Bernard M. Gordon–MIT Engineering Leadership Program/ Undergraduate Practice Opportunities Program

A $20 million pledge (with a matching component) from the Bernard M. Gordon Foundation made it possible to launch the Bernard M. Gordon–MIT Engineering Leadership Program (ELP) in 2007. This was the largest gift made to MIT's School of Engineering for curriculum development. ELP's goal is to educate, and to develop the characters of, outstanding MIT students as potential future leaders in the world of engineering practice and development and to work to transform engineering leadership in the nation, thereby significantly increasing product development capability.

ELP provides a select group of MIT engineering undergraduates with a challenging and supportive environment in which they develop engineering leadership skills that will prepare them to be highly effective leaders of engineering teams. For approximately 120 MIT engineering juniors and seniors, the first year of ELP, Gordon Engineering Leader Year One (GEL1), provides an introduction to engineering leadership experiences and development. For an exclusive group of 25 to 30 students, Gordon Engineering Leader Year Two (GEL2) is an intensely personalized leadership development program featuring significant interaction with industry leaders, staff, and fellow students.

The Undergraduate Practice Opportunities Program (UPOP) predates the GEL program. It was launched in 2001 as an initiative of the dean of the School of Engineering at that time, Thomas Magnanti. UPOP is a year-long program that prepares MIT sophomores to enter and thrive in the professional world, through experiential learning, individual coaching, access to internships, and mentoring relationships with MIT alumni and industry partners. In 2007, when the GEL program was formed, UPOP became a part of the GEL program, forming a natural progression from UPOP in the sophomore year to GEL1 and GEL2 in the junior and senior years. (Although UPOP is a welcome foundation for GEL, it is not a prerequisite.)

A UPOP organizational restructuring late in academic year 2013 streamlined the alignment of UPOP and ELP, generating improved synergy and use of resources.

Gordon–MIT Engineering Leadership Program

Educating tomorrow's engineering leaders demands a new approach that encompasses students' professional, personal, and leadership development in an environment that fosters the development of core values and builds upon the strong technical fundamentals of an MIT education.

Students participate in ELP to enrich their departmental education by developing their abilities to apply their technical training in the world of industry and research. ELP provides augmented opportunities in leadership and innovation, invention, and implementation. The program is delivered through an alliance of MIT departments, other MIT programs, industry, and alumni who interact with undergraduates and maturing engineers in master's degree programs. The program also offers education opportunities for early and mid-career engineering professionals.

Sustained program growth—both in terms of student engagement and philanthropic support—during AY2014 resulted in increasing relevance within MIT and beyond, and considerable progress toward program goals.

Goal: Educate and prepare the potential future leaders of engineering innovation, invention, and implementation efforts.

Although ELP's primary focus is on MIT undergraduate students (see specific program data and assessment analysis, below), in AY2014 the program also planned, developed, and worked with MIT Professional Education to deliver several short courses specifically designed for early- and mid-career engineering professionals in industry.

Within MIT, rising juniors or seniors from any department can apply to enroll in the first year of ELP. Although most MIT sophomores seeking to join the GEL program enter through UPOP (in AY2014, 73% of incoming GELs came from UPOP), others are admitted to the program on the basis of having demonstrated significant experience in an engineering project in an academic or industrial setting.

We project that 140 students will enter GEL1 in fall 2014, a considerable change from the initial cohort of 17 in fall 2008. Students entering the program in fall 2013 represented 15 departments across MIT, including all of the School of Engineering departments. Thirty-one students will advance to GEL2—the largest advancing cohort in program history.

The majority of students in GEL1 come from MIT's School of Engineering (the largest representation from Courses 2 and 6); the program also accepted students from Courses 4, 5, 7, 12, and 18 who have an engineering interest. Because we expect GEL program graduates to work in industry with professionals from other disciplines, a priority is to immerse GELs in such collaborative scenarios as early as possible.

Gordon Engineering Leader Years One and Two: Continued Growth

GEL1 is open to a competitively chosen cohort of MIT engineering juniors or seniors. GEL1 students participate in a set of elective subjects and immersive learning experiences that, taken together, approximate the level of an MIT concentration.

