The Gordon Engineering Leadership Program at Northeastern University

The NAE Bernard M. Gordon Prize 2015 Lecture
October 4, 2015

2015 Bernard M. Gordon Prize for Innovation in Engineering and Technology Education
"For developing an innovative method to provide graduate engineers with the necessary personal skills to become effective engineering leaders."

2015 Prize Winners:
Prof. Simon Pitts
Prof. Michael Silevitch

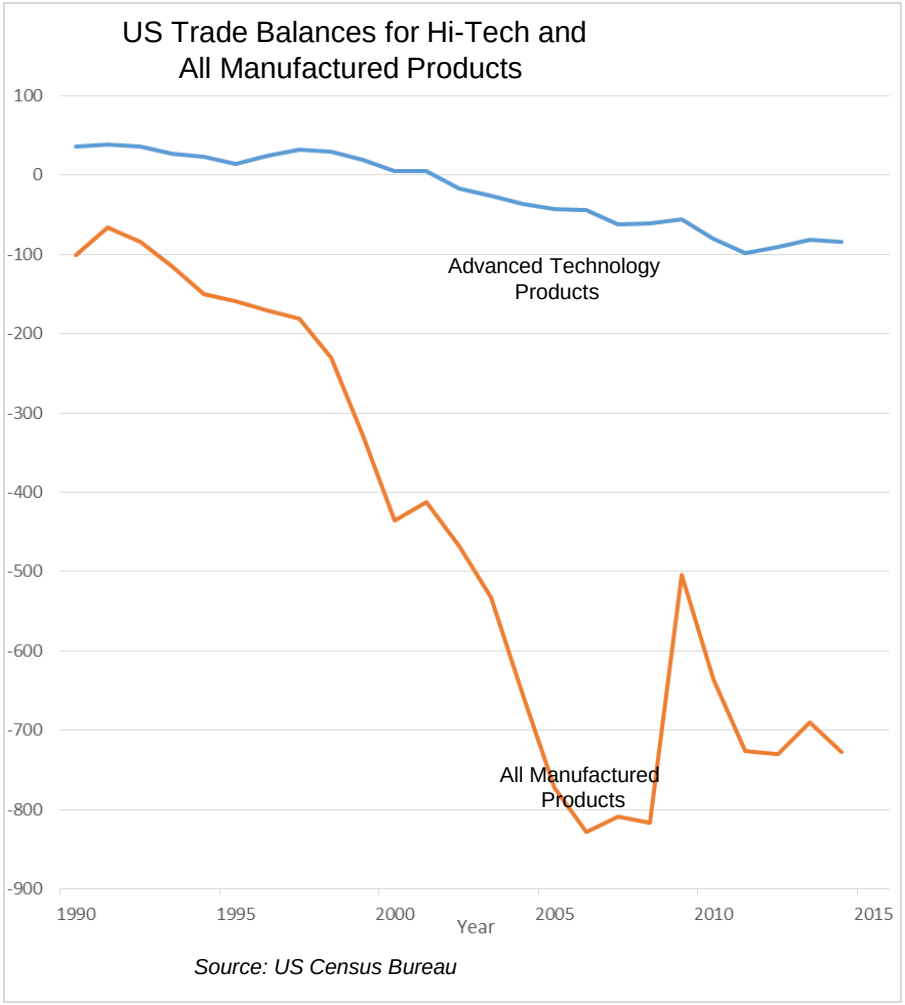
GIEL Team Members:
Prof. Steven Klosterman
Prof. Steven McGonagle

Experiential Learning

Snowfall was only108.6 inches

The GORDON INSTITUTE of ENGINEERING LEADERSHIP at Northeastern University

Concentrates on the knowledge, skills, and attitudes that reside at the intersection of engineering and leadership



Source: US Census Bureau

The trade balance in advanced technology manufactured products, many of them invented in the United States, turned negative in 2001 and has widened in the decade since

Start-Ups and mature companies are failing

There are significant "**Gaps**" …between the needs of ***practicing engineering leaders*** and the output of ***conventional engineering education***

