Preparing Future Generations for Executive Leadership Roles in Technical Organizations

Mr. Richard (Rick) Warren Blank, Johns Hopkins Engineering for Professionals

Richard W (Rick) Blank, B.A., B.S., M.S. Mr. Blank is a Lecturer in the Engineering for Professionals Master of Engineering Management Program at the Johns Hopkins Whiting School of Engineering. In this program he teaches Planning & Managing Projects; Finance, Contracts, & Compliance for Technical Professionals; Strategic Communications in Technical Organizations; and Executive Technical Leadership. He also holds an appointment as the Engineering for Professionals Corporate Engagement Lead. In that role he enables connections between corporations/agencies and Johns Hopkins to collaborate on advancing the skills of their employees. He was previously the MEM Program Manager.

Mr. Blank was appointed an adjunct instructor at the Whiting School of Engineering in January 2009, after joining the Johns Hopkins Applied Physics Laboratory (APL) in October 2006. Until his retirement from APL in September 2021, he held leadership roles as APL's Deputy Chief Quality Officer, served as the Chief of Strategy for the Force Projection Sector, lead program managers as the Deputy Business Area Executive for Undersea Warfare, and was the Ocean Data Acquisition Program Manager delivering acoustic and non-acoustic systems to the US Navy submarine fleet. From 1975 to 2006, Mr. Blank served in a variety of executive leadership and engineering positions for Rockwell Collins including Senior Director of Programs, Director of Engineering Processes, Director of International Joint Ventures and Alliances, Program Manager, Marketing Manager, and Systems Engineer. He has contributed to communications, navigation, and flight management system solutions for both commercial and military applications.

Mr. Blank received a Master of Science degree in Engineering / Applied Science from the University of California, Davis in 1975; a Bachelor of Science degree in Mathematics in 1973; and a Bachelor of Arts degree in Physics in 1973 also from the University of California, Davis. He has completed executive seminars in International Strategy Development from the Thunderbird University, the Executive Development Program from the University of Iowa, and Contract Finance for Program Managers at the Defense Systems Management College. Mr. Blank has authored or co-authored four technical papers; his article, "The NAVSTAR Global Positioning System," was published in Signal Magazine, November 1986 edition; he co-authored the paper "Putting Engineering Management on the Executive Track", presented at the American Society for Engineering Education, June 29, 2016; and moderated the Panel Session Translating Engineering Management from the Classroom to the Workplace at the ASEE National Conference June 6, 2023. He was also recognized with the Johns Hopkins Engineering for Professionals Distinguished Instructor Award for 2022-2023.

Mr. Stanislaw Tarchalski, The Johns Hopkins University

StaÅ Tarchalski is a retired senior executive with more than 30 years of progressive responsibility and experience in leading strategic business planning and execution, large/complex program development and management, technical leadership and systems e

PREPARING FUTURE GENERATIONS FOR EXECUTIVE LEADERSHIP ROLES IN TECHNICAL ORGANIZATIONS (Practice Paper Category)

Abstract

To meet the challenges and opportunities of educating new generations of engineering leaders for jobs of the future, Engineering Management programs must evolve with a strategy that integrates academic education with workplace application. That strategy must address the changing demographics of technical industries and their workforces. We can meet that challenge by unifying technical leadership fundamentals into an applied experience, internalizing engineering management coursework with a real-life technical leadership scenario that is applicable across industries.

Education research[1] shows that working professional students learn best through case studies, active learning, and project-based activity. This paper describes how the Johns Hopkins part-time Master of Engineering Management program builds on this approach by recruiting faculty who are senior executives from industry. These faculty apply their experience to drive nuanced critical thinking in a team-based real-world scenario. The paper further describes the course evolution from its first offering in 2015 by adapting specific adult-learning techniques such as retrieval practice, problem solving, critical thinking, cross-discipline collaboration, and relevance to working professional careers.

In this capstone course we take this approach to another level by inviting practicing senior executives from industry and government to role play a board of directors in a strategic, global investment scenario. Students acting in the roles of senior technical executives present a technical strategy and implementation plan where they assess the wants/needs of customers, the company's technical competitive position, make-buy choices, acquisition of critical technology, and technical organization integration to meet the company's strategy that evolves over the fourteen-week semester. The visiting senior executives then become the students' mentors, evaluators, and coaches for a day long experience of "walking in the shoes of senior technical executives". Capstone Day concludes with a visiting executive roundtable.

