5-Year Report for Master of Cybersecurity & Leadership
University of Washington Tacoma
Institute of Technology
Milgard School of Business

Prepared for the UW Graduate School
Office of Academic Affairs & Planning

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1. Overview

The Master of Cybersecurity & Leadership Program (MCL) at UW Tacoma's goal is to develop leaders who can effectively identify and promote solutions that protect an organization's cyber systems. It is designed for professionals and military personnel with technical backgrounds and work experience. The MCL program leverages the resources of the Institute of Technology and the Milgard School of Business to provide students with strong technical backgrounds and leadership skills for career advancement in the field of cybersecurity.

The MCL is a non-thesis, 40 credit-hour cohort based program that balances a technically-oriented curriculum focused on understanding the basic operations and functionality of cybersecurity systems and information assurance with a more behaviorally-oriented curriculum focused on the management of technical professionals and organizational leadership. Eight 5-credit courses are offered over four quarters commencing in Autumn 2014. They are Business Essentials, Networking and Internet Security, Principles of Cybersecurity, Leadership and Team Dynamics, Information Assurance, Risk Management and Security Strategies, Strategic Organization Change, Cybersecurity Management, and Project Management. Each quarter, students take two 5-credit courses. One course is taught by the Milgard School of Business faculty and the other course is taught through the Institute of Technology. These courses set the foundation for students to complete a team-based capstone challenge project with a local organization in the final quarter of the program.

MCL graduates leave with a practical understanding of operational cybersecurity, including the principles of data protection, network security, and information assurance, as well as the skills to manage technical professionals and lead strategic change in their organization.

2. Faculty

MCL faculty mainly consists of full-time faculty from the Institute of Technology and the Milgard School of Business who are specialized in Internet, computer and network security, information assurance, risk management, organization behavior, information systems and operations management, business communication, and marketing:

Bai, Yan, Ph.D.	Associate Professor, Institute of Technology
Barsness, Zoe, Ph.D.	Associate Professor, Milgard School of Business
Costarella, Charles, M.S.	Lecturer, Institute of Technology
Demirkan, Haluk, Ph.D.	Professor, Milgard School of Business
Grant, DC, M.S.	Lecturer, Institute of Technology
Goda, Bryan, Ph.D.	Professor, Institute of Technology
Nelson, Kent, Ph.D.	Senior Lecturer, Milgard School of Business
Sivadas, Eugene, Ph.D.	Professor, Milgard School of Business
Thompson, Tracy, Ph.D.	Associate Professor, Milgard School of Business

3. Students

Applications, Offers, Admissions

Table I shows the number of applicants, offers, students admitted, and graduates of MCL by academic year.

Table I. MCL Student Enrollment Date

MCL	Applicants	Offers	Enrolled	Graduates
AY 2013-14	45	33	30 SUM	-
			28 AUT	-
			27 WIN	-
			27 SPR	26
AY 2014-15	39	25	23 AUT	01
			22 WIN	-
			22 SPR	-
			22 SUM	20
AY 2015-16	53	52	38 AUT	-
			40 WIN	02
			35 SPR	-
			34 SUM	32
AY 2016-17	54	35	25 AUT	-
			26 WIN	01
			26 SPR	-
			26 SUM	26
AY 2017-18	54	45	33 AUT	-
			32 WIN	-

Graduates

Up to now, we have granted 108 MCL degrees.

Number and Progress of Students

This year we have 33 students enrolled in the MCL program. 32 students earned 10 credits in Autumn 2017. One student was put on academic probation for Winter 2018 due to incomplete course work because of a family issue.

Student Placements

Table II shows our MCL graduates' current work positions based on informal surveys and Linkedin pages. Some of our MCL graduates are working as cybersecurity technical managers and leaders in top companies, such as Boeing, Amazon, T-Mobile, Intel, City and State Government Agencies, and our Military.

Table II. MCL Student Placement

Company	Title
7 Cedars Resort	System Security Administrator
ACI Edge	Systems Engineer
Aetna	IAM Security Analyst
Air Force Reserves	Maintenance Officer/Flight Commander
Air National Guard	Mission Training Officer for Cyberspace Operations Squadron
Amazon	Technical Program Manager
Amazon Web Services	Technical Account Manager
Avanade	Business Analyst Lead
AVID Center	Technology Infrastructure Architect
Boeing	Computer Security & Information Protection Specialist
	Cyber Security Architect
	Configuration Management Analyst
	Information Security Architect
	Business Systems Manager
Catalysis	Database Administrator
Child Care AWare of Washington	IT Systems and Database Administrator
City of Redmond	Network Analyst
City of Tacoma	Senior IT Analyst
	Chief Information Security Officer
Continuant	Corporate Systems Manager
Consolidated Technology Services	Security Infrastructure Engineer