Implementation Skills

- Performance, quality, cost & timing
- "Front loading"
- Engineer for the "real" environment
- Required rigor and robustness
- Program management
- Designing for manufacture
- Designing to avoid failure modes

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Interpersonal Skills

- Leadership & Followership skills
- Influencing & motivating skills
- Communication skills
- Team skills
- Interdisciplinary decision skills
- Organizational & social awareness
- Connecting across cultures
- Willingness to engage with others
- Persistence

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Breadth of Focus

- Stakeholder focus
- Market & Customer focus
- Competitiveness
- Enterprise understanding
- Business acumen
- Narrow Discipline focus

GIEL Mission Statement

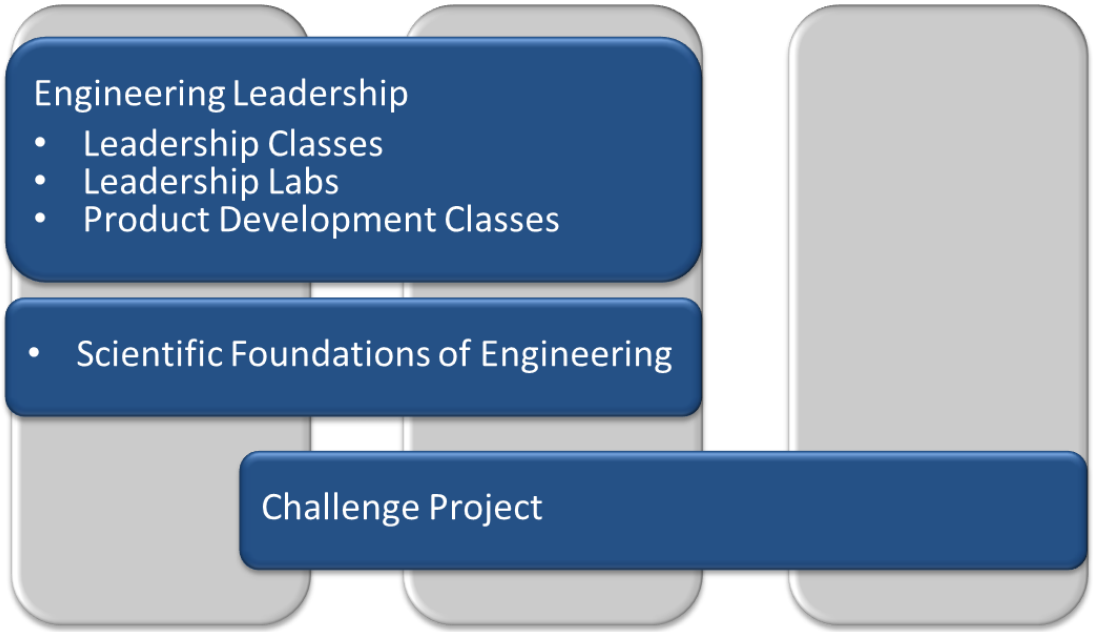
To create an elite cadre of engineering leaders who stand out from their peers in their ability to innovate, invent, and implement engineering projects from concept to market success.

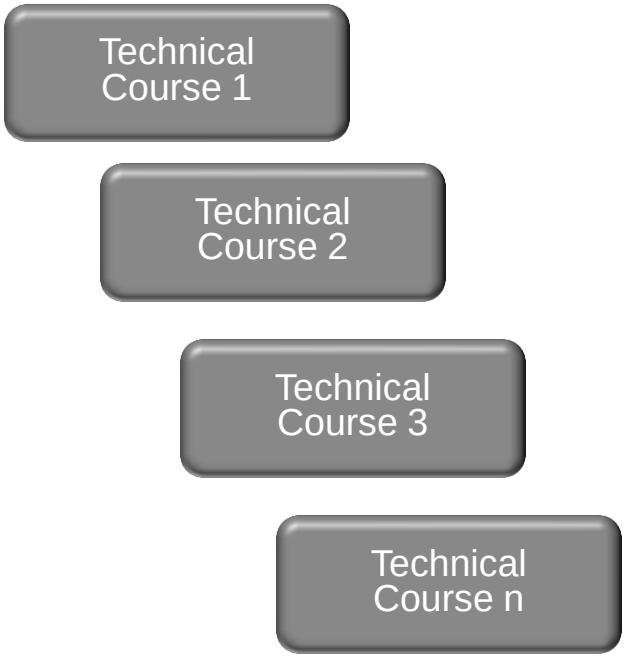
These leaders will demonstrate an exceptional ability to lead engineering teams by providing purpose, direction, and motivation to influence others to achieve their collective goals.