This paper describes how this course, as part of the Johns Hopkins Master of Engineering Management, integrates critical EM topics through the lens of the technical executive. It addresses leadership and organizational management, strategic planning, financial resource management, project management, make-buy supply chain management, management of technology, etc. In addition, this paper touches on how this course connects with our MEM program organization, outcome assessment, and program/course effectiveness. It simulates workplace application of engineering management skills and concepts with educational implications (including academic and industry collaboration). The instructors integrate their engineering management education success stories, innovative teaching practices, and combined asynchronous and synchronous learning networks with industry diversity.

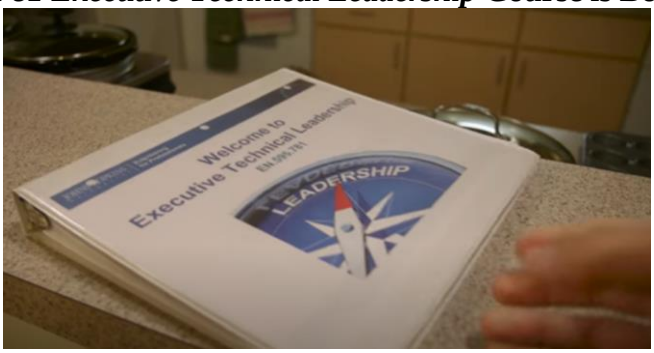
This course was first described at the ASEE National Conference, June 2016. Today's paper also addresses how the course has evolved responding to student feedback, changing student demographics, and MEM program restructuring.

Introduction

Do you have a course that prepares me for senior leadership roles in technical organizations? And how have those leadership roles and your courses evolved to address the challenges and opportunities of educating new generations of engineering leaders for jobs of the future? These questions have been asked by many of our working professional part-time Master of Engineering Management students. They are not looking for their first job out of college; they are looking to advance into leadership roles in their professional career, and maybe even to senior executive positions. They are also looking for their education experience to respond to the changing demographics of their peer students and to provide an opportunity to share perspectives on how technology is changing organizations' environments that must be dealt with by those organizations' technical executives. While in 2015, the simple answer was "NO", we recognized the need to give working professional students a glimpse into those leadership roles. And we have continued to evolve our *Executive Technical Leadership* course by unifying technical leadership fundamentals into an applied experience, internalizing engineering management coursework with a real-life technical leadership scenario that is applicable across industries.

A typical graduate level course consisting of lectures, text, leadership articles, homework, and exams would not fit the bill. Senior leadership roles in technical organizations require a combination of technical knowledge, management skills, leadership behavior, and most importantly -- critical thinking applied in the context of a technical organization's strategic and implementation challenges. So in Fall 2015, our course, *Executive Technical Leadership* was born (see Exhibit 1).

Exhibit 1. Johns Hopkins Engineering for Professionals
***595.781 Executive Technical Leadership* Course is Born**[2]



And it has continued to evolve by adapting to student constructive feedback, embracing research-based teaching techniques specifically tailored for the adult learner, and including opportunities to "rub elbows" with real-world technical executives who are living the roles our students aspire to.

Background

In the late 1970s, the Johns Hopkins University and the Applied Physics Laboratory, led by systems engineering pioneer Alexander Kossiakoff, had the vision for the creation of a new master's degree program in technical management, the forerunner today's Engineering for Professionals Master of Engineering Management (MEM) degree. There are no "full-time" instructors in this program. Rather, instructors are working professionals in their respective

fields, enabling them to provide students with in-depth, first-hand experience-based knowledge. The focus of this program is to provide the aspiring technical leader with a combination of management, leadership, and technical skills to better prepare them for leadership roles in technical organizations. And what's important about the pedigree of our instructors is that they are able to answer a common student question: "how did you become a senior executive and what steps were needed to attain that role?" Our instructors use the classroom environment to share a lot of "scar-tissue" on the path to senior leadership, a key differentiator of our MEM program.

All MEM students receive a grounding in management, leadership, and communication skills by taking the same five (5) core courses. They then choose from eighteen (18) technical tracks from other Engineering for Professionals master's degree programs to complete their the ten (10) course requirement. This provides a mix of leadership and management skills while also advancing their technical studies at the graduate level (see Exhibit 2).

