Leveraging a Research Center of Excellence Towards the Education of Engineering Leaders

Michael B. Silevitch
The Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems
&
Department of Electrical and Computer Engineering
Northeastern University
Boston, MA, USA
msilevit@ece.neu.edu

Stephen W. McKnight[1], Mariah Nobrega[2]

Abstract **- The Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems (Gordon-CenSSIS) is a multi-university National Science Foundation Engineering Research Center (NSF-ERC) founded in 2000. Its mission is to develop new technologies to detect hidden objects and to use those technologies to meet real world subsurface challenges in areas as diverse as noninvasive breast cancer detection and underground pollution assessment. With its commitment to leveraging technology transfer to spur economic development, Gordon-CenSSIS is intended to be a national model for the fusion of academic research and private-sector collaboration. In 2006, the Gordon Foundation provided a gift to sustain the NSF-ERC and create a new educational initiative: the Gordon Engineering Leadership Program at Northeastern University. This paper will describe the elements of the leadership program and indicates how it takes advantage of the research and development resources inherent in Gordon-CenSSIS.**

Index Terms – education, industrial collaboration, leadership, research and development

OVERVIEW OF THE GORDON ENGINEERING LEADERSHIP PROGRAM

In 2006, the Gordon Foundation, established by engineering innovator and philanthropist Bernard M. Gordon and his wife, Sophia, provided a generous gift to Northeastern University that had two goals. The first was to sustain the National Science Foundation Engineering Research Center for Subsurface Sensing and Imaging Systems (renamed from CenSSIS to Gordon-CenSSIS) past the original ten-year funding provided by the National Science Foundation. The second purpose was to create a new educational initiative: the Gordon Engineering Leadership Program at Northeastern University – the "Gordon Program". The Gordon Program will be located in the Gordon-CenSSIS building at Northeastern University and will use the resources and opportunities that have been allocated to and developed by Gordon-CenSSIS.

The Gordon Program is an intensive one-year graduate program that educates participants in the essential skills and knowledge required for them to assume leading roles in technical projects or programs. The Gordon Program will train graduates, called Gordon Fellows, who will constitute a cadre of technology drivers adept at envisioning new engineering products and skilled at leading multidisciplinary teams to bring their ideas to market. The major components of the program are Masters-level technical and leadership coursework and a "thesis-like" Challenge Project. The cornerstone of the new program will be this Challenge Project. It is expected that each participant will have a corporate or government sponsor. Each sponsor will help define a project that is deemed to be of key strategic importance to that organization. The Gordon Fellow will spearhead their sponsor's project from inception to completion and will be supported by mentors who have a demonstrated track record of leading major engineering projects in an industrial setting.

FIGURE 1. GORDON PROGRAM LOGO

The need for this type of a program is increasingly evident. According to the National Academies 2005 report "Rising Above the Gathering Storm", the United States has never faced greater challenges to its position as the global technology leader. Outsourcing trends are driving talented young people away from technical fields, while reduced industry funding for research and technical training undermines U.S. capacity to generate engineering breakthroughs. American universities continue to lead the world in basic engineering research, but they need to do

---

[1] The Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems & Department of Electrical and Computer Engineering, Northeastern University, mcknight@neu.edu,
[2] The Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems, Northeastern University, mnobrega@ece.neu.edu

more to bridge the gap between applied research and production. The Gordon Engineering Leadership Program at Northeastern University is envisioned to be the first of many programs that will re-establish the United States as the global leader in technology.

ROLE OF GORDON-CENSSIS R&D RESOURCES IN CHALLENGE PROJECT

Gordon-CenSSIS is uniquely suited for its role as an innovator in this area of experiential education. Not only is the Center headquartered at Northeastern University – one of the top cooperative education programs in the world – the Center has an outstanding track record in its own right for creating effective university-industry teams.

Recently, Gordon-CenSSIS has worked with industry to address important Department of Homeland Security (DHS) problems. One example is the Advanced Spectroscopic High Energy Radiation Detector (ASHERD) Program to detect threatening nuclear material in closed metal containers. A team led by Gordon-CenSSIS, in combination with industrial partner Bubble Technologies Inc. (BTI), researched and created a prototype model, which enabled industrial partner Raytheon to win one of the ~$400 million Advanced Spectroscopic Portal (ASP) production contracts from DHS. The first round of ASP units were installed in the New York Container Terminal in Staten Island in February 2007.

Another example of successful industry collaboration is the multi-sensor suicide bomber detection program currently being funded in Phase I by DHS. This effort includes two of the Gordon-CenSSIS partner universities and four industrial collaborators in a proof-of-concept program to demonstrate the effectiveness of combining multi-sensor probes with a human-in-the-loop video tracking system. Pending university-industry proposals include an infrared explosives detection system, an acoustics-radar approach to detect hidden tunnels and a proposal in preparation to create a pervasive layered reconnaissance capacity for ports of entry.

These examples serve to illustrate the agility and breadth of the Gordon-CenSSIS R&D structure, which operates with the speed and agility more typical of a results-driven private company than of an academic institution. It is precisely this structure that will give students in the Gordon Program the exposure to high-stakes, real-world product development that neither students in a traditional master's program nor low-rung recent hires to industry receive.

PROGRAM OFFERINGS

The Gordon Engineering Leadership Program will be comprised of three components.