The Graduate Engineering Leadership Program

Year 1 Graduate Engineering Leadership Program

Year 2 Additional Technical Courses resulting in Masters Degree





The Foundation

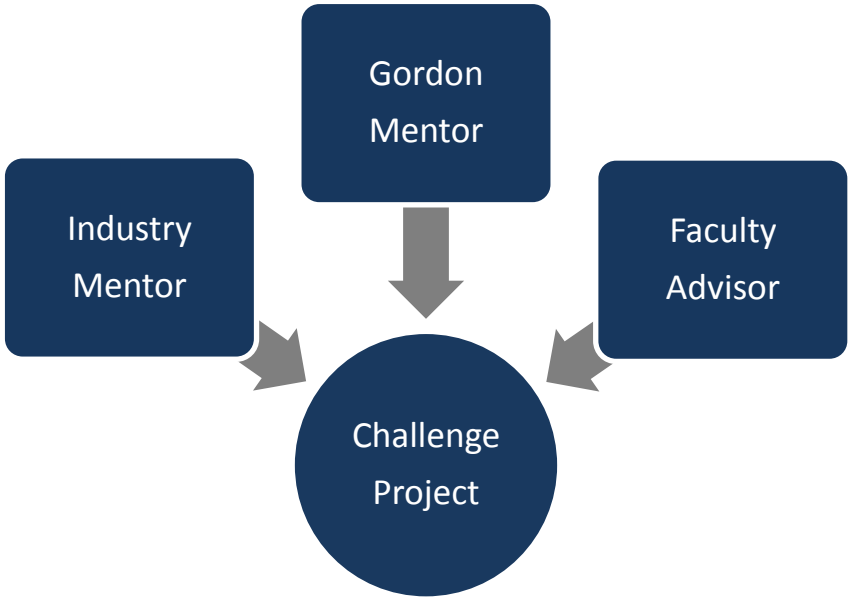
The foundational elements are integrated into every aspect of the curriculum

Experiential learning

Learning by doing – Integrating Theory and Practice
This concept in integrated in two key areas:

- ***Lead Labs*** – by immediately practicing the skills they have been exposed to in a simulated real world context the students learn and master the “how” as well as improve their understanding of “when” to use the skill
- ***Challenge Project*** – by completing the project for the sponsor company in an authentic real world environment, with all the idiosyncrasies and unpredictability that results, their learning experience is enriched.

