

Department of Mechanical Engineering  
The University of Maryland, Baltimore County  
1000 Hilltop Circle  
Baltimore, MD 21250

**Web address:** <http://www.umbc.edu/engineering/me/>

Panos G. Charalambides, Chair

March 23, 2007

“Transforming Mechanical Engineering at UMBC.” Invited presentation given at the ASME conference for Mechanical Engineering Department Heads held in San Juan, Puerto Rico, March 2007.

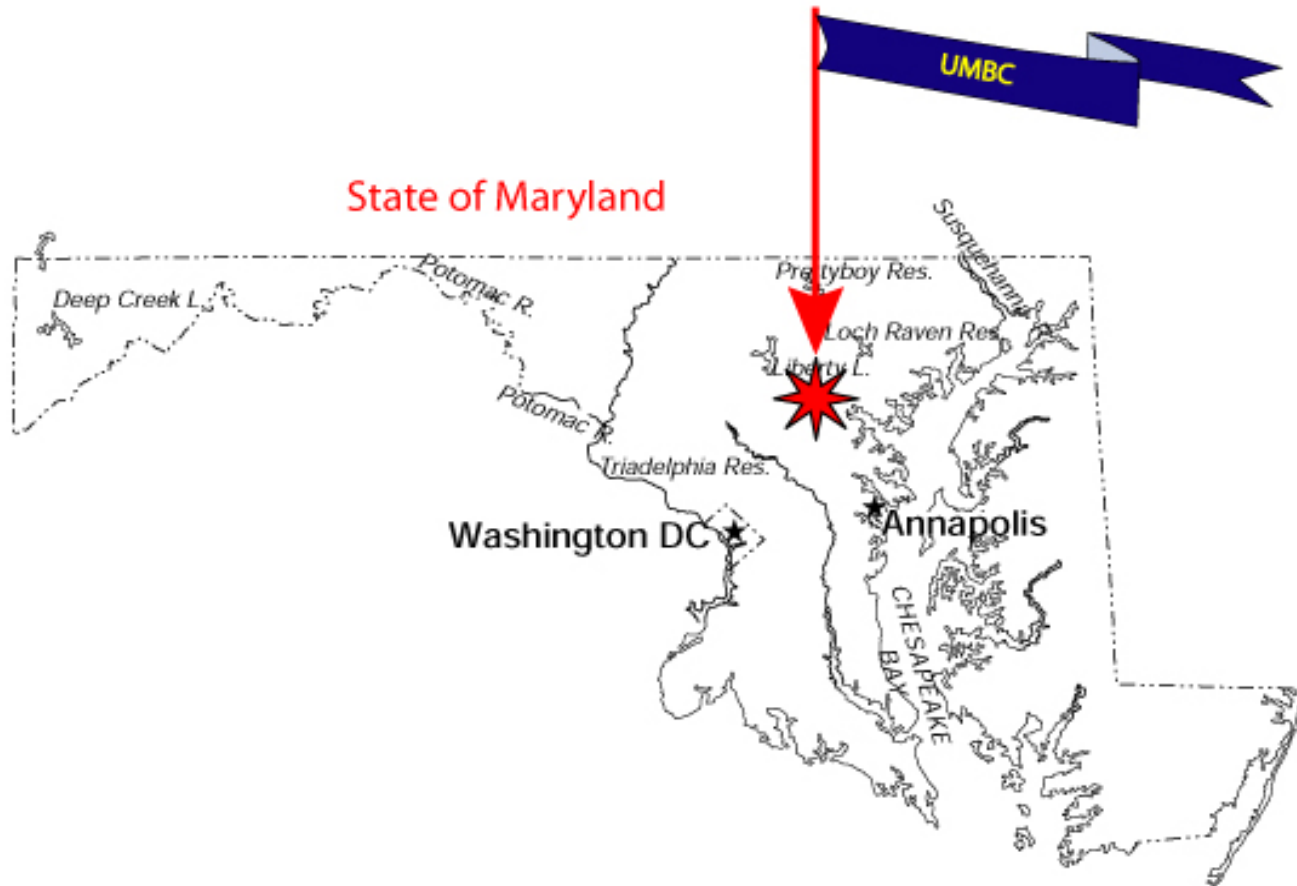
Where are we?



United States

State of Maryland

Puerto Rico



State of Maryland

UMBC

Deep Creek L.

Potomac R.

Susquehanna

Pretyboy Res.

Loch Raven Res.

Potomac R.

Liberty L.

Triadelphia Res.

Washington DC

Annapolis

CHESAPEAKE  
BAY

**techcenter @UMBC**  
(South Campus)

From I-83  
• Take I-83 east toward UMBC and go south on Hilltop Road.  
• Follow US Route 208 south toward Hilltop.  
• Turn left onto Hilltop and make the left turn into Tech Plaza.  
• Walk immediately north.  
• Turn left and proceed a half mile to entrance.

