program is a PhD in Technology with an inseparable programmatic link to a M.S. in Research Methods. The M.S. in Research Methods is an integral step leading to a Ph.D. in Technology. The M.S. in Research Methods CANNOT be taken as a standalone degree; students must be in the Combination Program pursuing a Ph.D. in Technology. Additionally, students in the Combination Program will only be awarded the M.S. degree after completing the Ph.D. in Technology.

The Combination Program provides students with the opportunity to conduct extensive and sustained original research in the fields of technology. Capitol Technology University is in a unique position to provide students with an avenue to pursue a deep proficiency in a field of technology. Graduates will learn how to contribute significantly to their chosen field through the creation of new knowledge and ideas. Further, students will be able to engage in research and publishing using the proper techniques and appropriate methodology.

The Combination Program will prepare the students to take roles as leaders in their chosen field of technology. The student will begin their path to success by building a solid foundation in research methods by learning from experts. Combination Program students begin with graduate-level course work in advanced writing, research techniques, methodology, ethics, qualitative and quantitative research, data collection, applied statistics, data analysis, analytics, and data visualization. Students will then continue their path to success at the doctoral level by working with a research committee from Capitol Technology University to develop a research proposal. Students work independently to conduct the study and produce a meaningful body of original research of publishable quality. In addition to a deep understanding of their chosen field of technology, students will be required to defend their knowledge of the legal, political, ethical, and

social dimensions of their field of research. Ultimately, the Combination Program will prepare students to achieve high-level expertise and a more profound understanding within a specific field of technology.

During the doctoral program, there are two options for completion of the Ph.D. in Technology within the Combination Program:

Dissertation Option: the student will produce, present, and defend a doctoral dissertation after receiving the required approvals from the student's Committee and the Ph.D. Review Board.

Publication Option: the student will produce, present, defend their original doctoral research after receiving the required approvals from the student's Committee and the Ph.D. Review Board. The student must also publish original research in a scholarly peer-reviewed journal of high stature.

Successful completion the Ph.D. portion of the Combination Program culminates in the award of a Ph.D. in Technology with M.S. in Research Methods.

Description of program requirements:

Entrance requirements:

Entrance Requirements

In order to be accepted into the program, students must have completed an appropriate undergraduate degree with a cumulative GPA of no less than 3.0 on a 4.0 scale. Students must also have a high level of expertise in a field of technology and show the academic promise of their future ability to produce original research of publishable quality (suitable for a scholarly peer-reviewed journal of high stature). Students must also provide a prospectus of at least 750 words that details their technological expertise and preparation for success in conducting original research within Capitol Technology University's Combination Program. International students are required to take the TOEFL and score at least 550 on the paper-based test or 79 on the internet-based test.

M.S. in Research Methods (30 credits)

TECH 700 - Project I: Fundamentals of Graduate Research & Design (6 credits)

Project I will introduce the fundamentals of graduate research and design. The project will focus on graduate level writing, APA style, and the fundamentals of scientific inquiry. The project will cover the areas of technology research, ethics of research, the stages of the research process, conceptualization and operationalization of research questions, data collection techniques, analytics, an introduction to qualitative and quantitative methods and measurement, a discussion of program evaluation research, and research proposal development. Prerequisite: None.

TECH 710 – Project II: Ethics and Philosophy of Research & Data Collection (6 credits)

Project II will address the ethics of conducting scholarly research. The discussion of research ethics will include, but not be limited to, informed consent, protecting anonymity of participants, and ethical participant protocols. Discussions will address the limits of researchers' obligations, along with providing a detailed look at the process of applying for Institutional Review Board approval. This project will provide students with an overview of the range of data collection

methods available to individuals undertaking research and to enable the student to consider the implications, application strengths and weaknesses of the various data collection methods. The module will also provide insight into the ways that such methods may be applied effectively and ethically in research. Prerequisite: None.

TECH 720 – Project III: Qualitative and Quantitative Research Design (6 credits)

Project III introduces the main research designs used in qualitative research. In addition to covering conceptual and epistemological issues associated with qualitative research design, the course introduces a range of qualitative research techniques. The strengths and limitations of various qualitative designs are explored with emphasis on issues of reliability, validity and representativeness. This project also introduces the main research designs used in quantitative research. In addition to covering conceptual and epistemological issues associated with quantitative research, the course introduces a range of techniques used in quantitative research. The strengths and limitations of various quantitative designs are explored with emphasis on issues of reliability, validity and representativeness. Prerequisite: TECH 700 and TECH 710.

TECH 730 – Project IV: Applied Statistics, Analytics, Decision Analysis, and Visualization (6 Credits)

Project IV covers the basic concepts of probability, common distributions, statistical methods, data analysis, developing a critical approach to the analysis of contingency tables, examining the basic ideas and methods of generalized linear models, linking logit and log-linear methods with generalized linear models, and developing basic facility in the analysis of discrete data using SAS, R, and Python. The project will also cover operations research techniques and their application to decision making such as mathematical optimization, networks modeling, stochastic modeling, and multi-objective modeling. Other topics covered include computer simulation, decision analysis using decision trees, and quantitative value functions. The project will culminate with visualization techniques. Students will learn different means of combating information overload as well as visual encoding as a method to supplant cognitive calculations with simpler perceptual inferences, improve comprehension, memory, and decision making. Prerequisite: TECH 700 and TECH 710.