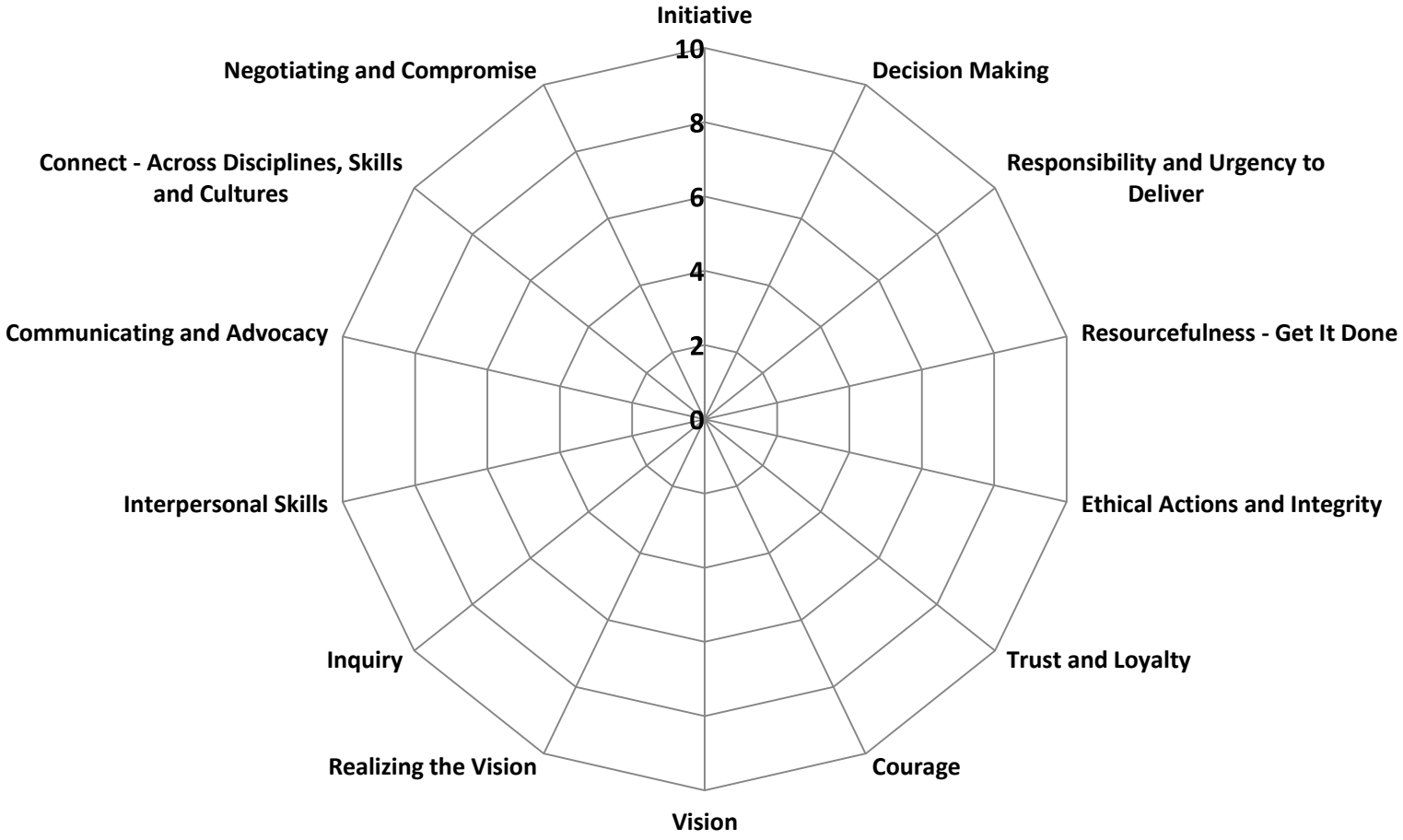
3-Way Mentoring



Leadership Capabilities

The curriculum focuses on 14 Leadership Capabilities (derived from research and experience) as essential qualities for successful engineers

Leadership Capabilities



Leadership Labs

Leadership Laboratories enhance the mastery of topics introduced in classes
Candidates explore topics through practical experience such as self-assessment, interactive role-playing, and case studies

Field Leadership Reaction Course

Field Leadership Reaction Course

Field Leadership Reaction Course

Field Leadership Reaction Course

Field Leadership Reaction Course

Field Leadership Reaction Course

FLRC Student Feedback

"This was perhaps the best leadership and team building experience I ever had. It was a unique opportunity to see a team form and develop before my eyes as we learned individual team members' strengths and weaknesses. At each obstacle we determined which team members would be best at solving various elements of complex challenges and how to get the whole team across the finish line."

