Developing a New Engineering Curriculum Focused on Entrepreneurship — or, the ongoing process of turning a vision into a curriculum

Stephen Schiffman, Olin and Babson Colleges
John Bourne, Olin and Babson Colleges
Mark Rice, Babson College
Where Did It All Come From?

- **F.W. Olin Foundation**, highly respected for 50 years
- 72 Buildings on 57 campuses
- Engineer, entrepreneur, baseball player
Evolution of plan by Olin Foundation

- Explore idea of starting/endowing “new” engineering college to meet needs expressed by others (e.g. NSF Engineering Education Coalitions, etc)
- Decision to start “green-field” college, co-located with Babson College
Babson College

- Business degrees only: BS, MBA, MS
- Executive education, too
- 1700 undergraduates, residential
- Nationally recognized UG curriculum
- Field-Based (FME)
- Integrative (IMC)
Leadership team formed 1999-2000

- President Richard K. Miller – from U of Iowa
- Provost David V. Kerns, Jr. – from Vanderbilt
- VP Innovation and Research Sherra E. Kerns – from Vanderbilt
The plan as conceived by foundation and leadership:

- **Mission:** To provide a superb engineering education at little or no cost to bright and enterprising students
- **Offer three degrees:** BS in ECE, ME, Engineering/Applied Science
- **Have collaborative programs with Babson linking engineering, business and entrepreneurial thinking**

Source: Olin College Newsletter, Volume 1, Issue 1, Fall 2000
The work: start-up of curriculum development in 2000-2001

- Faculty becomes a faculty
- Faculty questions and/or comes to grips with Olin College vision as set by Trustees and Leadership
- Faculty “investigate” other best practices and begin “inventing” a curriculum
Olin Curriculum vision after development by the faculty:
The Olin “triangle”

Superb Engineering

Creative Arts

Entrepreneurship
Selected Curriculum Goals at end of 2000–2001 “Bold Goals”

- Hands-on design projects in every year
- Authentic, ambitious Capstone senior/advanced student project (representative of professional practice)
- Experience working independently, as a member, and as leader of a team
- Performance before an audience including experts
- International/inter-cultural immersion experience
- Substantial constructive contribution to society
- Ability to communicate logically and persuasively in spoken, written, numerical and visual forms
- Self-sufficient individual able to articulate and activate a vision and bring to fruition

All accomplished within an environment of personal attention and concern
**Additional Curricular Objectives**

- Demonstrated significant creative artistic expression
- Significant work experience in a corporate culture
- Ability to apply basic business practices necessary to bring a product to the marketplace
Partner Year: 2001–2002

- 30 students “partners” arrive who will enroll as first-year students in fall 2002
- Purpose of academic year to help faculty and administration “invent” curriculum and student life.
- Interest in entrepreneurship gauged
- Students become part of the decision-making process
Curriculum Goals after partner year

- Superb Engineering
  - Hands-on projects at all times
  - Engineering design throughout
  - Multidisciplinary approach
  - Development of life-long learning skills

- Accommodation of student interests and needs
  - Significant, student-proposed sophomore project
  - Project flavors address student interests, learning styles
  - Independent study, research opportunities throughout
  - Free electives every year
  - Passionate pursuits
Curriculum Goals after partner year (cont.)

- Opportunities throughout the “Olin Triangle”
  - Integration of AHS, E! through 2nd year projects
  - Team ing, communication skills throughout
  - Substantial E! development via courses and practica
  - Explicit development of AHS competency areas
  - Intensive AHS experience in the fourth year
  - Electives provide for early specialization in AHS or E!

- Rooted in assessment
  - Learning plans
  - Competency-based Gates
  - FE requirement
Olin College today

- 75 first-year students
- 20 faculty
- 3 completed campus buildings
  - Classroom building
  - Campus center
  - Residence Hall
Olin/Babson partnership today

- Two independent institutions, adjacent campuses
- Sharing of campus operations
- Joint faculty appointments
- Joint curriculum development
- First-Year Liberal Arts “outsourced” to Babson
- Student interaction between schools
**Foundation Year 1**

**Year 1, Fall Semester**
- Computing
- Cohort: Physical & Mathematical Foundations of Engineering I
  - Calculus
  - ODEs
  - Mechanical & Electrical Systems I
  - Project(s) – Practica
- AHS
- Degree credits: 16/semester

**Year 1, Spring Semester**
- AHS
- Free Elective or Ind Study
- Cohort: Physical & Mathematical Foundations of Engineering II
  - Linear Alg
  - Prob & Stats
  - Mechanical & Electrical Systems II
  - Project(s) – Practica
- gate