TECH 740 – Project V: Capstone Project (6 credits)

Project V is the Capstone project. This project provides an opportunity for students to undertake an extensive piece of academic writing based on an original research conducted by the student. The research will be supervised by a faculty member and must be defended through oral examination. The thesis is a medium to demonstrate the student's understanding of research methods as applied to a topic of the student's selection. Students may also use this class to begin the prospectus for doctoral studies. Prerequisite: TECH 700, TECH 710, TECH 720, and TECH 730.

PhD in Technology (60 credits)

TECH 800 - Writing the Doctoral Proposal I (6 credits)

Project I. The student and the student's Committee will work to produce a proposal for research that is comprehensive in detail and planning. The proposal will address the research topic, scope and aims, objectives and a timing plan. Further, the skill set of the student will be evaluated by the committee and recommendations may be made to the Ph.D. Review Board to address

deficiencies. Prerequisite: Admittance to Track II.

TECH 810 - Writing the Doctoral Proposal II (6 credits)

Project II. The student will work to complete research milestones related to chapter one of their research according to the proposal and research plan. The prospective chapter will be reviewed by the student's Committee for approval prior to advancing to the next phase in the program.

Prerequisite: TECH 800.

TECH 820 - Writing the Doctoral Proposal III (6 credits)

Project III. The student will undertake a robust and comprehensive literature review, equivalent in scope and aim to a dissertation chapter two, within the boundaries of the proposal and research plan. The prospective chapter will be reviewed by the student's Committee for approval prior to advancing to the next phase in the program. Prerequisite: TECH 810.

TECH 830 - Writing the Doctoral Proposal IV (6 credits)

Project IV. Students will complete the research milestones associated with chapter three of the research. Further, students will finalize Institutional Review Board and Academic Review Board documentation. All research materials will be reviewed by the student's Committee and, upon reaching approval consensus, the committee will notify the Ph.D. Review Board of the student advancing to proposal oral defense status. Prerequisite: TECH 820.

TECH 840 - Doctoral Proposal Oral Defense (6 credits)

Project V. Upon approval from the Institutional Review Board, Academic Review Board, and PhD Review Board, the student will prepare a presentation for oral defense of the research proposal, research plan, and initial chapters of the dissertation. The Ph.D. Review Board and Dissertation Committee will evaluate both the student's proposal oral defense as well as the student's potential to complete the next phases of original research. Prerequisite: TECH 830.

TECH 900 – Doctoral Research Preparation I (6 credits)

Project VI. After receiving the necessary approvals, the student will conduct data collection and analysis activities consistent with the research plan. A complete and substantive presentation of the research results will be produced, equivalent to a dissertation chapter four. The student's Committee will review and approve related research materials. Prerequisite: TECH 840.

TECH 910 - Doctoral Research Preparation II (6 credits)

Project VII. The student will compose a draft research document in the appropriate form consisting of five chapters and submit the draft to the student's Committee. The student's Committee will review and approve related research materials. The student will make any required changes. Prerequisite: TECH 900.

TECH 920 – Doctoral Research Preparation III (6 credits)

Project VIII. The student will finalize the research document consisting of five chapters. The student's Committee will submit chapters four and five to university reviewers for approval. During Project VIII, the student is required to make the recommended changes and re-submit to the student's Committee; the student's Committee will re-submit to the university reviewers for final approval. Prerequisite: TECH 910.

TECH 930 – Doctoral Research Preparation IV (6 credits)

Project IX. The student will finalize the research document consisting of five chapters and will submit the document to the student's Committee. Upon review and approval, the student's Committee will notify the Ph.D. Review Board of the student's readiness for oral defense. The student will be responsible for preparing the oral defense and submitting for approval.

Prerequisite: TECH 920.

TECH 950 – Doctoral Presentation and Oral Defense (6 credits)

Project X. Upon approval from the Ph.D. Review Board, the student will prepare and deliver an oral presentation summarizing the body of research and defend such through oral examination. The student's committee and Ph.D. Review Board will confer to determine if the student has provided a sufficient and necessary oral defense of the research. Prerequisite: TECH 930.

2. Describe the educational objectives and intended student learning outcomes.

Educational Objectives:

- a. Prepare students to critically analyze problems in technology at the highest level and to identify relevant and useful information to move the field forward and support the attainment of desired outcomes.
- b. Prepare students to think critically by drawing appropriate conclusions from examining the output of methodological applications in the technological environment.
- c. Prepare students to conceptualize, apply and integrate effective qualitative and quantitative research strategies and to develop new information effectively.
- d. Prepare students to take a leadership role in a field of technology while employing the highest levels of ethics, analytics, decision analysis, data visualization.