Emily Anesta,
MIT Lincoln Laboratory

Leadership Labs

Classroom based Lead Labs follow each engineering leadership class:

Highly interactive
Often designated teams/team leaders
Task oriented
Engineering workplace scenarios
Role playing, case studies
After action review/ direct feedback

Sample Topics

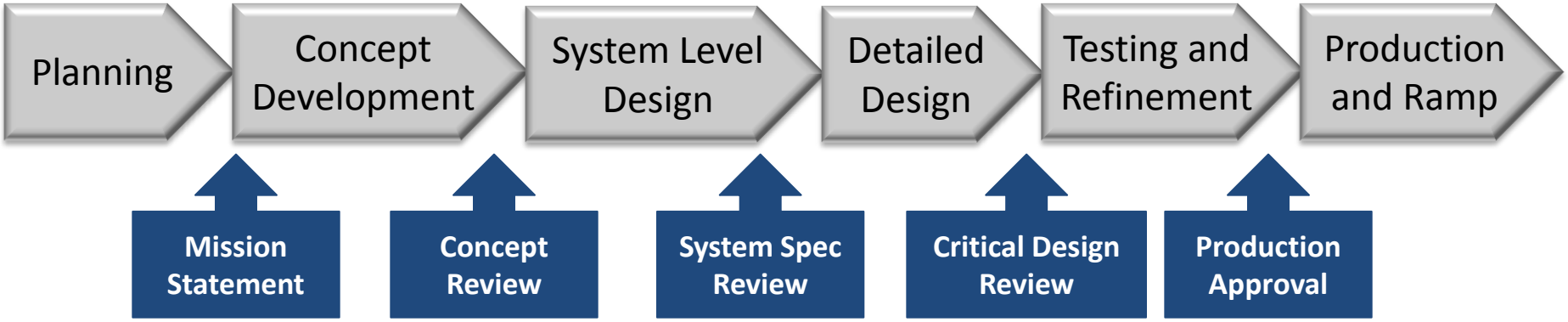
Leadership framework -Values
Group and team development
How to present
Leadership presence- Be, Know, Do
Decision making
Followership
Standards and accountability
Negotiation/dialog/inquiry
Ethics in workplace and beyond
Conflict resolution
Risk management

Build mastery of topics introduced in classes through practical experience

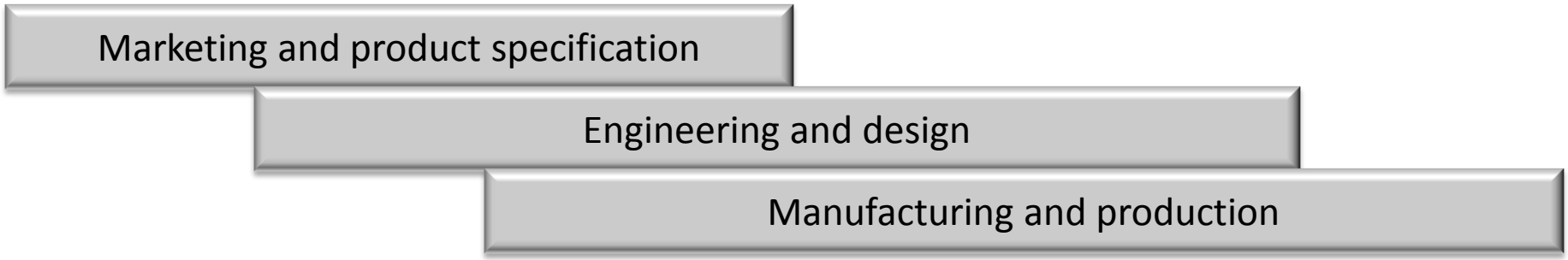
Product Development

Introduces engineering leadership in the context of the end-to-end product development process and reinforces that choices made early in the lifecycle have the most leverage and greatest impact

Product Development Process



Partnership and influence concurrency across the process



Students learn to:

- Unearth and refine customer needs
- Develop specifications, schedules and cost models
- Initiate, evaluate, plan, execute, test, validate, and complete a project
- Effectively lead teams in an extended enterprise
- Understand business and financial drivers

Topics

- Product development methods
- Organization structure and teams
- Planning and technology
- Market and customer needs
- Product specifications
- Cost, schedule
- Concept development
- Product architecture
- Program management
- Industrial design
- Finance for engineers
- Robust design
- Design for Manufacturing
- Validation, test, release
- Production/supply chain
- Service
- Quality and reliability
- Customer relations
- System design
- System engineering