The first is coursework. Students will be required to take two courses offered solely through the Gordon Program:

- Engineering Leadership, focusing on leadership qualities, product engineering, market assessment, and engineering excellence.
- Rapid Assessment from First Principles, focusing on understanding basic scientific limitations to use in evaluation of new technology.

Through formal instruction such as this, students develop a broader understanding of leadership skills, as well as math, physics and advanced technology, thereby better enabling them to assess the technical situation and develop their products. Students will also have the option of obtaining a master's degree in an engineering field of their choice. This will require completion of four graduate-level technical courses offered through Northeastern University's College of Engineering.

The second component of the Gordon Program is the "Challenge Project." The Challenge can best be conceptualized as a mountain that when scaled, will test the student and lead them beyond what they thought they could accomplish. Developed with the student's industry sponsor, the project will be important to and needed by the student's company. It will be chosen to "challenge" the students engineering knowledge, skills and attitude (i.e., leadership). Students will prepare development plans, including budgets and schedules. These plans will be critiqued for completeness and reasonableness by the industry sponsor in conjunction with the Gordon Program mentors. Challenge Projects will show students how to:

- have personal vision, broad product knowledge, highly developed personal skills, and top-to-bottom involvement and interaction at all organizational levels.
- motivate others and lead them toward shared goals
- be aware of their own limitations, successfully navigate them and seek help from others with more experience.

Figure 2 shows the timeline and expectations for the Gordon Fellow's Challenge Project.

The third component is mentoring. Students will interact closely with accomplished leaders in the engineering profession, who have been

FIGURE 2. CHALLENGE PROJECT – TIMELINE AND EXPECTATIONS

down this same path before. Mentors involved with the Gordon Program have led state-of-the-art developments of successful commercial and military products, and have founded or helped found several industrial firms to design and manufacture high-technology products. These proven individuals will impart needed knowledge and skills, and will serve as role models for effective engineering leadership and will assure the student's success.

THE GORDON FELLOW, AN EMERGING ENGINEERING LEADER

The year spent in the Gordon Leadership Program will accelerate the development of Engineering Leaders. Rather than taking ten to fifteen years in an industrial environment, working on increasingly difficult programs and managing larger parts of the development process, the Gordon Program will send a competent and vested Engineering Leader back to the resident company, ready to take on product development at an accelerated pace, shortening the leadership development process by a factor of two or more. On a personal level, the young leader returning from the Gordon Engineering Leadership Program will know that he can take on an engineering leadership challenge and succeed. He will have assumed responsibility for his challenge and his success. He will return to his organization ready to accept the next challenge.

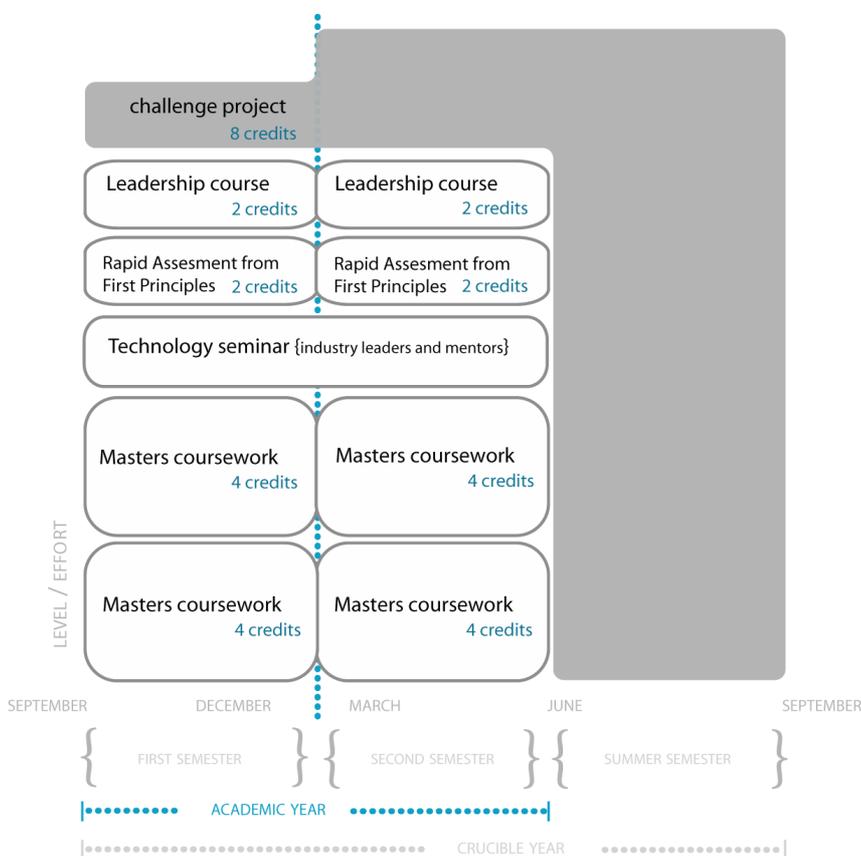### THE GORDON ENGINEERING LEADERSHIP PROGRAM: A DIAGRAMMATIC SUMMARY

FIGURE 3. DIAGRAMMATIC SUMMARY OF THE GORDON ENGINEERING LEADERSHIP PROGRAM