Learning Outcomes:

Upon graduation:

- a. Graduates will be able produce comprehensive research at the highest level within their field of technology that is of publishable quality in peer-reviewed scholarly publications of the highest level.
- b. Graduates will be able to demonstrate a mastery of an area of technology research, ethics of research, the stages of the research process, conceptualization and operationalization of research questions, data collection techniques, analytics, qualitative and quantitative methods, measurement, program evaluation research, and research proposal development.
- c. Graduates will be able to demonstrate and apply in-depth knowledge of the main research designs used in qualitative and quantitative research, conceptual and epistemological issues associated with qualitative and quantitative research design, and advanced qualitative research and quantitative techniques.
- d. Graduates will be able to demonstrate a mastery of the understanding and ability to evaluate the possible economic, social, legal, ethical, and environmental impacts of their technological solutions.
- e. Graduate will be able to demonstrate a mastery of the concepts of probability, common distributions, statistical methods, data analysis, analysis of contingency tables, generalized linear models, linking logit and log-linear methods with generalized linear model, and analysis of discrete data using SAS, R, and Python.

- f. Graduates will demonstrate a mastery of data visualization techniques.
- g. Graduates will be able to demonstrate a mastery of the different means of combating information overload as well as visual encoding as a method to supplant cognitive calculations with simpler perceptual inferences, improve comprehension, memory, and decision making.

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

N/A

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

The program will be accredited regionally by Middle States Commission on Higher Education (MSCHE) and the Association of Technology, Management, and Applied Engineering (ATMAE).

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

The university will not be contracting with another institution or non-collegiate organization.

H. Adequacy of articulation:

1. If applicable, discuss how the program supports articulation with programs at partner institutions.

This program does not have articulation partners currently. However, it is expected that articulation will work as it does for the university's current degrees. The university is very active with its transfer partners throughout the state and beyond. The goal of the university is to work with partners to make transfer as seamless as possible and to maximize transfer credits as allowable. There is a dedicated transfer student admissions associate to guide this process.

I. Adequacy of faculty resources (as outlined in COMAR 13B.02.03.11):

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

All faculty listed below have been engaged with the university for at least several years. Abu-Ageel, Antunes, Bajwa, Bajracharya, Barker, Butler, Hosseini, Pittman, and Sabbah are fulltime faculty members. All of the doctoral faculty hold terminal degrees. The university leadership is confident in the quality of the faculty and their abilities to provide a learning environment supportive of the goals of the university for student success. Additional doctorally-qualified faculty will be added as needed.

Instructors who will be engaged with the Combination Program are:

INSTRUCTOR	BACKGROUND	COURSES ALIGNED TO BE TAUGHT
Dr. Nayef Abu-Ageel Full-time	Ph.D., Electrical and Computer Engineering M.S., Electrical Engineering B.S., Electrical Engineering	TECH 700, TECH 740, TECH 950
Dr. Audrey Andrews Adjunct	D.M. Organizational Leadership M.S. Information Systems Management M.B.A.	TECH 710, TECH 740
Dr. Alex "Sandy" Antunes Full-time	Ph.D., Computational Astrophysics	TECH 730, TECH 740
Dr. Garima Bajwa Full-time	Ph.D., Computer Science and Engineering M.S., Electrical and Computer Engineering B.S., Electronics and Communication Engineering	TECH 740, TECH 950
Dr. Chandra Bajracharya Full-time	Ph.D., Electrical and Computer Engineering M.S., Applied Computing M.S., Electrical Power Engineering B.E., Electrical Engineering	TECH 740, TECH 950
Dr. Hasna Banu Adjunct	Ph.D. Theoretical Physics M.S. Mathematics B.S. Mathematics	TECH 700, TECH 740
Dr. Helen Barker Full-time	D.M. Organizational Leadership Ph.D. Public Administration and Policy (ABD) M.S. Information Systems Management M.S. Business Administration	All TECH courses
Dr. Richard Baker Adjunct	Ph.D., Information Systems M.S., Computer Science B.S., Mathematics	TECH 710, TECH 740
Dr. Malcolm Beckett	D.B.A. Quality Systems	TECH 710, TECH 740

Adjunct	Management in Homeland Security and Defense M.S. Information Systems Management PMP	
Dr. William Butler Full-time	D.Sc. Cyber Security M.S. Strategic Studies B.S. Computer Science NSTISSI No. 4011 CNSSI No. 4012 NSTISSI No. 4015 CNSSI No. 4016	All TECH courses
Dr. Jami Carroll Adjunct	D.Sc. Cyber Security M.S. Cyber Security M.B.A.	All TECH courses
Dr. Emily Darraj Adjunct	D.Sc. Cybersecurity M.S. Information Assurance	All TECH courses.
Dr. George Hoffman Adjunct	D.B.A. Business Administration M.S. Systems Management B.S. Engineering Technology	All TECH courses
Dr. Soheil Hosseini Full-time	Ph.D., Electrical, Electronics and Communications Engineering	TECH 740, TECH 950
Dr. Mary Margaret Johnson Full-time beginning 01/2018 PLEASE SEE NOTE BELOW	Ed.D. MAED CISSP A+ N+	All TECH courses
Dr. Priscilla Lewis Adjunct	D.M. Leadership M.B.A M.P.S Managerial Policy B.S., Economics & Mathematics	All TECH courses
Dr. Brian McElyea Adjunct	Ph.D. Leadership and Organizational Change; Specialization: Knowledge Management	TECH 710, TECH 740
Dr. Jack Ford Adjunct	D.Sc., Cybersecurity M.S., Information Assurance B.S., Computer Science Networking	All TECH courses