For those 25–30 students who successfully complete the first-year program requirements and elect to advance, GEL2 offers an array of highly personalized leadership development activities featuring a high degree of interaction with industry leaders, faculty, and fellow students. The aggregate two-year program requirements approximate those of an MIT minor.

During AY2014, ELP accelerated its growth trajectory. Student applications to GEL1 reached a record high, reflecting increased student awareness of—and demand for—Gordon ELP offerings.

In AY2014, a record 178 students applied for admission to Year One, up from 163 in AY2013 and 148 in AY2012-. Word of mouth among students is emerging as a substantial driver of program awareness, generating 33% of applications in AY2014 [the other leading source was UPOP (48%)].

In terms of preparing potential future leaders of engineering innovation, invention, and implementation efforts, 65 ELP students earned certificates of completion in May 2014. Some 27 were from the two-year program and 38 were from the one-year program (up from 59 certificate earners in May 2013 and 43 in May 2012).

Assessments of program students found that there was significant change in a number of their abilities, starting by a general ability to work more effectively on teams. In particular, students reported that they:

- Could more readily listen carefully to others, including those with whom they disagreed;
- Were better at acknowledging the useful contributions made by others;
- Were more able to be objective when their ideas were criticized; and
- Improved their abilities to help team members resolve differences of opinion.
- Taken together, the increases found in these and related capabilities suggest that ELP students are learning to improve their team leadership skills. These skills include having the character to pay attention to the needs of weaker members and to focus on obtaining the best results regardless of personal conflicts and disagreement.

Statistically significant data indicates that the program is producing MIT students who understand the importance of consistently delivering products, processes, and projects on time. Further, ELP students in exit assessments express increased confidence in their ability to create a process to arrive at a shared vision for a project.

Program faculty and staff seek to keep the program's content fresh by regularly modifying short subject offerings to remain relevant, challenging, and attractive to potential students and of interest to corporate and individual donors. For example, program staff designed and developed a revised version of ESD.054 Engineering Leadership that will be delivered for the first time in fall 2014. Plans are also under way to incorporate a project track in ELP courses.

Professional Education & Development: Expansion

Beyond MIT, ELP has expanded relationships with industrial firms as industry has become more aware of the program and of the high quality of students the program produces. Industry is increasingly involved in collaborating with program leadership to meet, engage with, mentor, and hire GEL graduates. The program also received more philanthropic support from individuals and industry last year (notably, pledges of $5 million from Ray Stata and $50,000 from Ed Trautman).

As a result of industry interest (indeed, demand) and increased philanthropic support, ELP expanded its offerings to professionals currently working in industry. Program faculty and staff worked closely with MIT Professional Education to develop and deliver courses on engineering leadership and innovation for early- and mid-career engineering professionals. These included:

- A week-long short subject on engineering leadership for early career professionals (29 participants from four countries);

- A week-long short subject on engineering leadership for mid-career professionals (18 participants from six countries); and
- Two three-day short subjects on engineering innovation & design. The first, in June, was offered to a 45-member delegation of South African industry professionals. The second, in July, was offered to 37 engineering industry professionals. Goal: Prepare all MIT engineering students to be more inclined to contribute to engineering innovation, invention, and implementation efforts and to be more effective contributors to such efforts.

ELP continues to meet this goal by supporting and enriching departmental programs throughout MIT (as well as through UPOP). In the aggregate, more than 1,000 students benefited from ELP activities in MIT's School of Engineering during AY2014.

As it has since its inception, Gordon ELP strives to enrich engineering leadership at the departmental level. During AY2014 Gordon ELP:

- Developed a new curriculum in summer 2013 and drafted a textbook (*Engineering Leadership – First Principles*) to accompany that curriculum;
- Piloted a new short course prototype in Engineering Leadership (EL-X) in fall 2013 for student feedback on content and delivery
- Provided a two-hour "project team success workshop" (project planning and introduction to effective teamwork) to Professor Barry Johnson's short subject, 10.10 (Introduction to Chemical Engineering)

Goal: Increase the focus of national engineering education on the development of leaders of engineering innovation, invention, and implementation.

A key outcome in AY2014 was the establishment of the Engineering Leadership Development Division within the American Society of Engineering Education (ASEE).

