

WORKSHOP SCHEDULE

**U259B Sunday Workshop, June 26 2016;
 sponsored by ASEE**

New Orleans Convention Center, 281
 Sheila Tobias and John Krupczak, co-conveners

**Introducing Engineering to Non-Engineering Students
 Timing, Variability, Institutional Commitment,**

8:00- 9:00 Introductions and General Discussion

Sheila Tobias, Project Consultant to Teagle Foundation
 John Krupczak, Professor of Engineering, Hope College

**9:00-11:00 Specific Course Adoptions into
 General Education**

- a) Robert Briber, R. D. Gomez (University of Maryland)
- b) Michael Chajes, (University of Delaware)
- c) Oldest/Newest (Princeton, Stony Brook, Virginia Tech), Michael Littman, Maria Garlock, (Princeton), Gary Halada (Stony Brook), Donna Riley (VaTech)

11:00-12:30- Stand-alone Courses/ Programs

- a) Minor(s) in Engineering Studies, Mani Mina (Iowa State)
- b) Honors College options, Aaron Krawitz (Univ.Missouri), Sheila Tobias

12: 30 -1:00 lunch break

**1:00-3:00 Introducing Engineering into a Liberal Arts
 College Environment**

- a) Hope College, John Krupczak
- b) Smith College, Donna Riley
- c) Wellesley College, Amy Banzaert
- d) Liberal Studies in Engineering, David Drew

3:00-5:00 Looking Ahead, Drew, Tobias, Krupczak

- a) Staffing non-standard courses; faculty training; joint teaching
- b) Financing programs: Outside, Inside

Affiliations of Participants

Robert Briber, Associate Dean for Research, Univ. of Maryland, College Park

R. D. Mel Gomez, Professor and Associate Chair for Undergraduate Education, Electrical and Computer Engineering, Univ. of Maryland, College Park

Michael Chajes, Professor and Chair of Civil and Environmental Engineering, Univ. of Delaware

Michael Littman, Professor, Mechanical and Aerospace Engineering, Princeton Univ.

Maria Garlock, Associate Professor, Civil and Environmental Engineering, Director of Program in Architecture and Engineering, Princeton Univ.

Gary Halada, Professor, Materials Science and Engineering, Stony Brook Univ.

Donna Riley, Professor and Interim Head, Department of Engineering Education, Virginia Tech

Mani Mina, Director, Minors in Engineering Studies (2006-2011), Iowa State Univ.

Aaron Krawitz, Professor Emeritus, Mechanical and Aerospace Engineering, Univ. of Missouri

John Krupczak, Program Director, Division of Undergraduate Education, NSF and Professor Engineering, Hope College

Amy Banzaert, Director of Engineering Studies and Lecturer, Wellesley College

David Drew, Platt Chair, Management of Technology, Claremont Graduate University

Sheila Tobias, Author, Consultant to the Teagle Foundation

Exemplary Syllabi

<p>Teaching Technology to All Course Content & Models</p> <ul style="list-style-type: none">● Technology of Everyday Life: Hope College● Engineering in the Modern world – Princeton Univ● Structures & the Urban Environ.- Princeton Univ.● Engineering as Gen Ed Option – Univ Maryland, College Park	<ul style="list-style-type: none">● Technology modules - Smith College● Engineering disasters- SUNY Stony Brook● Hist. Technology in America - Delaware Honors College● Sustainable Energy Tech. - U. Delaware● Stuff Matters - Stony Brook University
<p>Science and Technology of Everyday Life Hope College, GEMS 151</p> <ul style="list-style-type: none">● Engines● Fuel and air systems● Exhaust & emissions● Lubrication, ignition● Power train● Car body● Brakes	<ul style="list-style-type: none">● Steering● Photocopier● Current, batteries● Magnets/magnetism*● Electric motors*● Generator, power plants● Electric heaters● Lights, lasers
<p>Engineering in the Modern World CEE 102 Princeton University</p> <ul style="list-style-type: none">● Modern engineering and transformation of America● Telford and the Iron Bridge● Watt and the Steam Engine● Fulton and the Steamboat● Lowell and Water Power	<ul style="list-style-type: none">● Edison, Westinghouse and centralized power & light● Bell, Vail, and Telephone● Rockefeller & Oil Refining● Ford and the Automobile● Wright Bros. & the Airplane

Structures and the Urban Environment CEE 262 Princeton University

- Origins of structural art: Telford, Brunel
- Brooklyn Bridge & Roebling
- Eiffel Tower/Washington monument
- Eads Bridge, Firth of Forth
- Ammann & Washington Bridge
- Wind & Suspension: Verrazzano Narrows, Golden Gate Bridges
- Reinforced concrete & Robert Maillert
- Prestressing: Freyssinet et al

- New bridge forms
- Politics & Art of Spanish bridge design
- Cathedral & Skyscraper
- Khan & concrete buildings
- Structural design/modern bldgs.
- Earthquakes & Ethics
- Thin roofs: German & Spanish traditions
- Finding Forms: Ney, Nervi, Isler

