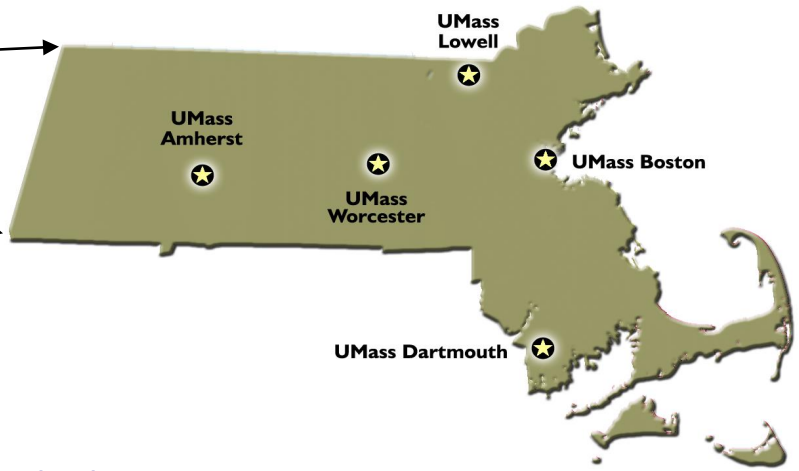


Engineering:
Global Opportunities, Global Challenges, Global Thinking

By:
Jack M. Wilson
President
University of Massachusetts

September, 2004

What shapes my views

- President, University of Massachusetts
- Vice President at both Univ. Of Mass. and Rensselaer (RPI).
- 34 years as a professor and administrator of all sorts
- Chairman, CEO, and Founder of software company built into industry leading public enterprise
- Formerly J. Erik Jonsson Distinguished Professor of Physics Engineering Science, Information Technology, and Management at RPI
- Co-Founder Severino Center for Technological Entrepreneurship
- Strong involvement in international programs including Asia, Eastern Europe, Mexico, etc.
  - China from 1982- this September. Chair, U.S.-Japan-China Trilateral

Issues in Engineering Education

- Globalism
- Nano-, Info-, Bio –, Cogno-, Enviro-
- Women
- Minorities
- Liberal Arts - Humanities
- Entrepreneurship
- Interactive Learning
- Continuing Education – Online learning

Messages to our universities

- While the ability to solve complicated models and equations will remain important, it will by no means be enough.
- Educating Engineers, and all students, more broadly to understand:
  - Communication,
  - Culture,
  - Economics,
  - People skills and team dynamics,
  - Entrepreneurship
  - Ethics,
- Tapping women and underrepresented minorities
- Take quality and standards to the next level!

National Academy Report

- broadly educated,
- who see themselves as global citizens,
- who can be leaders in business and public service, and
- who are ethically grounded.
- Chapter 4 takes the aspirations a step further by setting forth the attributes needed for the graduates of 2020. These include such traits as
  - strong analytical skills,
  - creativity,
  - ingenuity,
  - professionalism, and
  - leadership.

  (The Engineer of 2020: Visions of Engineering in the New Century, NAS/NRC 2004.)

National Academy of Science report

- This study suggests that if the engineering profession is to take the initiative in defining its own future, it must
  - (1) agree on an exciting vision for its future;
  - (2) transform engineering education to help achieve the vision;
  - (3) build a clear image of the new roles for engineers, including as broad-based technology leaders, in the mind of the public and prospective students who can replenish and improve the talent base of an aging engineering workforce;
  - (4) accommodate innovative developments from nonengineering fields; and
  - (5) find ways to focus the energies of the different disciplines of engineering toward common goals.

(The Engineer of 2020: Visions of Engineering in the New Century, NAS/NRC 2004.)

Universities must connect to communities.

- Work force development
  - Community needs in bio-, nano-, info-, medical-technologies.
- Educating underrepresented groups
- Collaborating with industry
- Research and Venture Capital are the fuel-air mixture for innovation.
- Technological entrepreneurship
- Understanding cultures

The University of Massachusetts

- **$1.7 B enterprise** in FY05 ($326M state appropriation- $400M+- in FY05)
- Over **$320M in sponsored research** (90% outside of Rt 128)(# 3 in Mass)
- **$25 Million per year** (top 20) in commercialization of research
- **5 campuses** and 80 off-campus sites throughout the Commonwealth
- **14,000 employees**, making UMass a major employer across the state
- **About 58,000** undergraduate/graduate/continuing education students
- **UMassOnline: 14,700** enrollments in workplace in 40 degree programs
- Over **10,000 graduates** annually
- Over **450 BS/MS/PhD** programs
- Over **320,000 alumni** – 2/3 living and working in Massachusetts
- **$1.7 B capital program** with huge deferred maintenance needs