Dr. John “Jack” Minogue Adjunct	D.Min., Doctor of Ministry M.Div., Divinity Doctoral Studies, Ethics MA, Theology BA, Philosophy/Minor: Mathematics & Physics	TECH 710, TECH 730, TECH 740
Dr. Ebonese Olfus Adjunct	D.Sc., Cybersecurity B.S., Information Systems	All TECH courses
Dr. Maurice Olfus Adjunct	D.B.A. M.P.A B.A., Accounting	All TECH courses
Dr. Alexander Perry Adjunct	D.Sc. Cyber Security M.S. Computational Mathematics	All TECH courses
Dr. Jason Pittman Full-time	Ph.D. Information Assurance M.S. Network Security B.S. English Literature and Microbiology	All TECH courses
Dr. Gale Pomper Adjunct	D.Sc. Cyber Security M.S. Network Security	All TECH courses
Dr. Eric Sabbah Full-time	Ph.D., Computer Science M.S., Computer Science B.S., Mathematics and Computer Science	TECH 740, TECH 950
Van Horn, H. Adjunct	Ph.D. Technology Management M.S., Network Security M.S., Information Architecture M.S., Business Administration B.S., Special Studies Science	TECH 710, TECH 720, TECH 740

JUSTIFICATION:

Capitol Technology University engages Adjuncts, in addition to faculty with terminal degrees, who are deemed subject matter experts in their field. Degrees that fuse fields of study like the Combination Program require individuals with a high level of expertise in more than one field of study. The technology environment/issues change so rapidly that we are well served in academics by those actively involved in the defense of our resources. In the academic environment, it is difficult to find in those willing to sacrifice the high wages that come with this expertise in the private and public sectors. The university is

not willing to sacrifice the quality of the learning experience; therefore, we engage the experts as Adjuncts or Professors of Practice (part-time faculty under annual contracts).

Examples of these experts:

Dr. Jami Carroll: Dr. Carroll has an MBA, government contract experience, and is a cybersecurity expert worldwide -- all of which allows him to provide a high-level learning experience.

Dr. Perry: Holds a high-level position in the applied area of cybersecurity and analytics.

Dr. Darraj: Dr. Darraj works as a cybersecurity expert across multiple disciplines within the cyber field, including data. She also is employed as a dissertation chair in our D.Sc. in Cybersecurity and Ph.D. in Management and Decision Sciences.

Dr. Pomper: Dr. Pomper is an expert in cybersecurity and works as a certification expert in the field. She has years of business experience in the private and government environment that allows her to provide a high-level learning experience.

Dr. Johnson: Dr. Johnson is a recently retired Army major. She holds a CISSP certification in cybersecurity and held the position of CIO while in the Army. She currently holds a full-time position at a community college teaching cybersecurity. Dr. Johnson is currently employed by Capitol as an adjunct in cybersecurity and a dissertation chair for our Ph.D. in Management and Decision Sciences and our D.Sc. in Cybersecurity. Dr. Johnson has accepted a full-time position with Capitol teaching cybersecurity at the graduate and doctoral level.

Fusing fields of study requires individuals with a skill set built on multiple fields of study and experience. The unique skill set of these individuals provide the type of high-level learning experience the university demands.

FACULTY WITH SPECIFIC EXPERTISE:

Dr. Beckett has a professional certification (i.e., PMP) in project management.

J. Adequacy of library resources (as outlined in COMAR 13B.02.03.12):

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

Library Services: The Puente Library offers extensive services and a wide collection for Capitol students to be academically successful. Library resources are available digitally. The library also provides a mailing service for materials borrowed through the Maryland system. The library is currently supporting the following degrees at the graduate level: M.S. in Computer Science, M.S. in Cyber and Information Security, M.S. in Electrical Engineering, M.S. in Information Systems Management, M.S. in Internet Engineering, M.B.A., D.Sc. in Cybersecurity, and Ph.D. in Management and Decision Sciences. Therefore, the library is fully prepared to support the

Combination Program.

Services provided to on line students include:

- “Ask the Librarian”
- Research Guides
- Tutorials
- Videos
- Online borrowing

Capitol Technology University’s online library as well as the on-campus library provides faculty and students with reference documents as well as texts appropriate to their learning experiences. Information about those services may be found at: <https://www.captechu.edu/current-students/undergraduate/library>.

The John G. and Beverley A. Puente Library provides access to management, decision science, and research methods materials through its 10,000-title book collection, e-books, and its 90 journal subscriptions. The library will continue to purchase new and additional materials in the management, decision science, and research methods area to maintain a strong and current collection in this subject area. Students can also access materials through the library’s participation in the Maryland Digital Library Program (MDL). This online electronic service provides access to numerous databases (Access Science, NetLibrary) that will provide access to the materials needed. Available databases include ProQuest, EBSCO, ACM, Lexis Nexis, Taylor Francis, and Sage Publications.