**Non-degree credits:** up to 3 per semester
- Passionate Pursuits
- Research (optional)
Foundation Year 2

Year 2, Fall Semester
- Signals & Systems
- Business Basics – or – AHS
- Materials Science – or – Biology
- Project(s) – Practica
- AHS – or – Business Basics
- Cohort: Bio/AHS, MatSci/AHS, or MatSci/Biz

Year 2, Spring Semester
- Vector Calculus
- Free Elective or Ind Study
- Communic. Theory – or – Thermo & Fluids
- Materials Science – or – Biology
- Sophomore Design Project
- Passionate Pursuits Research (optional)

RELA October 24, 2002
Year 3
- Tech Elective
- Math Elective

Year 4
- Free Elective/Ind. Study

Specialization Cohort
- Required Technical
- Project(s) – Practica

- AHS
- P.P/Research

Capstone
- Independent AHS Project
- Free Elective/Ind. Study

AHS
- P.P/Research

REEE October 24, 2002
Business/Entrepreneurship in Olin Curriculum Plan as of today:

- “Practica” in first-year cohort projects (e.g. opportunity assessment module)
- Business Basics course in second year – free-standing and cohorted flavors
- Courses and cohorts TBD in years 3 and 4 – links with Babson curriculum and students
- Minors, certificates, MS Entrepreneurship (Babson)?
Comments and Questions

1. Mark Rice
2. John Bourne
3. All
How Olin College fulfills the NSF Vision for Engineering Education

Relationship to the Engineering Education Coalitions
The N SF Engineering Education Coalition

- The building of Olin College provides a capstone to the work of the National Science Foundation over the last two decades in investigating improvements to engineering education.

- Compare NSF goals with Olin College outcomes:
  - Teaching and learning methods
  - Curriculum Content
  - Constituencies and Networks

- The following goals are from a John Prados (1998) presentation while he was still at NSF.
NSF Goals
Teaching and Learning Methods

- Faculty act as mentors, dedicated to nurturing and developing students as emerging professionals
- Develop and use educational materials founded in learning theory and cognitive science research
- Provide learning experiences that meet the needs of students with different learning styles
- Integrate education and research roles
- Stress active, collaborative learning; fewer lectures
- Integrate subject matter by showing relationships from the beginning of the student’s program
- Utilize emerging information technologies
- Develop capability, motivation for lifelong learning
NSF Goals: Curricular Content

- Maintain solid math and science knowledge base
- Integrate subject matter from math, basic science, humanities and social science, and engineering by introducing fundamentals in the context of application
- Integrate teamwork, communications, group problem definition and solving throughout the curriculum
- Address issues of cost and timeliness, quality, social and environmental concerns, health and safety, etc., in the context of engineering practice
- Recognize diverse learning styles and career goals
- Increase opportunities for international experience, possibly using distance learning technologies

Franklin W. Olin College of Engineering  REEE October 24, 2002
NSF Goals: Constituencies and Networks

- Increase success of underrepresented groups with effective strategies for recruitment, retention, and progression to graduation in engineering
- Develop effective linkages with K-12, 2-year colleges, dual degree programs, other transfer institutions
- Maintain regular, well-planned interaction with industry
- Create network of engineering education leaders
- Create, maintain, and disseminate evaluation findings that identify successful practices for replication
- Create incentives for chairs, deans, etc., to reward faculty who develop/implement learning innovations
- Reduce time & cost required for engineering degree

Franklin W. Olin College of Engineering

REEE October 24, 2002
An Example of a "Practicum"

Opportunity Assessment Practicum

Olin College
Spring, 2003
Figure 1: Curriculum Organization

Part I: 14 hr
- Getting started: course organizer presents (5h)
- Entrepreneur presentation: a complete example (2h)
  NCIAA Book exercise #1
  Practice in idea generation/teams
- VOSG Exercise #3
  Learn the VOSG, apply to ideas, post on Bb

Part II: 14 hr
- Initial ideas formation for case derivative #6
  Select teams
- Information Search #5 (marketing)
  Review industry materials
- Case: (Segway, 2003) #4
  Study materials provided, exercise

Part III: 14 hr
- Idea Generation #7: Detailed idea generation for your specific case
  Meet in teams
- Information Search #8: (technical+ detailed marketing research); patents
  Review library guides to technical searching; complete search
- VOSG #9 Exercise: Segway derivatives
  Rocket pitch, presentation creation

Legacy stored

Big Conversation Day Competition #12
Reports turned in

3 winners #11
Winner prepare

Competition within cohorts #10
Competition within cohorts
Competition within cohorts