During AY2014, ELP also continued to advance the Community of Practice for Leadership Education for Twenty-first Century Engineers (COMPLETE) by participating in two meetings on engineering leadership. One was at the Center for Creative Leadership (in Greensboro, NC) and one at Rice University. A founding member of COMPLETE, ELP remains a driving force behind advancing the agenda of this professional group.

Because ELP is a valued "thought contributor" in the field of engineering leadership education, ELP students in AY2014 were invited to, and attended, leadership and ethics conferences at the United States Military Academy, the United States Naval Academy, the United States Air Force Academy, and the Massachusetts Technology Leadership Council's UnConference.

In keeping with the program's mission to disseminate best practices in engineering leadership education, ELP faculty and staff delivered a peer-reviewed paper at the annual ASEE Conference in Indianapolis, Indiana, in June 2014: "A Method for Assessing Engineering Leadership Content in the Engineering Curriculum: A First Look at Civil Engineering Project Management Courses."

Undergraduate Practice Opportunities Program

In AY2014, UPOP conducted a thorough assessment of the program's vision, mission, and goals, generating a new mission statement:

UPOP's mission is to prepare sophomores to successfully integrate into and thrive in the professional world and to be strong contributors to their organizations.

With that mission in mind, UPOP supported a record number of MIT sophomores during AY2014. A record 536 members of the class of 2016 applied to UPOP in fall 2013. Applicants came from all MIT majors and represented almost half the sophomore class. UPOP accepted 480 applicants. A cohort of 334 students completed all the requirements of UPOP—a record 69% of accepted students.

Student Program Growth

UPOP enrollment has increased steadily since 2006, reflecting more demand from MIT undergraduates for the unique programming UPOP provides, offering students abundant opportunities to practice and integrate the skills they will need for career success.

UPOP requirements include individual coaching sessions with UPOP staff; an intense, week-long Team Training Camp workshop during the Independent Activities Period with experiential modules taught by MIT faculty and other industry professionals; topical seminars led by staff, industry professionals, and MIT alumni; a career-relevant summer internship experience; written reports over the summer during the internship experience; and follow-up meetings with staff.

The UPOP curriculum expanded to offer more topical workshops in the fall and spring semesters and more opportunities to engage with employers. Additionally, a thorough review of the Team Training Camp curriculum was conducted during the fall semester, resulting in clearer goals and through lines for the course, focusing content on communication, decision making, and team development—skills identified as key to success in the workplace.

Summer 2014 Internships

UPOP students are required to participate in a summer experience in an organization to help advance their professional goals. The majority of UPOP students participated in industry internships both in the US and overseas, in large corporations and small startups, in corporations and in research organizations. More than 44% of industry internships were acquired through an UPOP-established employer connection. Students also participated in undergraduate research opportunities programs, teaching and tutoring experiences, and volunteer activities.

- Number of UPOP students: 334
- Number of industry internships (domestic and international): 225
- Number of UPOP-specific or UPOP-connected internships: 100

Top Five Summer 2014 Intern Employers:

1. Pioneer Natural Resources
2. Google
3. DirecTV
4. MIT Lincoln Laboratory
5. New Valence Robotics

Employer Engagement and Sponsorship

In AY2014, UPOP saw its largest pool of actively engaged volunteers, sponsors, andemployers. More than 100 companies posted UPOP-specific job opportunities for sophomores and more than 200 companies registered for the Team Training Camp's capstone events: the January Networking Luncheons. UPOP also received two significant pledges in AY2014: $300,000 from Pioneer Natural Resources and $300,000 from Tom Wylonis.

UPOP augmented its traditional offerings of company field trips and educational events by debuting several company-sponsored events exclusively for UPOP students, including Shell "Lunch & Learns," Accenture and Apple Executive Talks, and many more.

UPOP also premiered its industry sponsorship program to great success in fall 2013 and raised close to $50,000 in operational funding from employers. UPOP plans to double its corporate fundraising initiative for AY2014-15.

Alumni and Mentor Support and Involvement

MIT alumni are extensively involved in all aspects of UPOP, most notably in the role of mentors for Team Training Camp during Independent Activities Period (IAP). MIT alumni and other industry professionals volunteer a week (seven consecutive days) to participate in the workshops as mentors for a team of seven or eight students.