Exhibit 2. Johns Hopkins Engineering for Professionals
MEM Degree Combines Leadership, Management, and Technical Tracks

As shown in Exhibit 2, the current core curriculum includes the course *595.781 Executive Technical Leadership.* This was not always the case. As part of the evolution of our MEM curriculum, in 2013 we conducted an in-depth analysis of existing engineering management programs throughout the United States to understand current trends in curriculum, course format, program structure, and student demographics. Our assessment is summarized in Exhibit 3.

Exhibit 3. MEM Market Analysis Reveals Gap in Executive Leadership Curriculum[2]

University	Online	Face-to-Face Instruction	Blended (Online & In Person)	Part Time	Full Time	Executive Track	Practitioner Faculty	Target Student (Early, Mid, Exec)
1	No	Yes	No	No	Yes	No	No	Early
2	No	Yes	No	Yes	Yes	No	No	Early
3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Mid, Exec
4	No	Yes	No	No	Yes	No	No	Early
5	No	Yes	No	No	Yes	No	No	Early
6	Yes	Yes	No	No	Yes	No	No	Early
7	Yes	Yes	Yes	Yes	Yes	No	Yes	Mid
8	Yes	Yes	Yes	Yes	Yes	No	No	Mid
9	No	Yes	No	No	Yes	No	No	Early
10	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Mid, Exec
11	No	Yes	No	No	Yes	Yes	Yes	Exec

This study revealed little academic focus on executive leadership development (Executive Track highlighted column in Exhibit 3), particularly the interaction with and eventual career paths of technical professionals into executive leadership positions. The role of an executive technical leader is not formulaic; it is not a sequential set of activities or a prescriptive process. There are major areas of market, customer, business environment, competition, innovation, process, infrastructure, people, organization, governance, finance, contracts, organizational change, and leadership that are essential for the executive to understand and execute for success. Further, these areas have tight interrelationships among them, and also with nontechnical disciplines such as finance, marketing, and sales.[2]

In addition to our own market analysis, we continued to receive student requests for clarification of the senior technical leader's role. Frequent questions were: *How did you become a senior technical leader? What capabilities do you need to be a successful technical leader? What knowledge, education, and work experiences did you need? What is involved in being a technical leader and what was your role? What were the challenges and difficulties that you faced? How is being a senior technical leader different from being a technical staff member or middle manager?*[2]

595.781 Executive Technical Leadership is Born

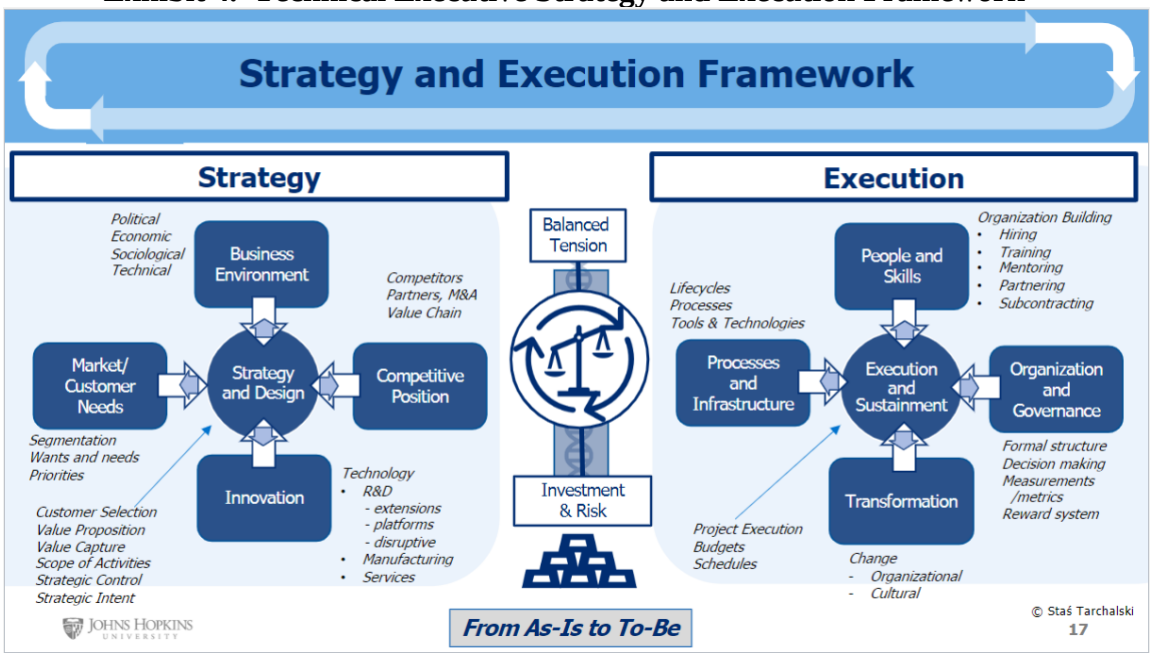
Responding to this need, **i**n Fall 2015, the Johns Hopkins University Whiting School of Engineering introduced the new *Executive Technical Leadership* course in its Engineering for Professionals MEM program -- filling a critical gap in traditional engineering management curricula as well as in most MBA study tracks.