From UMBC  
• Take Millage Center to Millage Road and Hilltop Avenue.  
• Turn left and proceed to Route 208 South.  
• Remain straight on until about...

**Mechanical Engineering**

- Building Directory**
- Academics (B-2)
  - Administration (B-1)
  - Business Services (B-3)
  - Student Union (B-4)
  - Engineering (B-5)
  - Library (B-6)
  - Student Services and Development Center (B-7)
  - Center for Science and Technology (B-8)
  - Center for the Environment (B-9)
  - Center for the Arts (B-10)
  - Center for the Health Sciences (B-11)
  - Center for the Humanities (B-12)
  - Center for the Life Sciences (B-13)
  - Center for the Physical Sciences (B-14)
  - Center for the Social Sciences (B-15)
  - Center for the Earth and Environmental Sciences (B-16)
  - Center for the Global Studies (B-17)
  - Center for the International Studies (B-18)
  - Center for the Law (B-19)
  - Center for the Policy Studies (B-20)
  - Center for the Urban Studies (B-21)
  - Center for the Water Resources (B-22)
  - Center for the Wildlife and Fisheries (B-23)
  - Center for the Woodlands (B-24)
  - Center for the Wetlands (B-25)
  - Center for the Watersheds (B-26)
  - Center for the Watersheds (B-27)
  - Center for the Watersheds (B-28)
  - Center for the Watersheds (B-29)
  - Center for the Watersheds (B-30)
  - Center for the Watersheds (B-31)
  - Center for the Watersheds (B-32)
  - Center for the Watersheds (B-33)
  - Center for the Watersheds (B-34)
  - Center for the Watersheds (B-35)
  - Center for the Watersheds (B-36)
  - Center for the Watersheds (B-37)
  - Center for the Watersheds (B-38)
  - Center for the Watersheds (B-39)
  - Center for the Watersheds (B-40)
  - Center for the Watersheds (B-41)
  - Center for the Watersheds (B-42)
  - Center for the Watersheds (B-43)
  - Center for the Watersheds (B-44)
  - Center for the Watersheds (B-45)
  - Center for the Watersheds (B-46)
  - Center for the Watersheds (B-47)
  - Center for the Watersheds (B-48)
  - Center for the Watersheds (B-49)
  - Center for the Watersheds (B-50)
- Academic Departments and Programs**
- Architecture and Environmental Science (A-1) B-2  
Astronomy (A-2) B-3  
Biology (A-3) B-4  
Chemistry (A-4) B-5  
Civil and Environmental Engineering (A-5) B-6  
Computer Science and Electrical Engineering (A-6) B-7  
Economics (A-7) B-8  
Education (A-8) B-9  
Engineering (A-9) B-10  
Environmental Science (A-10) B-11  
Geography (A-11) B-12  
History (A-12) B-13  
Information Systems (A-13) B-14  
International Studies (A-14) B-15  
Law (A-15) B-16  
Life Sciences (A-16) B-17  
Mathematics (A-17) B-18  
Mechanical Engineering (A-18) B-19  
Physics (A-19) B-20  
Political Science (A-20) B-21  
Psychology (A-21) B-22  
Public Policy (A-22) B-23  
Public Relations (A-23) B-24  
Public Safety (A-24) B-25  
Public Service (A-25) B-26  
Public Works (A-26) B-27  
Social Science (A-27) B-28  
Sociology (A-28) B-29  
Theater (A-29) B-30  
Urban Studies (A-30) B-31  
Visual Arts (A-31) B-32  
Women's Studies (A-32) B-33
- Lecture Halls**
- Biological Sciences (L-1) (A-1) B-2  
Chemistry (L-2) (A-2) B-3  
Engineering (L-3) (A-3) B-4  
Physics (L-4) (A-4) B-5  
Public Policy (L-5) (A-5) B-6  
Public Works (L-6) (A-6) B-7
- Offices and Services**
- Accounting (O-1) (A-1) B-2  
Administration (O-2) (A-2) B-3  
Admissions (O-3) (A-3) B-4  
Business Services (O-4) (A-4) B-5  
Campus Safety (O-5) (A-5) B-6  
Career Development Center (O-6) (A-6) B-7  
Center for the Environment (O-7) (A-7) B-8  
Center for the Health Sciences (O-8) (A-8) B-9  
Center for the Humanities (O-9) (A-9) B-10  
Center for the Life Sciences (O-10) (A-10) B-11  
Center for the Physical Sciences (O-11) (A-11) B-12  
Center for the Social Sciences (O-12) (A-12) B-13  
Center for the Urban Studies (O-13) (A-13) B-14  
Center for the Water Resources (O-14) (A-14) B-15  
Center for the Wildlife and Fisheries (O-15) (A-15) B-16  
Center for the Woodlands (O-16) (A-16) B-17  
Center for the Wetlands (O-17) (A-17) B-18  
Center for the Watersheds (O-18) (A-18) B-19  
Counseling (O-19) (A-19) B-20  
Financial Aid (O-20) (A-20) B-21  
Health Services (O-21) (A-21) B-22  
Human Resources (O-22) (A-22) B-23  
Information Systems (O-23) (A-23) B-24  
International Studies (O-24) (A-24) B-25  
Law (O-25) (A-25) B-26  
Life Sciences (O-26) (A-26) B-27  
Mathematics (O-27) (A-27) B-28  
Mechanical Engineering (O-28) (A-28) B-29  
Physics (O-29) (A-29) B-30  
Political Science (O-30) (A-30) B-31  
Psychology (O-31) (A-31) B-32  
Public Policy (O-32) (A-32) B-33  
Public Relations (O-33) (A-33) B-34  
Public Safety (O-34) (A-34) B-35  
Public Service (O-35) (A-35) B-36  
Public Works (O-36) (A-36) B-37  
Social Science (O-37) (A-37) B-38  
Sociology (O-38) (A-38) B-39  
Theater (O-39) (A-39) B-40  
Urban Studies (O-40) (A-40) B-41  
Visual Arts (O-41) (A-41) B-42  
Women's Studies (O-42) (A-42) B-43