Recent UMass Successes

Federal Grants

- **$40 M** UMA ERC -Atmospheric Sensing
  - (with Raytheon, IBM, MA/Com. etc)
- **$17 M** UMD/Tufts Botulinum Center
- **$16 M** UMW Immunology Grant
- **$12 M** UMB-Boston Science Ed Partnership
- **$3 M** UMB BATEC Grant
- >$10 M pending ERC to UMass Lowell, Northeastern, UNH, etc.

Tech Commercialization

- **$20 M CVIP** last year and $13 M in Q1 of this year
- **$10 M** + Licensing of **RNAi** (Araios start-up)

Philanthropy

- **$20 M** Partnership with Nantucket Conservation Foundation
  - $20 M to endowment with 6 endowed chairs and $ 8 M strategic fund
- **$3 M** Blais Chair to Craig Mello at UMW

UMass Online

- **$12.7** M in UMassOnline external revenues

Challenge: Partnerships

- CASA: An Engineering Research Center
  - Collaborative Adaptive Sensing of the Atmosphere
  - ~ $40 million from NSF, State, Industry, UMass
  - University partners: UMass Amherst, University of Oklahoma, Colorado State University, and the University of Puerto Rico, Mayaguez
  - Industrial partners: Raytheon, IBM, MA/COM, Vaisala, Vieux and Associates, Telephonics, and The Weather Channel
  - Government partners: NSF, NOAA's National Severe Storms Laboratory and Oak Ridge National Labs

Challenge: Bio- Engineering

- Susan Hockstein appointed as president of MIT
  - Illustration of the importance of Bio-Tech.
  - "Many were pleased that Hockfield is a neuroscientist rather than an engineer, a sign of a change already underway at MIT. The past two presidents, who served a total of 24 years, were both engineers, and MIT built its global reputation on engineering. But **life sciences and their intersection with engineering are the hottest topics at MIT** today. This is the first year in MIT history that research funding from the National Institutes of Health equals or exceeds funding from the Department of Defense, Mead said at a press conference yesterday. 'So the shift is already taking place.' "
    - Boston Globe 27 August 2004

Challenge: Entrepreneurship

- RNAi Discovery
  - University of Massachusetts Medical School
- Promises opportunities for both research and treatment of genetic or DNA and RNA based diseases.
- Science magazine designates this as the number one discovery of 2002.
- Initial license for $10 million to existing company.
- New company created in Worcester.
- Worcester positioned to be the center of development of RNAi technologies

And there is more

- Konarka Technologies
  - Lowell
- Avant Immunotherapeutics
  - Fall River
- Green Chemistry
  - Boston – Lowell
- Fisheries/Marine Sciences
  - Dartmouth
- UMass Amherst
  - BayState Partnership