As the capstone within the Johns Hopkins Engineering for Professionals MEM, the course was designed to give students a deep understanding of various technical executive roles using a combination of learning methods, ranging from framework-based concepts to case-based application of the concepts in a simulated business/technical leader environment -- essentially providing students an opportunity to practice the senior technical leader role in a "safe" environment.

The *Executive Technical Leadership* course framework is based on a compendium of timeless concepts and applied practices developed by thought leaders from notable institutions such as Harvard Business School, MIT/Sloan, Stanford, and numerous others, as well as the lead instructors' experiences as senior executives in aerospace, commercial, and research careers. Unlike traditional online courses that include textbook reading, homework assignments, midterm/final exams, and/or a semester project, the instructors recognized they needed to design the course around an opportunity for students to "live in the shoes" of a senior technical executive. The instructors also recognized the course needed structure, so its design included these key features:

- A strategy and execution course framework providing anchor points for key concepts (see Exhibit 4).

Exhibit 4. Technical Executive Strategy and Execution Framework[3]



Each focus area is an anchor point for key concepts and best practices that the student learns through lectures, supporting readings authored by critically acclaimed thought leaders, and videos of prominent technical leaders either speaking about their perspectives and experiences or captured in their daily roles as senior executives. While the organization of the framework may give the impression that there is a natural order or sequence of activities, it is important for the student to understand that these focus areas are developed largely in parallel, with continuous iteration and interaction.

- The students apply what they have learned in a continuous, iterative simulated scenario environment where, assembled into teams, they play the roles of - technical executive leaders, guided by the course instructors. Initial offerings of the course had the student teams play the roles of VP of Engineering and VP of Manufacturing.
- A fictional, but based-on a real-life scenario was written to provide the student teams an opportunity to apply critical thinking to decisions made in their technical executive role. We created a medium-sized company and provided enough detail in its profile to enable the students to apply the challenges of each assignment to this fictional setting. The company

named TDI was founded in the late 1960s by a mechanical engineer who served in the army during the Vietnam War. It grew over the next 50-years to approximately 500 employees and $60M in sales from military shelters, enclosures, high mobility special forces vehicles, and simple electro-mechanical robots, the latter being part of a TDI acquisition. TDI's CEO recognized that in order for the company to flourish and grow, it would need to expand beyond currently served market segments and product offerings. With its small success in robotics, TDI looks to enter into the expanding demand for robots across applications such as hazardous operating environments (e.g. military applications, disaster recovery), healthcare, and industrial (e.g. manufacturing, warehouse operations). TDI recognized that to address these applications, it needs to add software, vision recognition, and artificial intelligence capabilities it does not have. These new technical areas place new skills and capital equipment demands on both the Engineering and Manufacturing parts of the company. Furthermore, the new targeted markets and products require rapid and dependable technical services capabilities.

- The scenario evolves throughout the 14-module course with the first-half of the semester raising strategic questions for the technical executives and the second-half focusing on their implementation plans for the decisions they have to make. As an example, Module 2 focuses on Market and Customer needs through the lenses of technical executives. The student teams are given a tool called $APPEALS (see Exhibit 5) to assess items important to the customer such as price ($), assurances, performance, packaging, ease of use, availability, life cycle cost, and social acceptance. Students then apply the results of their analysis to each of the three market segments mentioned above and interpret the implications for their respective functional areas. For example, consider price: assess the importance of a conceptual product for each of the applications (hazardous operating environment, medical, and industrial) and then identify a "target design to unit production cost" -- a decision for which both the Engineering and Manufacturing executives would be responsible. The objective is to provide a technical executive view of what's important to customers to help make strategic decisions on whether to pursue these new opportunities.