Scientific Foundations

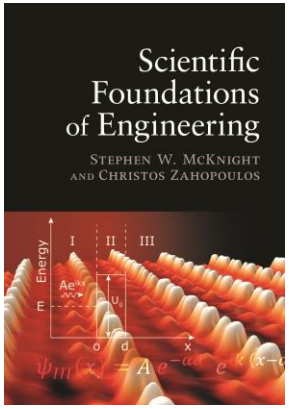
Provides a foundation to enable interaction across different engineering disciplines. Candidates also gain confidence in their ability to tackle and learn new fields without being intimidated

Scientific Foundations

Supports the "T" shaped engineer model: (depth in at least one discipline and system and breadth to lead and collaborate across disciplines, systems and functions)

Provides students with the first principles of the main engineering disciplines that they are likely to face when leading cross-functional teams. Enables them to make informed decisions and ask the right questions when faced with information from outside their personal domain of expertise

Strengthens ability to leverage scientific analysis to understand problems and lead resolution, often under time pressure



Challenge Project

For the Sponsor – a product or process of value and impact is developed on behalf of the organization
For the Student – an opportunity to apply knowledge and develop confidence under real-world time, business, performance, and quality pressures

Challenge Project Examples

Bo Zhou and Dan Wells – Entegris

The Challenge Project concentrates on a technology development and delivery challenge from the student's sponsor company.

It is the analog of the thesis experience focused on providing Project Based Learning in three primary areas:
- *Market Value*
- *Technology Development / Technical Depth*
- *Leadership*

The Challenge Project is a key win–win element of the Leadership Program. It produces a market worthy impact for the sponsor while facilitating mastery of classroom topics in an authentic context for the student. He/she delivers a project with a degree of difficulty above his/her prior capability.

Shawn Cousins
EMC
Application Performance Profiler Proxy

Laura Mikinos
NEC Energy
SBIR to design a trailer mounted solar thermal power generator

Jessica Patel
Raytheon IDS
Adding robustness to an automated design process

Jason Harland
EMC
Firmware validation and emulation suite to support hardware validation