Department of Transportation	CyberSecurity and Information Technology
Department of Labor and Industries	IT Project Manager
DXC Technology	Info Systems Security Manager
ERNwest	IT Manager
Fidelity Technology	Network Engineer and Security Consultant
GRC at Optive INC	Security Consultant
Hope Academy	Principal
IBM	Security Consultant
Infoblox	Associate Software Developer
	Fraud Analyst
Integrated Auction Solutions	Quality Assurance Engineer
Intel	Network Support Specialist
	Enterprise Information Security, Senior Software Engineer/Architect
King County	Information Assurance Consultant
Madigan Army Medical Center	Correspondence Technician
Microsoft	Digital Advisor
MultiCare Health System	IT Associate - Intern
PCC Aerostructures	System Manager
Pierce Transit	Assistant Manager Network & Security
Pittman Consulting, LLC	Business Owner
REI	Cyber Threat Engineer
Reserve bank of Atlanta	Information Security Specialist
S&K Global Solutions, LLC	IT Specialist
Smartsheet	Security Solutions Engineer
Special Operations Joint Task Force	ISR Collection Manager
Staples	Technician
Subsentio LLC	Chief Engineering and Chief Information Security Officer
Succeed to Lead, LLC	Cybersecurity Instructor/Writer/Developer
Tacoma Public Utilities	Critical Infrastructure Protection Lead
	Communication Security Technician
T-Mobile	Associate Engineer, SystDesign & Strategy
	Principal Engineer: Cyber Security and Compliance
	Senior IT System Analyst
Travelers	Business Systems Specialist
US Customs and Border Protection	Management and Program Analyst

US Air Force	Network Intelligence Analyst
US Navy	IT Specialist
	Project Manager
University of Washington	Extension Lecturer
US Army	IT Manager and Network Administrator
	Battalion Communications Officer
	Project Manager
	Captain
US Department of Housing and Urban Development	Director of Information Technology
VA Office of Strategic Integration/Center for Applied Systems Engineering PMO Office	Deputy Associate Director
Washington State Department of Health	Information Security Risk Manager

Student Surveys

Responses from surveys we conducted in Academic Years 2015-16 and 2016-17 from MCL capstone challenge project partners, such as Tacoma Power Utilities, Microsoft, Boeing, City of Tacoma, and F5 Networks, was favorable, indicating that our students have achieved very good cybersecurity, communication, and leadership skills.

Differences from expectations in the proposal

In the original proposal, we projected the enrollment numbers listed below.

Table IV. Enrollment Target

Year	1 2013	2 2014	3 2015	4 2016	5 2017
Headcount	24	30	40	50	50
FTE	24	30	40	50	50
Program Graduates	21	27	36	45	45

On average we have about 30 enrolled per year, but there are some fluctuations from one year to another.

4. Changes to the Program since its Inception, including

Administration

The MCL degree is housed within the Institute of Technology, which is transitioning to a School at UW Tacoma in 2017. The MCL organization's structure was changed from one Program Director in the Institute of Technology overseeing the academic program to Co-Program Directors from both schools for the duration of the Academic Year 2016-17.

Curriculum

When the MCL program was created in Academic Year 2013-14, it was set up as five 8-week modules, but due to scheduling problems the format has changed to eight 5-credit courses which have run on the quarter system since Academic Year 2014-15. One major difference includes the addition of a business essentials course; this is a brand new course which is a lift from the business program's week-long seminar for business executives. Another change is the tailoring of the program toward the final capstone project courses including: Cybersecurity Management (TCL 570) and Project Management (TCL 580). Other than these two changes, 80 percent of the program remains the same.

Faculty

Since MCL degree program was launched in Academic Year 2013, courses in leadership are mainly taught by full-time faculty members from the Milgard Business School. While courses in IT and Cybersecurity were first taught by the Institute full-time faculty members in Year 1, the majority of courses were taught by part-time instructors in Years 2 and 3, and partly so in Year 4. Finally, in Year 5 teaching was conducted by full-time faculty members in the Institute again.

Staff

Staff for the MCL program includes Curtis Black (Graduate Program Advisor and Recruiter). Other degree support (administrative and fiscal) is mainly received from the Administrator and Director of Operations of the Institute of Technology.

Budget or Resources

Table III. MCL Budget by Year

Year	Revenue	Expenses
AY 2012-13	$145K	$9K
AY 2013-14	$397K	$298K
AY 2014-15	$439K	$300K
AY 2015-16	$668K	$560K
AY 2016-17	$509K	$314K

Table III shows overall revenue and expense from Years 0 to 4. Without increasing tuition over the past five years, MCL program's fiscal reserves indicate that we have sufficient net revenue for hiring more faculty and staff to offer more classes/sections, and provide increased academic and professional support to our students.

5. Progress of the Program

As outlined in the original proposal, the MCL program provides a thorough knowledge base for managers and technology leaders concerned with the design, development, implementation, operation, and management of systems, and with the protection of an organization's information asset. The MCL learning objective and outcome assessment for the 8 MCL courses overseen by MCL teaching faculty members over the past four years show that our MCL students have achieved the following learning goals outlined in the program proposal.