Exhibit 5. $APPEALS – View Through the Lens of the Technical Executive[3]

$APPEALS -- View Through the Lens of the Market/Customer	
$ Price	Price the market/customer is willing to pay
Assurances	Reliability, safety, support, and quality
Performance	Technical performance requirements
Packaging	Visible attributes
Ease of use	User friendly, ease of maintenance and repair
Availability	Buying experience, product/system up time, spares
Life cycle cost	Total cost including acquisition, sparing, training, repairs
Social acceptance	Cultural comfort and receptive to use the product/system

- This is where the delivery of the course and the role of the instructors are important. As student teams apply the concepts and tools presented in the course, they grow in their experience of addressing issues and making decisions from the executives' perspectives. Acting more like consultants than lecturers and homework graders, the instructors help the students grow from individual contributors to seeing things from an executive level. Rather than focusing on just the technical development or manufacturing details, the student teams

begin to realize the importance of converting market-based requirements into implementation details, addressing the importance of their technical organizational structure to incorporate new skills, balancing technical investments in the legacy product lines with exploring new opportunities, merging new technical tools, working collaboratively across disciplines, addressing organizational culture, and finally persuasively presenting a strategy and implementation plan at the CEO/President and Board of Directors levels.

- Capstone Day ties it all together providing four experiences for the students: executive mentoring by visiting real-life technical executives, Board of Directors level presentation, feedback, and an executive round table Q&A discussion. Students join the instructors and visiting executives for an in-person, intensive, day-long meeting to present their technical executive strategy and implementation plan to a "board of directors" role-played by four "visiting executives" who hold senior leadership positions in their respective companies. In the first deliveries of this course both teams were prepared to brief the visiting executives, but because of time-constraints only one team was selected by the flip of a coin. The presenting team, with visiting executive coaching allowed during the presentations, was expected to apply critical thinking, message rationale, probing questions, and lively discussion while presenting their technical strategy and implementation plan. Capstone Day concluded with opening the floor for students to ask questions of the visiting executives about anything related to their role in the real world (see Exhibit 6).

Exhibit 6. Visiting Executives Role-Play Board of Directors and Round-Table Q&A

Setting the Stage for Continued Improvement

To ensure a comprehensive process for receiving and evaluating feedback from students, multiple channels were used to gather assessment data: formal structured evaluation, informal student feedback, and instructor self-assessments. At the conclusion of the semester, each student was asked to formally assess the course and the performance of fellow teammates on their respective teams. Emphasis was placed on the mid-term and capstone presentations because these were intended to show that the students could integrate learning across all content modules into persuasively delivered technical portions of business growth plans.

Student feedback includes effectiveness of individual instructors, content, and presentation of course material. Students were also provided the opportunity to submit written comments to supplement the numerical feedback. Overall, the course and instructors received more than a 93% favorable score. These scores were supplemented with verbatim comments such as:

"This was by far the best course I have taken at Hopkins. It was challenging, it allowed us to create scenarios that translate to real life."

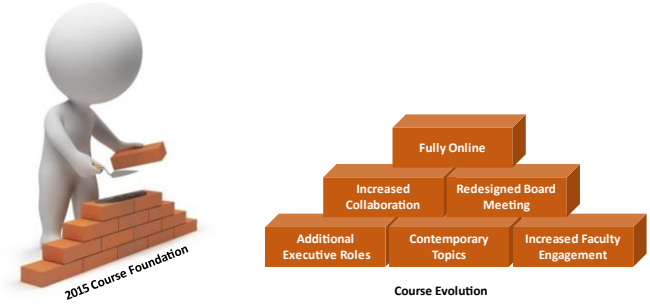
"I enjoyed the capstone day the way we interacted with the other teams, the VPs, and the instructors. We need more classes like this. The data presented throughout the course is well planned out and was executed perfectly."

Students also appreciated the variety of perspectives of the instructors and the fact that we would challenge each other (not just the students), much like in real enterprises.

Additionally, we received constructive feedback as to how to improve the course in the future, which we cover in the next section, the Evolution of the Course.

Evolution of the Course:
In the Fall of 2020 we consolidated student feedback and our own observations over five years into a revision of the course (see Exhibit 7).

