



# **A Call for Entrepreneurship Education in Engineering**

**April 27, 2016**

Perspectives in Chemical Engineering  
Panel Discussion

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# Outline

- **Introduction**
- **Training the 21<sup>st</sup> Century Engineer**
  - Historical Perspectives: Evolution of the Engineering Discipline
  - Effective Engineering in the 21<sup>st</sup> Century
  - UD Engineering and Entrepreneurship
- **Conclusions**

# introduction





# Engineering @ UD

- **Engineering Curriculum offered since 1850**
  - In the 1920s, >50% of UD students were engineers!
- **Civil Engineering**
  - First professor hired in 1839
  - Graduated first engineers in 1892; ABET-accredited since 1936
- **Mechanical and Electrical Engineering**
  - Established 1891; ABET-accredited since 1936
- **Chemical Engineering**
  - Established in 1914; ABET-accredited since 1941
  - Started first-ever PhD program at UD

125-year  
Anniversary  
in 2016

Centennial  
Celebration  
in 2014



# Engineering @ UD

- **Environmental Engineering**
  - Established fall 1995; ABET-accredited since 1999
- **Computer Engineering**
  - Established fall 1996; ABET-accredited since 1999
- ***(Computer & Information Sciences***
  - *Transferred into the College in 2010)*
- **Biomedical Engineering**
  - Established fall 2009; Preparing for ABET-accreditation in 2014/15
  - First set of graduates in spring 2014



## Definitions



- **Creativity**

- The phenomenon of creating something new, original, and valuable;
- The ability to transcend traditional ideas, rules, patterns, relationships, etc., and to create meaningful new ideas, forms, methods, interpretations...

- **Innovation**

- The creation of something new and original *that makes an impact on society*; or the novel entity itself.





## Definitions

- **Entrepreneurship**

- The process, capacity, ability and willingness to identify, develop, organize and manage any enterprise—especially a business venture—typically with considerable initiative and risk;
- Activities range in scale from solo projects to the creation of major corporations (*MITre; Google; Apple*)

- **Characteristics (of the Entrepreneurial Spirit)**

- Creativity, Innovation and Risk-taking
- Can be nurtured (developed?)
- Essential to a nation's ability to succeed and remain competitive in today's market place



## Why Entrepreneurship @ UD

- **We owe it to our students**
  - Not all can or will become entrepreneurs....
  - Those with the inclination can be trained and nurtured
- **We owe it to the State of DE**
  - Land grant mandate
- **We owe it to the nation and the world**
  - Essential to a nation's ability to succeed and remain competitive in today's market place
  - What better way to "change the world"?



# training the 21<sup>st</sup> century engineer





# Historical Perspectives

- **From Archimedes to the Romans**
- **18<sup>th</sup> and 19<sup>th</sup> Century**
  - Dominant Science: *Physics*
  - Technological Innovations and Engineering
- **20<sup>th</sup> Century**
  - Dominant Science: *Chemistry*
  - Technological Innovations and Engineering
- **21<sup>st</sup> Century**
  - Dominant Science: *Biology* (incl. *Information Sciences*)
  - Technological Innovations and Engineering?
- **Tracks Evolution of Engineering Education**



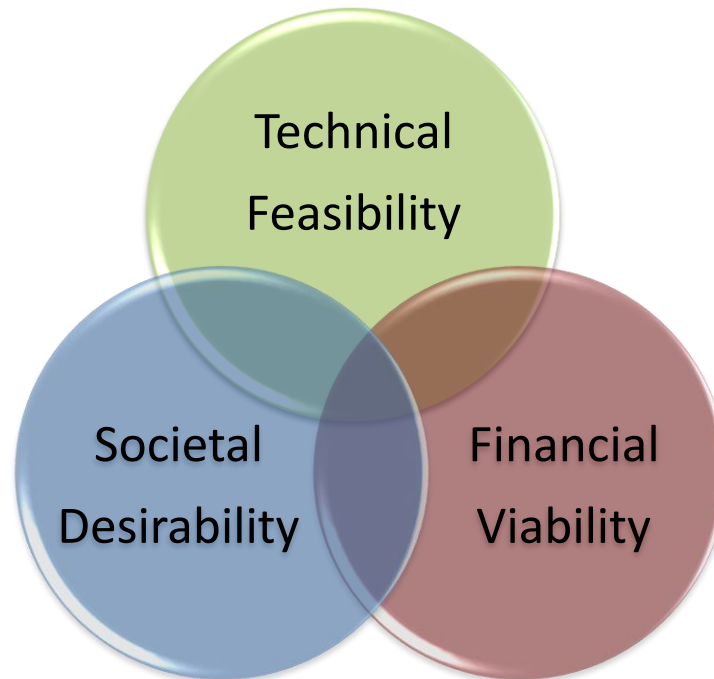
# Evolution of Engineering

- “Military” and Civil Engineering
- Mechanical/Aeronautical; Electrical Engineering
- Chemical Engineering; Materials Engineering
- Computer Science and Engineering
- Biomedical Engineering