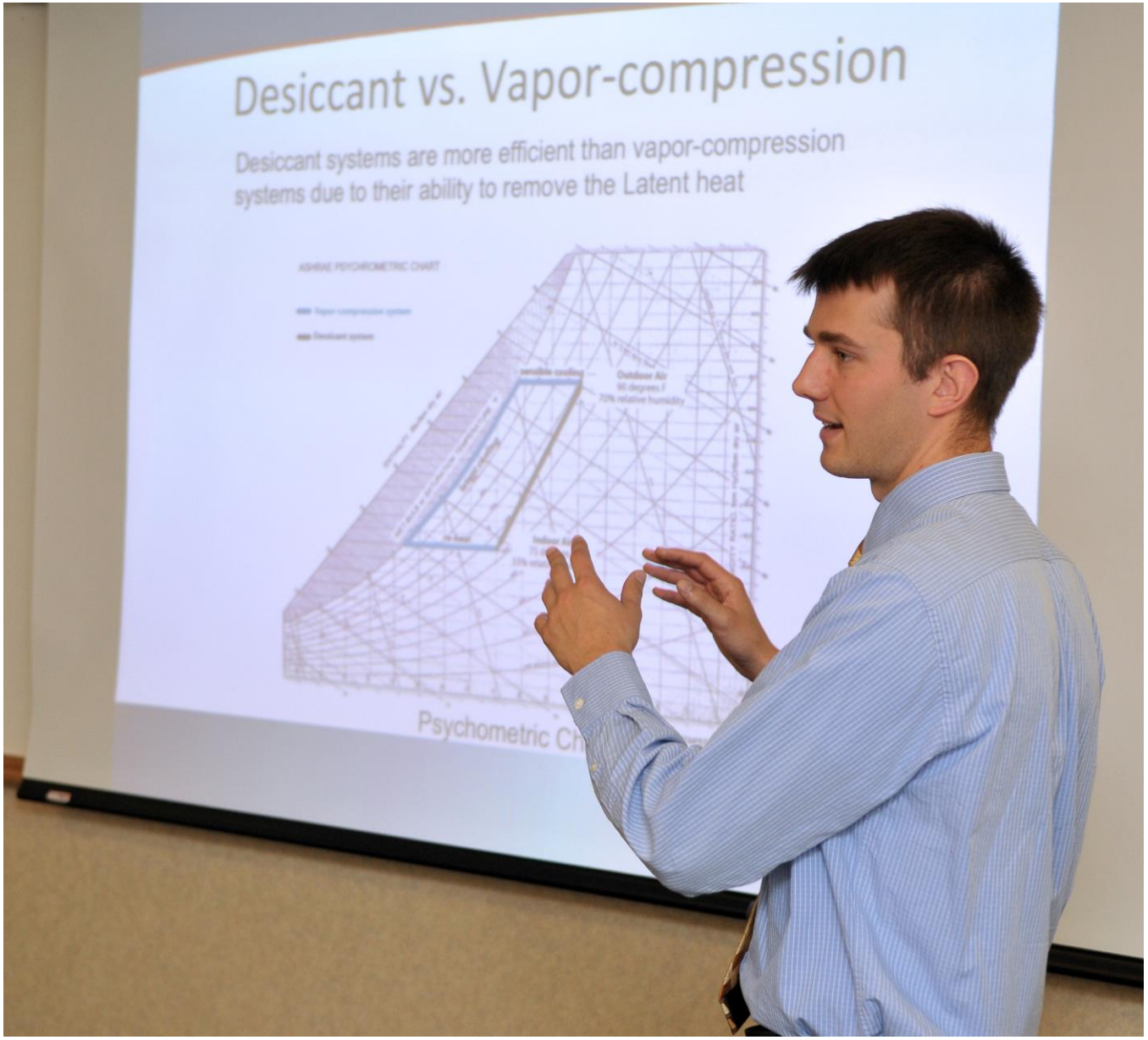
Lauren Brown
WEAC FDA
Developed a priority based process for the analysis of high risk medical devices

Abdul-Karim Barrie
Entergy- Pilgrim Nuclear Station
Developed Feed water heater level transmitters for nuclear power systems