Exhibit 7. 595.781 *Executive Technical Leadership* Course Building on a Strong Foundation



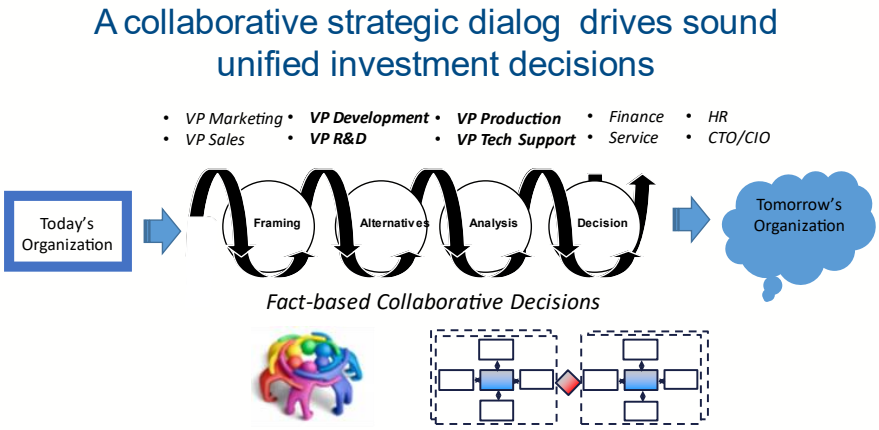
Based on this feedback, we introduced:

- **Additional senior executive roles:** We expanded the senior executive roles that students play from only VPs of Engineering and Manufacturing to VPs of Research, Technical Services, and CTO/CIO. Creating these new roles introduces a more comprehensive division of labor at the senior technical levels in the real-world.
- **Contemporary topics:** Senior technical executives are constantly being challenged with innovative methodologies, processes, and technologies. We integrated Agile approaches, methodologies, and cultures into the strategic and execution framework. Students are now able to adopt Agile into their strategic planning approaches. We also integrated Digital Twin technologies into the course for students to consider how engineering, manufacturing, technical support, and CTO/CIO senior executives should implement digital representations of products, manufacturing/production, and technical support into their plans.
- **Increased faculty engagement:** Our assessment of student feedback and our own observations indicated that students desire increased interaction with faculty to facilitate improved comprehension of nuanced topics, critical thinking and decision making. This is particularly important for cross-functional collaboration across different senior technical executive roles. We took two actions: (1) provide instructor mentoring and facilitation of teams as they learn to collaborate on critical senior executive challenges and decisions, and (2) implement an IT environment to enable cross-team collaboration, as well as increased

instructor engagement using Microsoft Teams. These two capabilities enable a more immersive learning experience through transfer of instructors' knowledge and critical thinking. The former capability places a greater emphasis on recruiting instructors with extensive senior technical executive experience.

- **Increased collaboration between senior technical executive teams:** In the real world senior executives must work collaboratively to unify their work into an integrated business strategy (see Exhibit 8). Through our increased faculty engagement we mentor students to create a single, integrated technical strategy and execution plan. We've also provided two new lectures on how to create and present a persuasive senior executive level presentation.