- Arts**
- The Center for Art and Visual Culture (A-1) B-2  
Joseph Beuys Sculpture Park (A-2) B-3  
Lizette Gallery (A-3) B-4  
MOCA Hill-Facility (A-4) B-5  
Theater (A-5) B-6
- Activities**
- Center for the Environment (A-1) B-2  
Center for the Health Sciences (A-2) B-3  
Center for the Humanities (A-3) B-4  
Center for the Life Sciences (A-4) B-5  
Center for the Physical Sciences (A-5) B-6  
Center for the Social Sciences (A-6) B-7  
Center for the Urban Studies (A-7) B-8  
Center for the Water Resources (A-8) B-9  
Center for the Wildlife and Fisheries (A-9) B-10  
Center for the Woodlands (A-10) B-11  
Center for the Wetlands (A-11) B-12  
Center for the Watersheds (A-12) B-13
- Visitor Parking Lots**
- The Commons Garage (V-1) B-2  
Visitor Parking with Access on Level 1  
Student Parking on Upper Level  
Walker Avenue Garage (V-2) B-3  
Visitor Parking with Access on Upper Level  
Administration Zone Garage (V-3) B-4  
Visitor Parking with Access on Upper Level  
Guest Faculty/Staff Parking on Lower Level

- Map Legend**
- Visitor Parking
  - Reserved Student Parking
  - General Parking
  - Information
  - Emergency Plaza
  - UMBC Transit Bus Stop
  - City Transit Bus Stop
  - After Hours
  - Student Parking
  - Faculty Staff Parking
  - See Map Traffic



**CERA**  
CONSERVATION and ENVIRONMENTAL  
RESEARCH AREA

Who are we?