The Puente Library can provide access to historical management and decision science materials through its membership in the Maryland Independent College and University Association (MICUA) and the American Society of Engineering Education (ASEE). Reciprocal loan agreements with fellow members of these organizations provide the library access to numerous research facilities that house and maintain archives of management and data science documents. The proximity of the University of Maryland, College Park and other local area research and academic libraries provides the Puente Library with quick access to these materials as well.

The library currently supports the needs students at the masters and doctoral level.

K. Adequacy of physical facilities, infrastructure and instructional equipment (as outlined in COMAR 13B.02.03.13):

- 1. Provide an assurance that the physical facilities, infrastructure and instruction equipment are adequate to initiate the program, particularly as related to spaces for classrooms, staff and faculty offices, and laboratories for studies in the technologies and sciences. If the program is to be implemented within existing institutional resources, include a supportive statement by the President regarding adequate equipment and facilities to meet the program’s needs.**

No new facilities are required for the Combination Program. The university has sufficient classrooms to accommodate any hybrid or traditional classroom courses. The online class platform is web based and requires no additional equipment for the institution. The current learning management system meets the needs of the degree program. The Astronautical

Engineering Lab, Cyber Lab, Business and Technology lab, Computer Lab, Robotics Lab and soon-to-be built Unmanned and Autonomous Systems Lab together meet the potential research needs of the students providing local and virtual support.

L. Adequacy of financial resources with documentation (as outlined in COMAR 13B.02.03.14):

- 1. Complete Table 1: Resources. Finance data for the first five years of the program implementation are to be entered. Figures should be presented for five years and then totaled by category for each year.**

TABLE 1: RESOURCES

Resource Categories	Year 1	Year 2	Year3	Year 4	Year 5
1. Reallocation Funds	\$25,000	\$0	\$0	\$0	\$0
2. Tuition/Fee Revenue (c + g)	\$299,960	\$1,214,910	\$1,994,910	\$2,684,910	\$3,044,910
a. Number of F/T Students	10	33	59	82	94
b. Annual tuition/Fee rate	\$20,000	\$30,000	\$30,000	\$30,000	\$30,000
c. Total F/T Revenue (a x b)	\$200,000	\$990,000	\$1,770,000	\$2,460,000	\$2,820,000
d. Number of P/T Students	10	15	15	15	15
e. Credit Hour Rate	\$833	\$833	\$833	\$833	\$833
f. Annual Credit Hour	12	18	18	18	18
g. Total P/T Revenue (d x e x f)	\$99,960	\$224,910	\$224,910	\$224,910	\$224,910
3. Grants, Contracts and Other External Sources	0	0	0	0	0
4. Other Sources	0	0	0	0	0
TOTAL (Add 1 – 4)	\$324,960	\$1,214,910	\$1,994,910	\$2,684,910	\$3,044,910

This proposal builds upon an existing degree programs.

- 2. Provide a narrative rationale for each of the resource categories. If resources have been or will be reallocated to support the proposed program, briefly discuss those funds.**

a. Reallocated Funds

Capitol Technology University has reallocated funds during Year 1 for support of program and course development, online support, office materials, travel, professional development, and initial marketing. There is no substantial impact on the institution because of the reallocation of these funds. The reallocated funds will be recovered after the first year. The program is expected to be self-sustaining post Year 1.

b. Tuition and Fee Revenue

Tuition is calculated with no annual tuition increase. A 10% attrition rate has been calculated.

c. Grants

There are currently no grants etc. at this time.

d. Other Sources of Funds

There are currently no other sources of funds.

3. **Table 2: Expenditure. Finance data for the first five years of the program implementation are to be entered. Figures should be presented for five years and then totaled by category for each year.**

TABLE 2: EXPENDITURES
Courses are taught by adjunct professors.

Expenditure Category	Year 1	Year2	Year 3	Year 4	Year 5
1. Faculty (b + c below)	\$151,000	\$255,000	\$255,000	\$262,650	\$270,529
a. #FTE	1.5	2.5	2.5	2.5	2.5
b. Total Salary	\$127,500	\$212,500	\$212,500	\$218,875	\$225,441
c. Total Benefits (20% of salaries)	\$25,500	\$42,500	\$42,500	\$43,775	\$45,088
2. Admin Staff (b + c below)	\$1,320	\$1,320	\$1,360	\$1,400	\$1,442
a. #FTE	.02	.02	.02	.02	.02
b. Total Salary	\$1,100	\$1,100	\$1,133	\$1,167	\$1,202
c. Total Benefits	\$220	\$220	\$227	\$233	\$240
3. Support Staff (b + c below)	\$3,060	\$3,151	\$6,493	\$6,687	\$6,888
a. #FTE	.05	.05	.1	.1	.1
b. Total Salary	\$2,550	\$2,626	\$5,411	\$5,573	\$5,740
c. Total Benefits	\$510	\$525	\$1,082	\$1,114	\$1,148
4. Equipment	\$500	\$1,100	\$1,550	\$2,100	\$2,450
5. Library	\$0	\$0	\$0	\$0	\$0
6. New or renovated Space	\$0	\$0	\$0	\$0	\$0
7. Other Expenses	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
TOTAL (ADD 1-7)	\$160,880	\$265,571	\$269,403	\$277,837	\$286,309