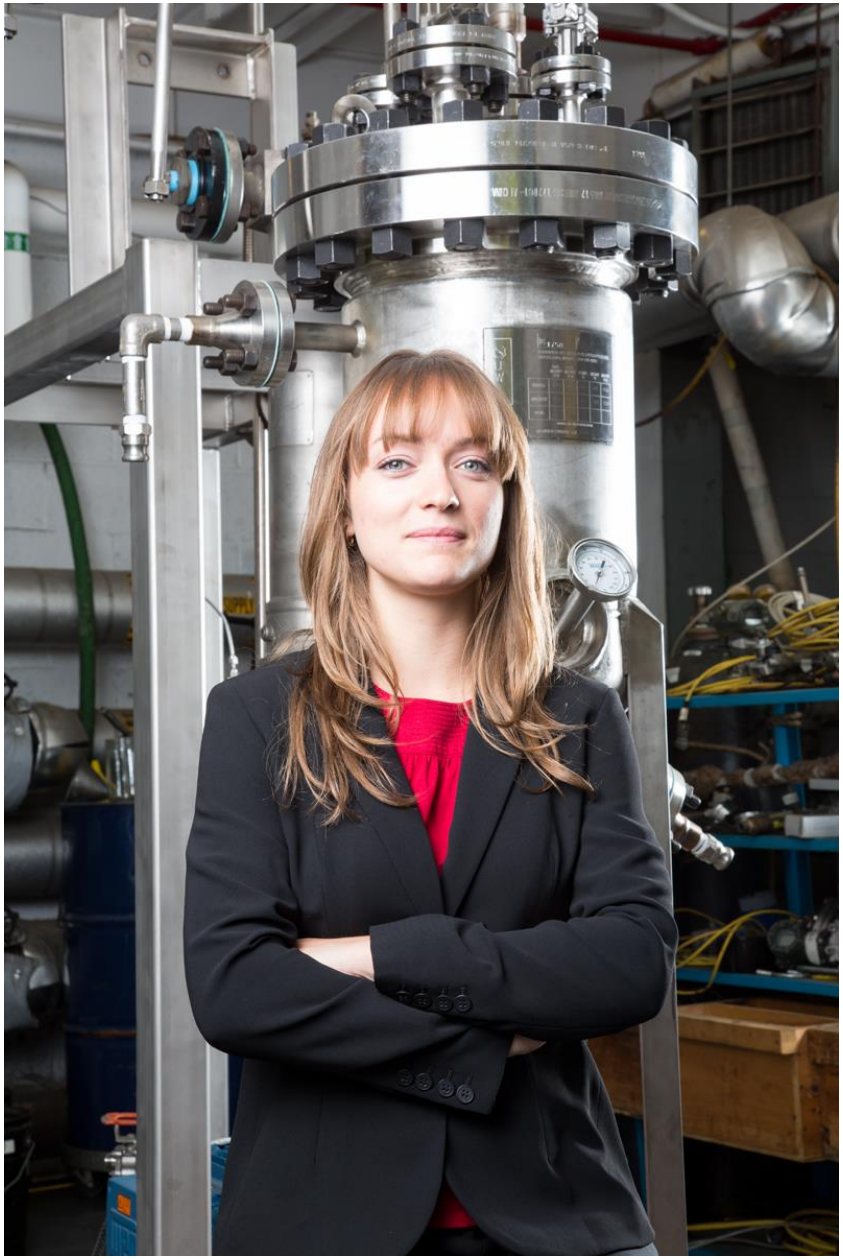
Sheldon Green
Raytheon IDS
Using Model Driven Systems Design to Enable Product Development

Nobuhito Suzuki
Mitsubishi Heavy Industries
Developed a new systemized global program management capability

Trevor Ruggiero - Fikst



Csky Young - Artisan Industries



Matt Dickman - Neurologica

Harry Malkasian - BOSE

Focus

The curriculum continually reinforces engineering in context: leading teams to engineer products and processes that satisfy the collective needs of the market, customers, and their organization's stakeholders

The 12 Month Engineering Leadership graduate certificate may be pursued as a standalone or combined with any Masters or PhD program

Professional Master of Science	Traditional Master of Science	Doctor of Philosophy
Computer Systems Engineering	Bioengineering	Bioengineering
Energy Systems	Chemical Engineering	Chemical Engineering
Engineering Management	Civil Engineering	Civil Engineering
Information Systems	Electrical & Computer Engineering	Computer Engineering
Sustainable Building Systems	Electrical & Computer Engineering Leadership	Electrical Engineering
Telecommunication Systems Management	Industrial Engineering	Industrial Engineering
	Mechanical Engineering	Information Assurance
	Operations Research	Interdisciplinary
		Mechanical Engineering
		Network Science

NAE Survey data

How would you rate the program in contributing to your overall character and leadership development?

- Most important experience yet in improving Leadership capability 52%
- Essential to Development 38%
- Important but not essential 10%
- Little or no impact 0%

To what extent has the program contributed to your advancement?

- Not likely without GEL 7%
- Major impact 61%
- Important but not essential 27%
- Little or no impact 4%

The GORDON INSTITUTE of ENGINEERING LEADERSHIP at Northeastern University

The Leadership program delivers its mission of enhancing knowledge skills and attitudes on both sides of the Venn diagram:

Improving the ability to lead diverse teams of engineers with different personalities, cultures, discipline expertise, world views, motivation levels and sensitivities

Improving the capability to technically lead projects by integrating the engineers (and the non-engineers) on the team to move projects from the concept stage through to commercial success.

We are closing the “Gaps” and accelerating the contribution and careers of engineers

NAE Award Event
Northeastern University
April 2015

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