1. Are fluent in concepts and terminology appropriate to a leader in cybersecurity, and are able to communicate effectively orally and in writing in professional settings;
2. Are able to evaluate a range of cybersecurity events, including those of major scale, evaluate the business impact, determine risk posture and develop effective responses, and are able to use risk assessment concepts and methodologies to determine proactive measures in protecting organizations from critical data exposure.
3. Understand how to launch and assess organizational change initiatives, how to effectively lead and manage teams, and work effectively within an interdependent group to achieve common goals.

The MCL program has been actively recruiting and supporting traditionally underrepresented minority students. The number of MCL students who are African American has doubled. We have seen continuous increases in the number of Hispanic and female students since its inception in 2013. Since 2017, we have been a member of the Academic Alliance of the National Center for Women & Information Technology (NCWIT) and committed to collaborative efforts on increasing the focus on recruiting and retaining more talented women and underrepresented groups in the technology field. In 2018, we are supporting five Women students' attendance to WiCys 2018, a NSF/Industry/Academically-supported main conference in the nation to further the growth, networking and mentoring of women within the cyber field.

Generally, the MCL program has grown healthily. One indication is that the UW Tacoma Milgard School of Business program was extended accreditation for the undergraduate and master's degree programs in business, including MCL, for an additional five years by AACSB International - The Association to Advance Collegiate Schools of Business - in 2016. This year we have successfully partnered with University of Colorado in Colorado Springs and created an agreement allowing our MCL graduates to directly transfer into their Ph.D. in Engineering Concentration in Security program.

6. Challenges

Challenges Addressed/Being Addressed

1) Admission and Enrollment

    a. We changed admission criteria based on our applicant demographic information over the past 5 years. Specifically, we now require preferred candidates to have a minimum of four years of work experience, instead of having a minimum of three years of supervisory and/or leadership work experience.

2) Student effectiveness and support

    a. For admitted students with little or no technical background but many years of leadership/management experience in a cyber-related field, we offer Tech Bootcamp to boost up their technical background to help them smoothly transit into the MCL program. We have successfully organized two summer camps for the 2016-17 and 2017-18 MCL cohorts.
    b. We developed two new courses: TCSL 601 Internship and 600 Independent Study. These courses allow students to submit a petition to substitute one of the 8 courses through these two courses. It is suitable for students who qualify for a waiver due to academic background and/or industry experience in the subject matter of one of the 8 MCL courses, but wish to build their knowledge by taking a different class in a related area. Moreover, given that the MCL is a lock-step, cohort based program, each class in the existing curriculum is only offered one time per year. Consequently, students who fail a class must wait an entire year to retake it. Adding these two new courses has positive impacts under very specific and infrequent circumstances.

3) Faculty composition

To meet the requirements for the Milgard School of Business AACSB accreditation and more importantly, from the MCL student feedback on demanding more interactions and guidance from the instructors, and more hands-on laboratory experience to strengthen their technical skills in cyber, all Cyber courses offered this year by the Institute of Technology are taught by full-time faculty members.

Challenges Anticipated in the Next Five Years

1) Refine the focus of program and appropriate governance structure

   - The MCL program's leadership has changed three times over a 5-year period, including transitioning from one Program Director in the Institute of Technology overseeing the academic program to Co-Program Directors from the Institute of Technology and Milgard School of Business. It affects program involvement directly and indirectly, such as discrepancy in admission and enrollments, instability in the instructional resources of the Institute of Technology within the young MCL program, and continuous curriculum refinement.
   - Job placement data in Table III shows that MCL alumni are mainly working as managers and technology leaders in specific aspects of software security, application security and operation security; Few focus on the strategic plan and management of an entire organization's security and cyber systems. This raised a question — does the current 4 + 4 course model that equally distributes course offerings between the two schools provide MCL students with sufficient skillsets that current cyber jobs' need?

2) Faculty resources

   - The MCL program was established five years ago. No request for a teaching faculty position has been submitted before. The MCL courses are taught by existing faculty members from other academic programs. Those faculty members have been overloaded over the past couple of years. With an increase in the demand for a large

cyber security workforce in the region and nation, faculty and staff support specifically for this program has become an urgent need.

7. Goals

1) We will work on recruiting high-quality full time faculty members to instruct MCL courses. As the MCL program continues to grow, we will recruit more staff to support students' career development.
2) We plan to work on establishing articulation agreements with local universities and colleges which provide their graduates with a seamless transfer experience into our MCL program so as to steadily increase our enrollment.
3) We will more actively recruit and retain women and underrepresented students in the cybersecurity field.
4) A different model for course delivery (hybrid or online) is being considered due to large percentage of commuter students and ever-increasing I-5 traffic.

8. Appendices

1) Original MCL degree program proposal

2) Milgard AACSB accreditation in 2016

3) MCL Course Master Syllabi