4. **Provide a narrative rationale for each of the resource categories. If resources have been or will be reallocated to support the proposed program, briefly discuss those funds.**

a. Faculty

Table 2 reflects the faculty hours in total, but this does not imply that these are new hire requirements.

b. Administrative Staff

Capitol Technology University will continue with current the administrative staff through the proposed period of time.

c. Support Staff

Capitol will continue with its current administrative staff through year two. Additional support staff will be added in year 3.

d. Equipment

Software for courses is available free to students or is freeware. Additional licenses for the LMS will be purchased by the university at the rate of \$50 per student per semester. No additional equipment is needed.

e. Library

Money has been previously allocated for additional materials to be added to the on-campus and virtual libraries to ensure currency of literature for graduate studies.

6. New or Renovated Space

No new or renovated space is needed.

7. Other Expenses

Funds have been allocated for office materials, travel, professional development, course development, national and international marketing, and additional scholarships.

M. Adequacy of provisions for evaluation of program (as outlined in COMAR 13B.02.03.15):

The assessment process at the university consists of a series of events throughout the Academic Year. The results of each event are gathered by the University Assessment Team and stored in Canvas for analysis and use in annual reports, assessments, etc. The University Assessment Team analyzes the results, develops any necessary action plans, and monitors implementation of the action plans.

Academic Year Assessment Events:

Fall Semester:

- Faculty submit performance plans consistent with the mission and goals of the university and department. The document is reviewed and approved with the academic dean.
- Department Chairs and University Academic Dean review the Graduating Student Survey data.

- Department Chairs and University Academic Dean review student internship evaluations.
- Department Chairs and University Academic Dean review grade distribution reports from the spring and summer semesters.
- Department Chairs and University Academic Dean review student course evaluations from the summer semester.
- Departments conduct Industrial Advisory Board meetings to review academic curriculum recommendations. The Advisory Board meets to begin curriculum review or address special issues that may arise related to curriculum. Based on an analysis and evaluation of the results, the University Academic Dean, faculty and the advisory boards will develop the most effective strategy to move the changes forward.

NOTE: A complete curriculum review for degrees in the Department of Engineering occurs every 2 years. In most cases, the changes only require that the University Academic Dean inform the CAO and provide a report that includes a justification and the impact of the changes as well as a strategic plan. Significant changes normally require the approval of the CAO and the Executive Council.

- University Academic Dean and Vice President for Academic Affairs attend the Student Town Hall and review student feedback with department chairs.
- Post-residency, the University Academic Dean meets with the faculty to review the student learning progress and discuss needed changes.
- At the August Faculty Retreat, the faculty reviews any outstanding student learning challenges that have not been addressed. The issues are brought to the University Academic Dean for review and development of implementation plans.

Spring Semester:

- Faculty Performance Plans are reviewed with faculty to identify issues of divergence and to adjust the plan as needed.
- Department Chairs and University Academic Dean review grade distribution reports from the fall semester.
- Department Chairs and University Academic Dean review the Graduating Student Survey data.
- Department Chairs and University Academic Dean review student course evaluations from the fall semester and the spring semester (in May before the summer semester begins).
- Department Chairs and University Academic Dean meet to review the content of the graduating student, alumni, and course surveys to ensure the surveys continue to meet the university's assessment needs.
- At Annual Faculty Summit in May, the faculty review and discuss student learning challenges from the past academic year and provide recommendations to the Academic Dean for review and development of implementation plans.
- Department Chairs conduct interviews with potential employers at our Career Fair (this will move to fall and spring in 2016-2017).
- Departments conduct Industrial Advisory Board meetings to review academic curriculum recommendations.

Based on the foregoing inputs from faculty, students, industry representatives and Department Chairs, the University Academic Dean prepares the proposed academic budget for the upcoming year. Budget increases are tied to intended student learning improvements and key strategic initiatives.

In addition to these summative assessments, the University Academic Dean meets with the Department Chairs weekly to review current student progress. This formative assessment allows for immediate minor

changes, which increase faculty effectiveness and, ultimately, student outcomes.

The Faculty Senate meets monthly during August through April. The Faculty Senate addresses issues that impact student outcomes as those issues emerge. The leadership of the Faculty Senate then provides a report on the matter to the University Academic Dean. The report may include a recommendation or a request to move forward with a committee to further examine the issue. In most cases, the changes only require the University Academic Dean to inform the CAO and provide a report that includes a justification and the impact of changes as well as a strategic plan. Significant changes normally require the approval of the CAO and the Executive Council.

Student Learning Outcomes:

Student learning outcomes are measured using the instruments identified above as well as assigned rubrics/measures (e.g. capstone courses, competency exams/projects) dictated by the accreditation requirements of regional accreditor (Middle States Commission on Higher Education) and our degree specific accrediting body (ATMAE). This program is designed to meet the requirements of ATMAE and will be reviewed for accreditation by ATMAE.