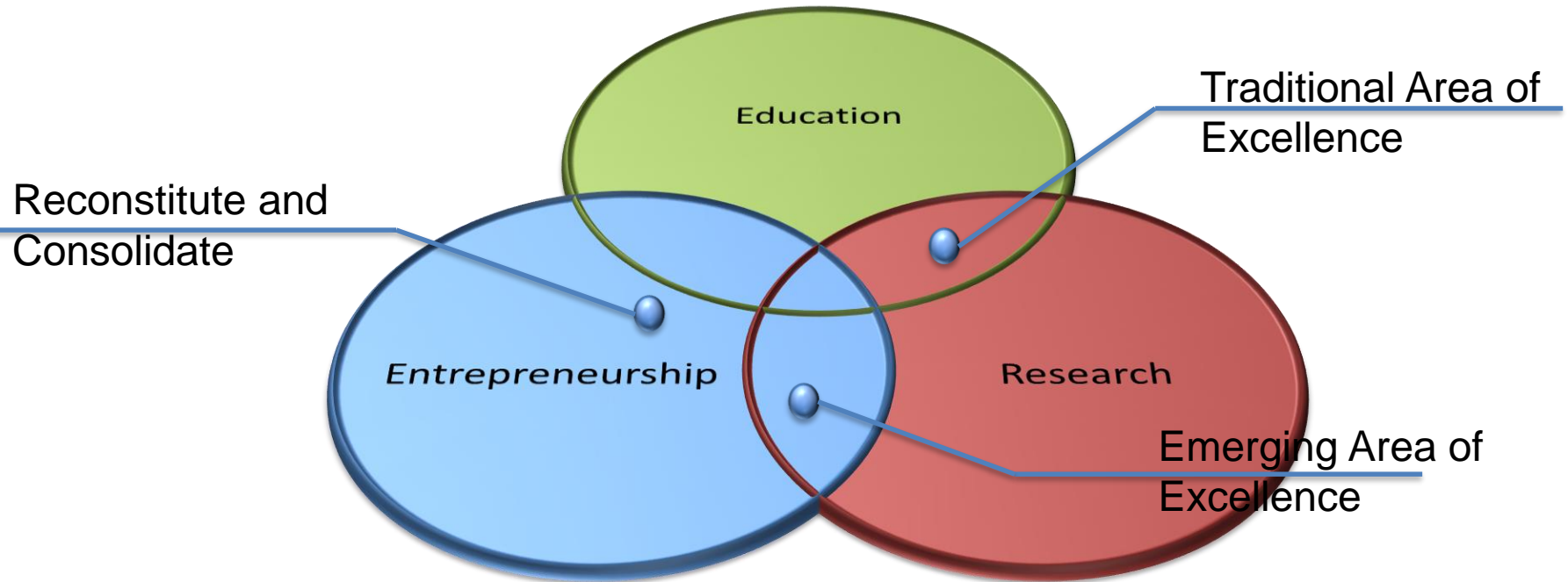
# Effective Engineering in the 21<sup>st</sup> Century

- **Tripartite Components**





# Engineering @ UD





# UD Engineering & Entrepreneurship

- **Education**
  - Courses and Classroom Instruction
  - Participation with Lerner College's Horn Initiative (Venture Development Center)
  - Practical Programs ("Spin In"; Design Projects; ... )
- **Faculty Technology Innovations and New Ventures**
  - Commercializing Innovations; Spinning out New Companies
  - Examples: *Terry Papoutsakis (Elcriton); Jingyi Yu (Naked Eye 3D cameras, TVs, etc.); Prather (EM Photonics); Norman Wagner (Body Armor from STF)...*

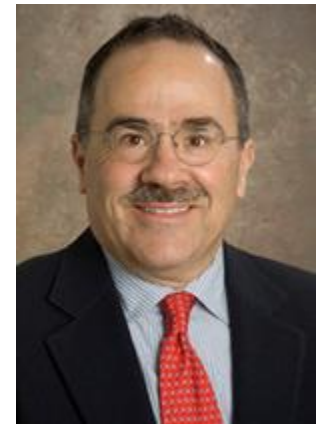


# Technology Innovation & Creating New Ventures

Commercialization  
Tech Transfer  
Spinning out new companies



*Terry Papoutsakis*



*Bruce Chase/John Rabolt*



# Space

Need: World Class Maker Space



Incubators

Wet and Dry labs



Design Studio





# UD Engineering & Entrepreneurship

- **Going forward**
  - Develop new/Enhance existing programs/collaborations
  - Create Ecosystem (Students, Faculty, Staff, Alumni, Mentors, Industrial Partners, State Partners, VC, etc.)
  - Develop and Strengthen Infrastructure (OEIP; College Entrepreneurship Officer; World Class “Maker Space” Additional Incubator space;...)

# conclusion





# Conclusion

- **In the Future**
  - Two kinds of Colleges of Engineering: those that promote and nurture entrepreneurship and those that don't
  - We know what kind UD CoE will be

*The College of Engineering will foster an interdisciplinary learning environment, rich with advanced research focused on societal challenges, to produce:*

*Global engineering leaders and **entrepreneurs**;  
fundamental advances in science and technology; and  
**game changing inventions***



## Finally

- **Shakespeare** (12<sup>th</sup> Night; Malvolio)

*“Some are born great;*

*Some achieve greatness;*

*and some have greatness thrust upon them”*

- **Same is true of Entrepreneurs**

- UD Engineering wants to develop, train and nurture entrepreneurs (whether natural born or not)

- If you are a student, faculty, staff, alum, friend, ***“Come, let’s go change the world, together!”***

**THANK YOU!**



# 0. Foundational Elements

- CORNERSTONE: **EXCELLENCE**
- Financial Stability
- Community
- Diversity

*With a shared vision and commitment to excellence, a financially healthy college whose community members are willing to be collegial, while genuinely valuing and respecting one another, IS UNSTOPPABLE*