Exhibit 8. Senior Executive Collaboration Drives Sound Strategy and Investment



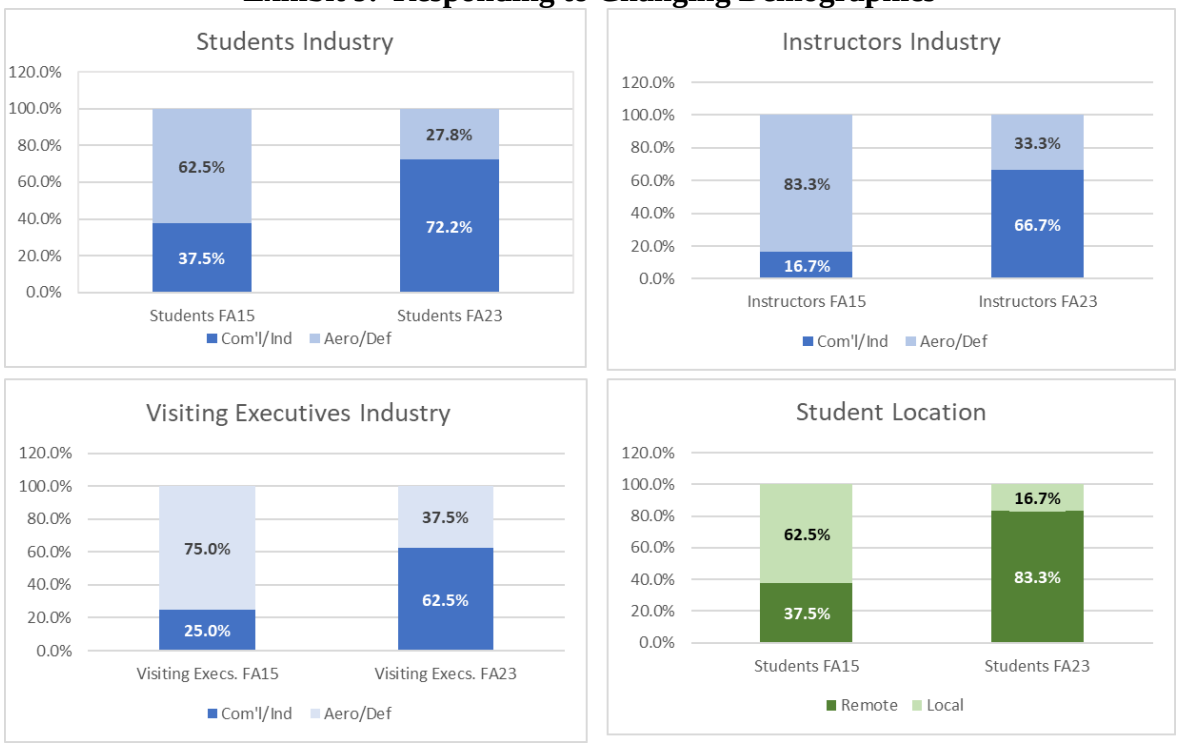
- **Redesigned Capstone Day into a Board of Directors meeting:** Strategic and operational business plans typically require the approval of a board of directors in their role as fiduciaries of an organization. Since the students are presenting a persuasive technical investment plan to a simulated board of directors, we have restructured Capstone Day to resemble a real-life board of directors meeting. This shifts Capstone Day from a traditional classroom setting to an improved simulation that brings an air of seriousness and importance as student teams strive to secure a full board endorsement. Student teams are now required to provide a pre-read to the board of directors three days prior to Capstone Day to mimic expectations in the real world.
- **The COVID pandemic forces Capstone Day to be fully online:** Between the Spring 2020 and Spring 22 semesters the pandemic forced Capstone Day into a fully online format. In the Fall 22 semester we resumed in-person Capstone Day with the option for students and visiting executives to participate online while using our pandemic-era improved online collaborative technologies.

Responding to Changing Demographics

Even after these changes, we recognized that was not enough. Consider the student demographics from the one course section when it was first introduced in Fall 2015 (Exhibit 9). At that time, the majority of our students came from aerospace and defense companies (62.5%), and so did our instructors (83.3%) and visiting executives (75%). By Fall 2023, the picture had changed considerably with the majority of our students now coming from commercial and

industrial companies (72.2%). So, recognizing that our working professional students value instructors with experience they can relate to, and needing to grow our instructor "bench strength" to now accommodate 3 course sections, we proactively recruited new instructors to match those demographics. Our instructors and visiting executives now reflect those changing dynamics too, at 66.7% and 62.5%, respectively, representing commercial and industrial experience.

Exhibit 9. Responding to Changing Demographics



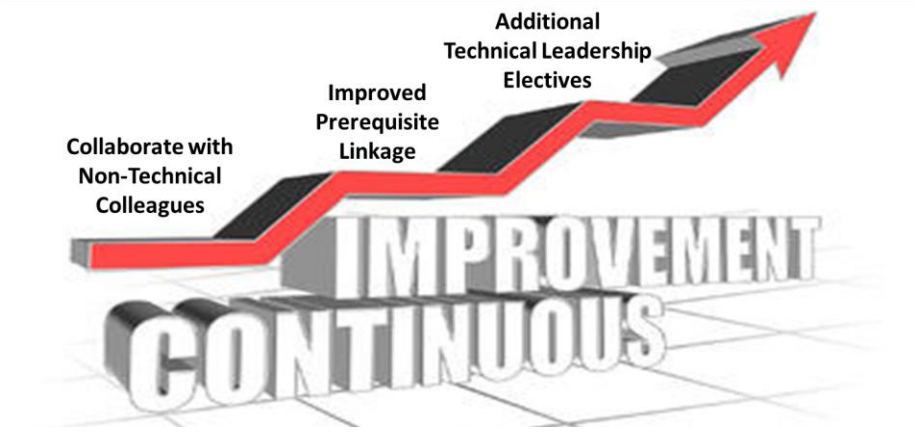
We also saw a shift in geographic location. In Fall 2015, the majority of our MEM students came from the local Baltimore/Washington region (62.5%). Not surprising since this course, and many of our other MEM courses, were offered on campus and in person. Johns Hopkins Engineering for Professionals was already proactively moving to more online offerings that align with working professional education preferences. And further encouraged by even broader acceptance of remote online education during the COVID pandemic, the geographic reach of our MEM program in general, and this course in particular, expanded. As an example, in Fall 2023, typical sections had 83.3% of its students participating remotely from outside the Baltimore/Washington region. Not only has that expanded the diversity of our student population but it mirrors the changes in today's workforce where much of the company networking is done over video conference.