N. Consistency with the State Minority Student Achievement goals (as outlined in COMAR 13B.02.03.05 and in the State Plan for Post-Secondary Education):

Capitol Technology University is a majority/minority school. Our programs attract a diverse set of students. Special attention is provided to recruit females into the STEM and multidisciplinary programs such as the B.S. MCIT, M.S. CIT, M.S. ISM, D.Sc., and Ph.D. in Management and Decision Sciences. The same attention will be given to the Ph.D. in Technology.

O. Relationship to low productivity programs identified by the Commission:

This program is not associated with a low productivity program identified by the commission.

P. If proposing a distance education program, please provide evidence of the Principles of Good Practice (as outlined in COMAR 13B.02.03.22C):

a. Curriculum and Instruction

Some courses in this concentration will be offered in an online classroom environment as well as in hybrid (synchronous and traditional classroom).

i. A distance education program shall be established and overseen by qualified faculty.

The Department of Engineering, where this degree will be sponsored, is staffed by qualified teaching dean and chair, and other appropriately credentialed faculty.

Evaluation of courses/programs are done using the same process as all other programs. (Please see section M of this document.). All Capitol faculty teach in the traditional classroom environment and online. (Please see qualifications in Section I of this document.)

- ii. A program's curriculum shall be coherent, cohesive, and comparable in academic rigor to programs offered in traditional instructional formats.**

Online programs/courses meet the same accreditation standards, goals, objectives, and outcomes as traditional instruction at the university. The online course development process incorporated the Quality Matters research-based set of standards for quality online course design to ensure academic rigor of the online course is comparable to the traditionally offered course. The dean, chairs, and faculty review curriculum annually. Courses are reviewed at the end of each term of course delivery. This process applies to online and traditional courses. In addition, advisory boards are engaged in the monitoring of course quality to ensure quality standards are met regardless of the delivery platform.

- iii. A program shall result in learning outcomes appropriate to the rigor and breadth of the program.**

Online programs/courses meet the same accreditation standards, goal, objectives, and outcomes as traditional classroom delivery. Learning platforms are chosen to ensure high standards of the technical elements of the course. The dean monitors any course conversion from in-class to online to ensure the online course is academically equivalent to traditionally offered course and that the technology is appropriate to support the expected rigor and breadth of the programs courses.

- iv. A program shall provide for appropriate real-time or delayed interaction between faculty and students.**

The program courses will be delivered in a format using Adobe Connect and the LMS Canvas. This system supports both synchronous and asynchronous interaction between faculty and students. Some of these class may also be in hybrid (online real-time and traditional classroom) format.

- v. Faculty members in appropriate disciplines in collaboration with other institutional personnel shall participate in the design of courses offered through a distance education program.**

Currently employed faculty acts as an internal advisory board for program changes including course and program development. All faculty are selected on domain experience and program-related teaching experience.

When new faculty or outside consultants are necessary for the design of courses offered our Human Resources Department initiates a rigorous search and screening process to identify appropriate faculty to design and teach online courses. Again, all faculty are selected on domain experience and program-related teaching experience.

b. Role and Mission

- i. A distance education program shall be consistent with the institution's mission.**

Distance education is consistent with the institution's mission. Please refer to Section A (page 2) of this proposal.

ii. Review and approval processes shall ensure the appropriateness of the technology being used to meet the program's objectives

The dean and department chairs are an integral part of the curriculum approval process. The dean, chairs and faculty are participants in any new institutional technology changes. The dean approves technologies brought into the classroom by faculty to ensure compatibility with existing technology as well as with course and institutional objectives.

c. Faculty Support

i. An institution shall provide for training for faculty who teach with the use of technology in a distance education format, including training and learning management system and pedagogy of distance education.

The Department of Distance Learning and the instructional technology division support the online program needs of faculty and students. These departments and the help desk provide constant and on-going support to the faculty. The Canvas portion of the program is the online learning management system. When a new faculty member is assigned to teach an on-line course, the distance learning department provides formal training for that instructor. New faculty are assigned an experienced faculty mentor to ensure a smooth transition to the online environment as well as to ensure compliance with the institution's online teaching pedagogy. The university believes this provides the highest-level learning experience for students and faculty.

ii. Principles of best practice for teaching in a distance education format shall be developed and maintained by the faculty.

The Distance Learning Department, in conjunction with the dean and an assigned mentor, provide on-going support and instruction on best online practices. Best practices are shared among faculty by the dean and chair as well as through formal events. There are also several texts in the library available to the faculty, which cover distance learning techniques and technology.

iii. An institution shall provide faculty support services specifically related to teaching through a distance education format.

As mentioned previously, the university online platforms offer several avenues to support instructors engaged in online learning. The Director of our Distance Learning Division is highly skilled and trained in faculty development. Several seminars and online tutorials are available to the faculty every year. Mentors are assigned to new faculty. Best practice sharing is facilitated through the dean and chair and through formal meetings.

d. An Institution shall ensure that appropriate learning resources are available to students including appropriate and adequate library services and resources.