Engineering Courses as Gen Ed Offerings University of Maryland

- Managing Natural Disasters, Galloway & Link
- Engineering in the Developing World, Lowell
- Transportation Innovation, Lowell
- Future of Technology: Sustainable Development or Sensational disaster
- Engineering and Modern Medicine: Lawson
- Technology Choices, Lawson
- Entrepreneurial opportunity: 21st century ventures
- Bigger, Faster, Better: Quest for Absolute Technology

Engineering Disasters Stony Brook University

- OVERARCHING CONCEPT CASE STUDY
- Engineering & design needs Design success
- Complexity & organizations Titanic
- Control of complex systems 3 Mile Island
- Assessing risk in systems Challenger
- Risk and changing environ. Katrina
- Energy/complexity spiral Deepwater Horiz. spill
- Failure modes, forensic eng'g. Mianus Br. Collapse
- Complexity and ethics C. W. Post arena collapse

Technology in America Univ. of Delaware, Honors College Lectures (examples)

- Watt & Industrial Revolution
- Fulton and River Highways
- Carnegie & affordable steel
- Ford, Sloan, & automobiles
- Wright & Langley planes
- TVA and Western dams
- Radio: Hertz to Armstrong
- Transistor and Computer
- Power generation in America

Stuff Matters - Stony Brook University

- Indomitable: Metals
- Trusted: Paper
- Fundamental: concrete
- Delicious: Foods
- Marvelous: Foams
- Invisible: Optical prop's.
- Unbeatable: Carbon uses
- Refined: Plastics
- Immortal: Biocompatibles

Excerpts from the ASEE Press Release, March 21, 2016

The American Society for engineering Education (ASEE) with financial support from the Teagle Foundation and guidance by consultant Sheila Tobias, has launched a web site highlighting case studies that examine the benefits of greater integration between the liberal arts and engineering..”ASEE is thrilled to be a part of this project,” says ASEE Executive Director, Norman Fortenberry, “Having an increased understanding of engineering processes by future policy makers, industrialists, consumers, and citizens will be of immense value in developing rational solutions that satisfy human needs. This project has the potential to greatly contribute to the achievement of these outcomes.”

Judith Shapiro, President of the Teagle Foundation, says, “When we embarked on an initiative to bring the liberal arts into closer academic and intellectual alignment with professional schools and programs, engineering soon became our major focus....We realized we should be exploring how the undergraduate liberal arts curriculum can be enriched by closer ties to engineering programs and how engineers themselves can be better prepared for their vocation through a stronger grounding in the liberal arts.”

James Duderstadt, President Emeritus at the University of Michigan and an education reform advocate , writes in a backgrounder to the Collection, “Much in the way that the liberal arts of classical learning, the *trivium* and *quadrivium*, have evolved over the past two centuries to include the natural and social sciences, today the intellectual foundation of engineering, of creating solutions, systems, and practices to apply technology to the needs of our society, have become a true “liberal art”.

Sheila Tobias Introduction

Teaching about Engineering to Liberal Arts Students

For decades now, encouraged by the National Academy of Engineering, NSF, and other bodies, higher education has been committed to expanding *technological literacy*. What is new and defines the Teagle Foundation’s collection of case examples now featured on ASEE.org/Publications is a growing consensus that “technological literacy” has to be grounded in the *intellectual discipline of engineering*.

In less than a year of search, more than a dozen extant courses and in some instances entire programs, have been identified that are varied in their content and pedagogy, and so far successful in terms of faculty commitment and student enrollment. These (mainly) new courses and programs stem from no single source. Rather, they encompass a wide variety of initiatives: from the dream and long-term commitment of individual faculty members (Princeton), to the initiative by a college president (Wesleyan), a college-wide commitment to include Engineering in a newly constituted set of General Education “I” course offerings (University of Maryland) and to a university-wide one-course Tech graduation requirement at Stony Brook *originating* in the College of Engineering and Applied Sciences.

In collaboration with ASEE, the 12 case studies, incorporating syllabi and commentary on pedagogies that work, together with a review of an earlier effort to Redefine the New Liberal Arts, and a Backgrounder by President Emeritus James Duderstadt, are meant to become the stimulus and the core of a growing **Inventory** of courses, programs, and commentary.

Sheila Tobias has spent the past 30 years trying to account (without reference to inherent, unalterable variables) first for girls’ and women’s avoidance and apparent “disabilities” in mathematics (*Overcoming Math Anxiety, Succeed with Math, Banishing Math Anxiety*) Then, for a larger mixed-gender population, why the reluctance to study the physical sciences (*They’re not dumb, they’re different, Breaking the Science Barrier, The Hidden Curriculum: Faculty Made tests in College Science*) and, finally inventing and promoting alternative career paths for STEM majors. She has been supported by the Ford and Sloan Foundations, and Research Corporation for Science Advancement in Tucson where she makes her home.