Planned Improvements Going Forward

In the Johns Hopkins Engineering for Professionals program, every course undergoes a 3-year refresh cycle. The descriptions above reflect revisions of this course in 2018 and 2021 based on constructive feedback from students, instructors, and visiting executives as part of our

continuous improvement process. The course is now undergoing another refresh cycle started in Spring 2024. It will expose future students to new technical executive challenges such as a hybrid workforce of on-site and remote workers, introduction of artificial intelligence, application of design technologies such as "digital twin", explosion of the amount of data available about their company's products and application, etc. In addition we plan to make course improvements in the areas of increased simulated case fidelity: (1) role playing non-technical functional areas, (2) creating improved linkages to prerequisite Engineering Management courses, and (3) developing follow-on elective courses in the Engineering Management Leadership track that build off the concepts, principles and case study from *Executive Technical Leadership* (see Exhibit 10).

Exhibit 10. MEM Program Continuous Improvement



- **Role playing non-technical functional areas:** While our MEM program is not intended to replace or complete with an MBA program, we have found that it will be beneficial for students to increase their awareness and knowledge of marketing, financial, contracts, and human resources concepts. Specifically we intend to augment our lectures and case study in each of these areas to enable students to perform tradeoff decisions in collaboration with those functional areas e.g. how technical decisions are linked with financial performance. The instructors will role play senior marketing, finance and HR executives during these collaborative tradeoff discussions. Likewise, during Capstone Day the visiting executives will play these roles as members of the board of directors.
- **Create improved linkages to prerequisite MEM:** As a corollary to the point above about role-playing non-technical roles, we plan to strengthen linkages to courses which introduce marketing, finance contracts and HR principles and practices in courses required prior to enrolling in *Executive Technical Leadership*. We would like to instill in students that these principles and practices are very important for senior technical executives to engage in meaningful dialog and collaboration which is key to well-integrated strategies and execution plans that result in customer acceptance of products and services and successful market performance.
- **Develop follow-on elective courses in the MEM Technical Leadership track:** Students have expressed interests in deeper understanding of topics such as product management, supply chain management, mergers and acquisitions as extensions of strategies and execution plans developed in *Executive Technical Leadership*. Building off those areas of interest we have already successfully developed and launched a Product and Supply Chain Management

course which builds off the foundation set in *Executive Technical Leadership*. This course builds on top of the case study in *Executive Technical Leadership*. We are planning to develop a course in Mergers and Acquisitions for the Technical Professional off the same platform and case study.

Conclusions

We have applied a well-known technique of coupling lectures & readings based on best practices and principles, with simulations of the real-world, that are important to our students and their employers. Using extensive student feedback, we have a continuous process of improving the course, making it increasingly relevant to students and employers by adapting to the changing student demographics, increasing the fidelity of our simulation, and making it more real-world (increasing executive-level engagement, integrating contemporary topics). **Preparing students to meet the challenges and opportunities of a new generation of engineering leaders for jobs of the future is not a series of courses, it is an experience in applied critical thinking.**

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References

[1] Brown, Roediger, and McDaniel, *Make It Stick, The Science of Successful Learning*. The Belknap Press of Harvard University Press, 2014.

[2] Suter, Tarchalski, Theodori, Beaty, McLoughlin, and Blank, "Putting Engineering Management on the Executive Track", in *ASEE 123rd Annual Conference & Exposition; June 26-29, 2016.*

[3] *595.781 Executive Technical Leadership* course, Johns Hopkins Engineering for Professionals.