Students can receive assistance in using online learning technology via several avenues. Student aides are available to meet with students and provide tutoring support in both subject matter and use of the technology. Tutors are available in live real-time sessions using Adobe Connect or other agreed upon tools. Pre-recorded online tutorials are also available.

In addition to faculty support, on ground and online tutoring services are available to students in a one-on-one environment.

Laboratories (on ground and virtual) are available for use by all students and are staffed by faculty and tutoring staff who provide academic support.

Library services and resources are appropriate and adequate. Please refer to Section J (page 24) of this document and the attached letter from the university president, the library adequately supports the students learning needs.

e. Students and Student Services

- i. A distance education program shall provide students with clear, complete and timely information on the curriculum, course, and degree requirements, nature of faculty/student interaction, assumptions about technology competence and skills, technical equipment requirements, learning management system, availability of academic support services and financial aid resources, and costs and payment policies.**

Students are provided support identical to traditional on campus students as the technology is utilized by all our students. Curriculum, course and degree information are available on the university website and via e-mail and mail by request. The expectations as it pertains to the faculty/student interaction are available to students during virtual open house events, literature, website, etc. In addition, this information is part of the material distributed for each course. Students receive guidance on proper behavior/interaction in the online environment to facilitate a high-level learning experience. Computer requirements are listed on our website and are provided to students in the welcome package. Students are provided a list of departmental services and contacts. Students may request special/additional training to include one-on-one training. In addition, training videos are available in Capitol Technology University's student web portal.

- ii. Enrolled students shall have reasonable and adequate access to the range of student services to support their distance education activities.**

Students have access to the same services as traditional on ground students. Some of these services are facilitated via such tools as Skype. For instance, distance students attend job fairs via Skype facilitated by an assigned campus representative. In addition, training videos are available in Capitol Technology University's student web portal.

- iii. Accepted students shall have the background, knowledge and technical skills needed to undertake a distance education program.**

Students are required to have the same skills as tradition on ground students. Training is available for students to familiarize them with the tools of the distance learning system.

- iv. Advertising, recruiting and admissions materials shall clearly and accurately represent the program and services available.**

Advertising, recruiting, and admissions materials do clearly and accurately represent the program and the services available.

f. Commitment and Support

- i. Policies for faculty evaluation shall include appropriate considerations of teaching and scholarly activities related to distance education programs.**

All faculty, including online faculty, are strongly encouraged to participate in at least one or two professional development opportunities to improve online teaching skills. Faculty are highly encouraged to share their experiences with fellow faculty as well as through publications and presentations. These factors are considered in the annual goals and objectives of faculty and, therefore, are considered in evaluation of performance for promotions, etc. Scholarly activities are recognized in formal university publications. Funding in the annual budget is provided for conferences in support of scholarly activities. Faculty meetings and colloquiums provide opportunities to share best practices among faculty. This includes online faculty. In addition, all faculty are offered the opportunity to attend the annual graduation ceremony and attend the annual faculty residency training event at the expense of the university.

- ii. An institution shall demonstrate a commitment to ongoing support, both financial and technical, and to continuation of a program for a period sufficient to enable students to complete a degree or certificate.**

The university has made the financial commitment to the program. (Please refer to Section L.) The university has a proven track record of supporting degree completion.

g. Evaluation and Assessment

- i. An institution shall evaluate a distance education program's educational effectiveness, including assessment of student learning outcomes, student retention, student and faculty satisfaction and cost-effectiveness.**

The university applies the same evaluation standards and processes to all degree programs at the institution. (Please see Section M, page 30, for an in-depth process description.)

In the Department of Engineering, where this program will be sponsored, evaluations are done at the course level, student level, curriculum level, and faculty level as well as other stakeholder groups.

Assessment is based on the integration of all the above items as appropriate. Changes are developed and implemented by the faculty responsible for the courses upon approval of the dean. At the end of this cycle, an evaluation is repeated and results analyzed with the appropriate stakeholders regarding the effectiveness of the changes. This is an ongoing process. The university has a vice president and team in charge of outcomes and assessment supporting formal assessment measures.

- ii. An institution shall demonstrate an evidence-based approach to best online teaching practices.**

Capitol Technology University has established a course/program matrix, which requires faculty to report student outcomes and suggestions for improving student performance. The university complies with the requirements of its accrediting bodies regarding

outcomes/evidenced based accreditation (Middle States Commission on Higher Education, ABET, IACBE, and NSA/DHS). The university is in good standing with all its accrediting bodies.

iii. An institution shall provide for assessment and documentation of student achievement of learning outcomes in a distance education program.

The assessment for distance learning classes/students is the same as for all programs at the university. Faculty provide required data on student achievement. The Learning Management System provides data on student achievement. Proof of these assessments is available during the class and post class to the VP of Academic Affairs, dean, and department chairs. On an annual basis, the information is reported to accreditation authorities such as Middle States Commission on Higher Education, IACBE, ABET, and NSA/DHS. The same requirement will occur with ATMAE for this program.