Mentors are essential for delivering curriculum content; and of the 45 mentors who participated in AY2014, 36 were repeat participants from past years and nine were new. Additionally, several alumni delivered topical seminars to UPOP students on subjects ranging from patent law to entrepreneurship. Drew Houston '05, UPOP alumnus and Dropbox founder and chief executive officer, and Rich Sheridan, chief executive officer of Menlo Innovations and author of Joy, Inc., participated in UPOP IAP workshops as keynote speakers.

To continue advancing the goals of UPOP through mentor and alumni involvement, the program established a UPOP Advisory Board, which met for the first time in July 2014.

Staffing Changes and Relocation

To maintain program growth and maximize cost efficiencies, UPOP reduced its staff in AY2014. This resulted in an organizational realignment that is closer to that of ELP. Staff layoffs included the executive director, the employer relations manager, and the

office administrator. The remaining five staff members include two student program coordinators, an employer relations coordinator, an administrative assistant for mentors, faculty, and special events, and a senior administrative assistant. All staff now report to Leo McGonagle, executive director of ELP. Additionally, in June 2014 the UPOP office relocated to Building 1, thus making way for the new Nanotechnology Building at the site of the former office in Building 12. The new office space provides more student and visitor meeting areas as well as workspace for all five staff members.

Accomplishments and Awards: Gordon ELP and UPOP

- Combined, the programs affected more than 1,000 students throughout the Institute.
- The combined programs planned and executed an industry outreach campaign to increase industry collaboration and partnership (Shell, Pioneer Natural Resources Group, etc.) substantially.
- The combined programs attracted corporate funding in the form of grants and company sponsorships as well as from a pool of committed individual donors, including program alumni.
- The combined programs coached more than 30 ELP students to obtain summer InternshipPlus experiences (InternshipPlus focuses on leadership experiences during the internship and is a program-completion requirement for students in the GEL Year Two program).
- 178 MIT undergraduates applied to ELP to join GEL Year One in fall 2014; 140 students representing 15 MIT departments (including all departments in the School of Engineering) will start GEL Year One in fall 2014.
- 65 students earned Program Completion Certificates in May 2014.
- The programs coordinated with MIT Professional Education to offer four professional education courses to 140 participants.
- ELP staff spearheaded the establishment within ASEE of an official Engineering Leadership Development Division.
- ELP recruited 40 system design and management leaders for global operations to serve as mentors for students in GEL Year Two.
- ELP held two Industry Advisory Board meetings to receive input from engineering industry leaders..
- ELP added members to the Industry Advisory Board to improve the representation of women and other minorities (and better reflect student demographics).
- ELP refined existing tools to assess engineering leadership education: The results are useful for identifying areas where efforts could be invested to improve the program, and to further document the success of the program for external communities interested in adopting elements of the ELP model.
- ELP delivered a new program website that highlights program features and benefits.

- UPOP recruiting efforts resulted in a record number of 536 student applications.
- UPOP retention efforts resulted in 334 students completing the program, which continued the trend of increased yearly retention.
- UPOP raised $50,000 in operational funding from corporate sponsors.
- UPOP expanded the employer outreach program to include more than 2,000 companies that engage with MIT students through a year-round variety of events and activities.

Future Plans: Gordon ELP and UPOP

The ELP and UPOP programs plan to:

- Continue to work closely and actively with MIT's Resource Development to solicit potential program supporters to meet fund-matching goals for ELP (the program has a matching fund requirement; we are currently behind schedule in terms of meeting this obligation) and for the UPOP program;
- Continue coordinating with appropriate MIT personnel to facilitate moving into permanent space for ELP staff;
- Continue to market UPOP to attract and recruit a large and diverse class of students;
- Expand participation by UPOP alumni both to help the next generation of UPOP students and to further entrench skills learned in UPOP—"learning by teaching"
- Engage ELP alumni as mentors and donors and in pedagogical offerings (as appropriate);
- Work with underrepresented departments from the School of Engineering to increase diversity of engineering disciplines among students participating in the GEL Year One and GEL Year Two programs; and
- Develop new (and update existing) promotional and information collaterals for both UPOP and ELP (video, website, print, etc.).

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