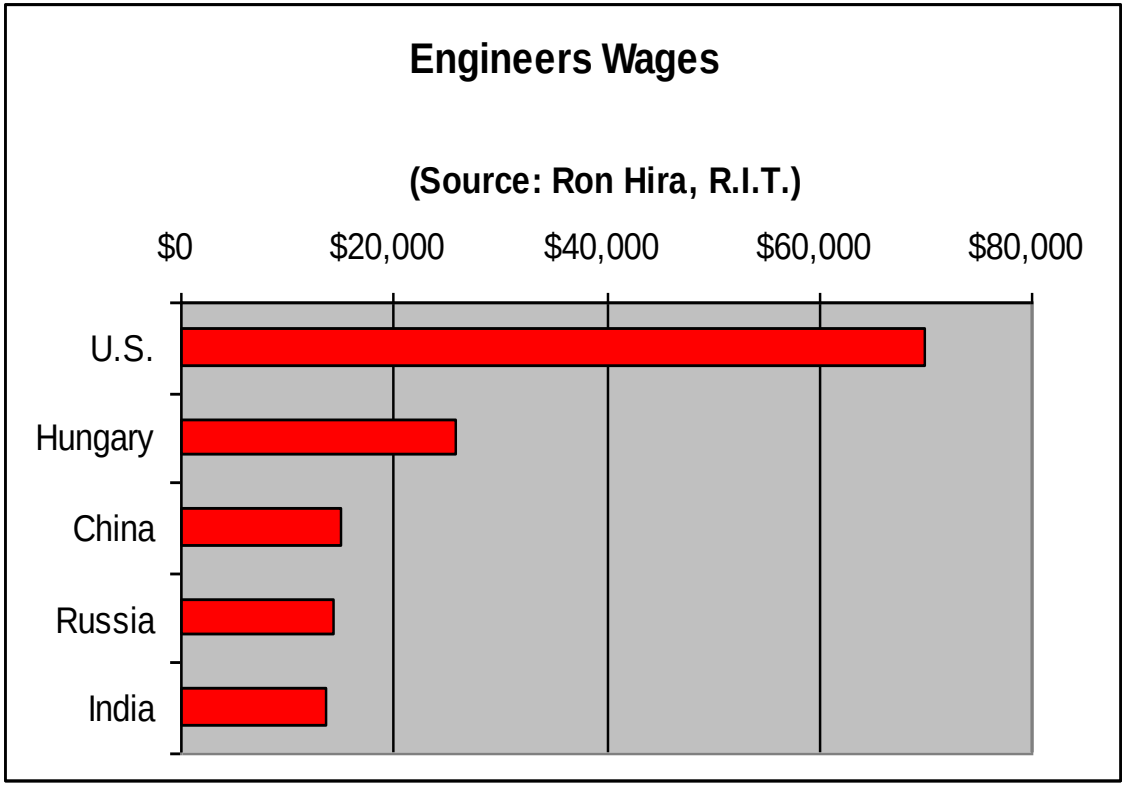
Challenge: The Global Economy

- *"We are moving toward a global economy. One way of approaching that is to pull the covers over your head. Another is to say: It may be more complicated -- but that's the world I am going to live in, I might as well be good at it."*

Phil Condit,
former Chairman and CEO,
The Boeing Company

Cost of Engineers

- U.S. $70,000
- Hungary $25,690
- China $15,120
- Russia $14,420
- India $13,580



- In spite of the wage differential, overseas wages make engineers well paid by local standards.

Why?

- Gail Dundas, Intel Corporation
  - "You have to look at all the factors. There are times when cost effectiveness is a part of it, but it is not the stand alone reason. We have growing markets, good talented people in those markets, and people who are more educated than ever before."

Great universities all over the world

- Tsinghua, Beida, and other Chinese Universities
  - UMass has strong program of cooperation with Tsinghua and others.
- Indian Institute of Technology
- Many Japanese Universities.
  - Aside: William Smith Clark, fourth President of UMass, helped with the founding of what is now Hokkaido university.
    - "Boys, be ambitious"
- Universities are the nucleus of economic and social development.

Global Corporations are moving jobs

- According to Business Week
  - Intel: 3,000 chip design jobs to India by 2006.
  - Microsoft 500 software design jobs to India and China in 2003.
  - Oracle: 4000 software design jobs to India in next five years.
  - Phillips: 700 consumer electronic design jobs to China in next few years.

Outsourcing of engineering/technical

- Forrester Research: 3.3 million jobs by 2015
  - $ 136 billion in wages lost
- Gartner Inc.: estimates 10% of Computer services and software jobs to be outsourced by 2004 end.
- Deloitte Research surveyed 100 of the worlds largest financial services companies
  - Expect to outsource 2 million jobs in next five years.
  - Outsource $356 billion in operations in next five years
- A political challenge and an economic conundrum

Steve Ballmer, CEO of Microsoft

- Steve Ballmer, the CEO of Microsoft and I recently (Sept. 1) were the two keynote speakers to a group of 750 high technology business executives in the U.S.
- “Free flow of scientific and engineering talent is critical for the economic development of the U.S., China, and the world.”

Steve Ballmer
CEO, Microsoft

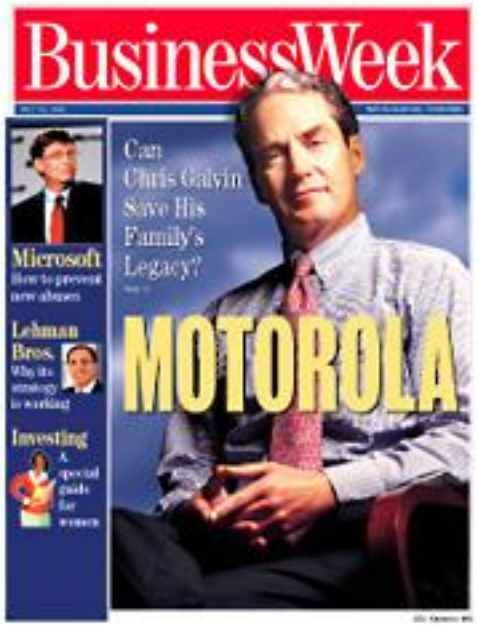
Jack Wilson
President, UMass

The Forty Year Degree

- Many years ago I keynoted an ASEE International Conference with:

- Christopher Galvin,

  then President Motorola:
  - We are not hiring any more graduates with four year degrees.
  - We want employees with **forty year** degrees



Challenge: Continuous Education

- The paradox of the Internet
- Engineers in the workplace face a difficult challenge.
  - How can they keep up with the pace of technical change and the new economy business environment when they find themselves overwhelmed with work and with little time for traditional educational programs?
  - They are ideal candidates for high quality and high flexibility learning environments.
- Can the internet bring learning to the learner rather than forcing the learner to come to the learning.
- So much to learn and so little time.

Maintenance contract on every degree

- No longer good enough to give a student a four year degree and send him or her out into the world with a quick goodbye and an occasional request for a donation.
- Need to be there for every student throughout his or her career.
  - Updating a degree
  - Career direction changes
  - Lifestyle education requirements

UMassOnline – www.umassonline.net

Fiscal Year 2004:

- Total Enrollments: 14,787
- Tuition Revenue: $12.7 million
- Revenue growth rate: 39% per yr
- Enrollment growth rate: 32%

Recognized Market Leadership - Awards

- Winner, United States Distance Learning Association Excellence In Distance Teaching Award, 2003
- Winner, Sloan Consortium Award for Effective Practices in Student Satisfaction, 2003
- Winner, University Continuing Education Association's (UCEA) Outstanding Continuing Education Faculty Award, 2002
- MBA, MPH, and MEA degrees designated "Top U.S. Online Programs" by U.S. News and World Report in 2000.

UMassOnline Programs

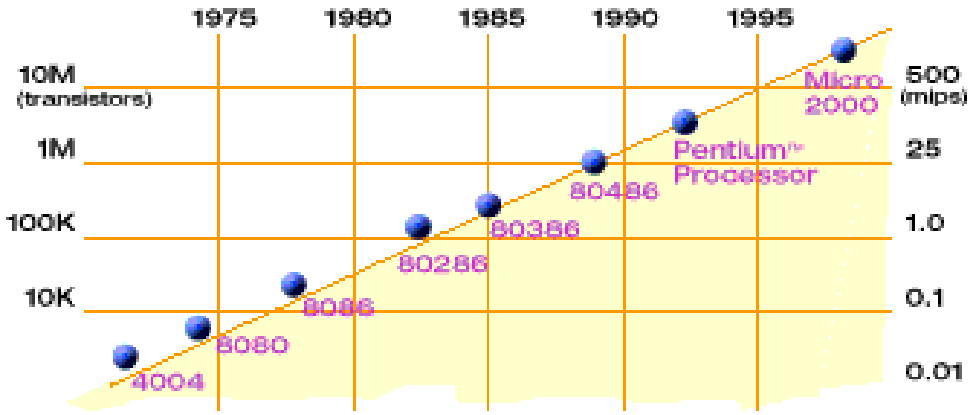
- Graduate Degrees: 11
- Graduate Certificates: 4
- Undergraduate Degrees: 7
- Undergraduate Certificates: 13
- Non-Credit Certificates: 2

The University in the Convergence of

- **Computing, Communications, and Cognition**
  - **Transforming our educational programs**
    - **Online programs, partnership with WebCT, Centra, and others.**
    - **Interactive learning in traditional classrooms**
    - **Linking communities in different geographies**
    - **Developing global programs**
  - **Transforming our business practices**
    - **Enterprise systems – expensive and powerful**
    - **Development of Central Shared Services**
  - **Transforming our research**
  - **Transforming our community service.**

Wilson's Favorite Laws!

- **Moore's Law**:
  - CPU performance doubles every 18 months



- **Bandwidth law**:
  - Bandwidth is doubling even faster!
- **Metcalf's Law**:
  - the value of a network scales as n^2 where n is the number of persons connected.

Challenge: filling the pipeline

- EiMC The Engineering in Mass Collaborative
  - http://www.eimc.org/
  - “We have a technology pipeline problem: Not nearly enough of this country’s students, especially young women and minorities, are pursuing studies and careers in math, science, and engineering.”

Engineering:
Global Opportunities
Global Challenges
Global Thinking

THANK YOU!

Jack M. Wilson, President

www.jackmwilson.com