Dr. Apoll Anagnostou



Dr. Dwayne Arola



Dr. Dawn Bostrom



Dr. Shlomo Carmi



Dr. Pappos Charalambides



Dr. Chuck Collins



Dr. Tony Samahar



Dr. Akhondjoo



Retired

Dr. Chayvon Kercak



Dr. Ronghui Ma



Dr. Lisa Spiering



Dr. Arif Doshi



Dr. Tirk Topolinski



Dr. Yanyan



Dr. Weidong Zhu



Dr. Marc Zupan



No longer at UMBC

Mr. Tim Champ



Mr. John Gottschalk



Ms. Cindy Luo



Mr. Chuck Smilthson

Mechanical Engineering Personnel --- January, 11, 2007

State of  
The Department of  
Mechanical Engineering



# Assessing %Effort

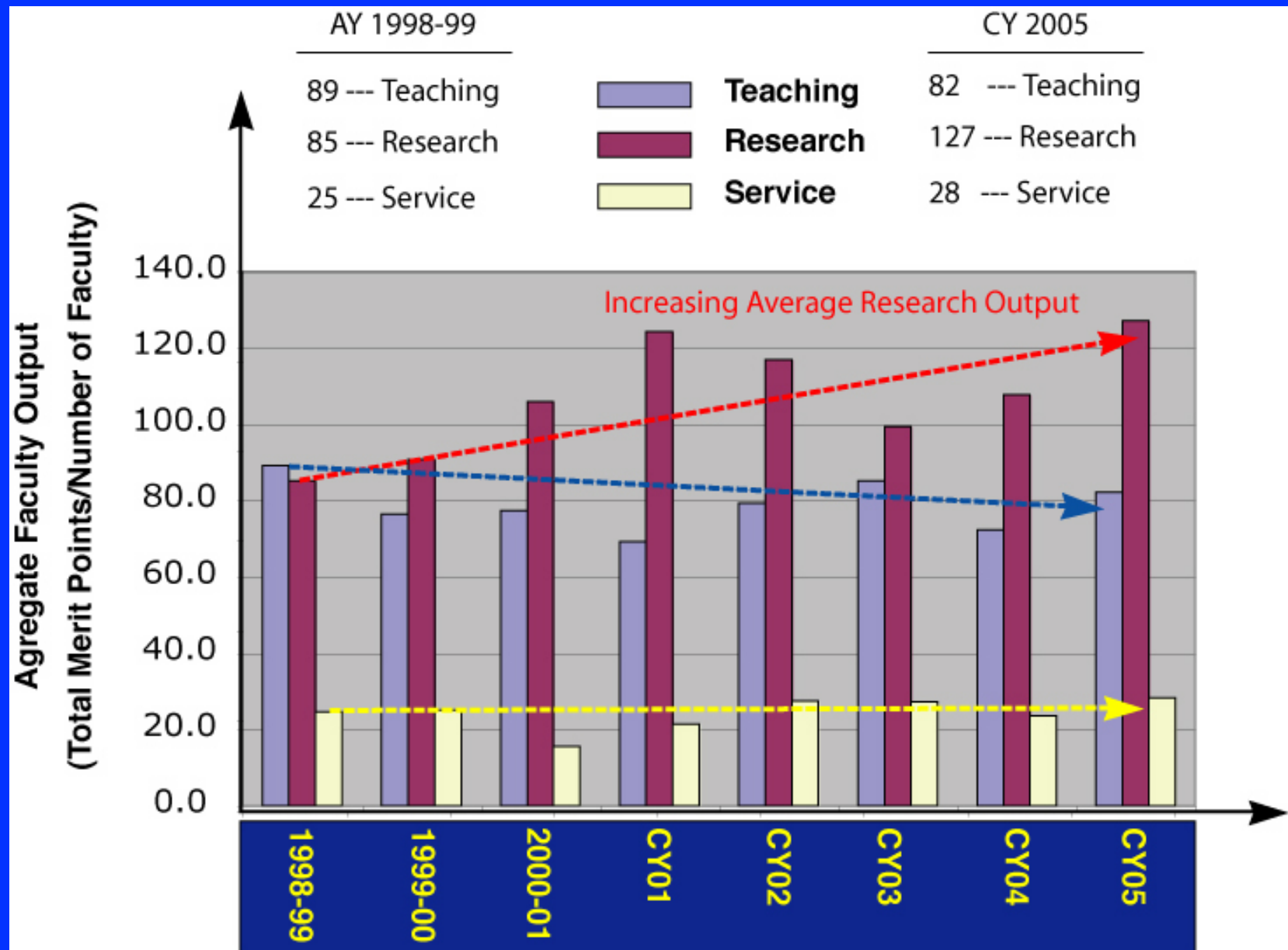
		TEACHING					RESEARCH										SERVICE			Total
	# of Faculty	Courses	SCEQs	Curriculum Innovation	Res. Students	Degrees Conf	J Papers	Non-j. papers	Patents	Conf Abstracts	Book Chapters	Books	Proposals Submitted	Fund Expend	GRA Support	Internal Service	Admin	External Service	Total	
AY 98-99	8	41.3	9.1	6.3	24.4	8.1	37.5	6	0.5	9	1.5	0	0	30.6	0	13.5	5.1	6	198.9	
AY 99-00	11	45	7.5	1.4	16.5	5.9	26.4	0	1.5	8.1	0	0	12	34.2	8.5	14.5	3.6	7	192.1	
AY 00-01	12	48	7.9	0.8	16.7	3.8	30	0	2.2	12.9	2	2.5	12	35	9.3	8.7	2	4.9	198.7	
CY01	11	36.7	8.6	3.5	15.3	5	21.6	5.4	2.6	8.4	12	3	15	43.5	12.7	10	1.5	9.9	203.9	
CY02	11	45	10.9	5	14.2	4.1	27.3	7.6	2	7.9	2.2	0	12.3	45.5	12.1	12.9	4.6	10	223.5	
CY03	11	47.3	9	4	16.4	8.45	13.2	7.4	3.6	5.5	4.4	0	12.3	42.9	10	14.7	3.2	9.3	211.5	
CY04	15	39.8	8.7	6	13.8	4	11.2	9.2	3.5	4.2	0	0	13.6	53.9	12.1	10.1	5.3	8.1	219	
CY05	15	43.9	9.6	5	18.9	4.7	9.6	9.6	2.7	6.2	1.6	0.8	14	61.9	20.6	16	4	8.3	245.2	
		TEACHING					RESEARCH										SERVICE			

# Merit Index Outcomes

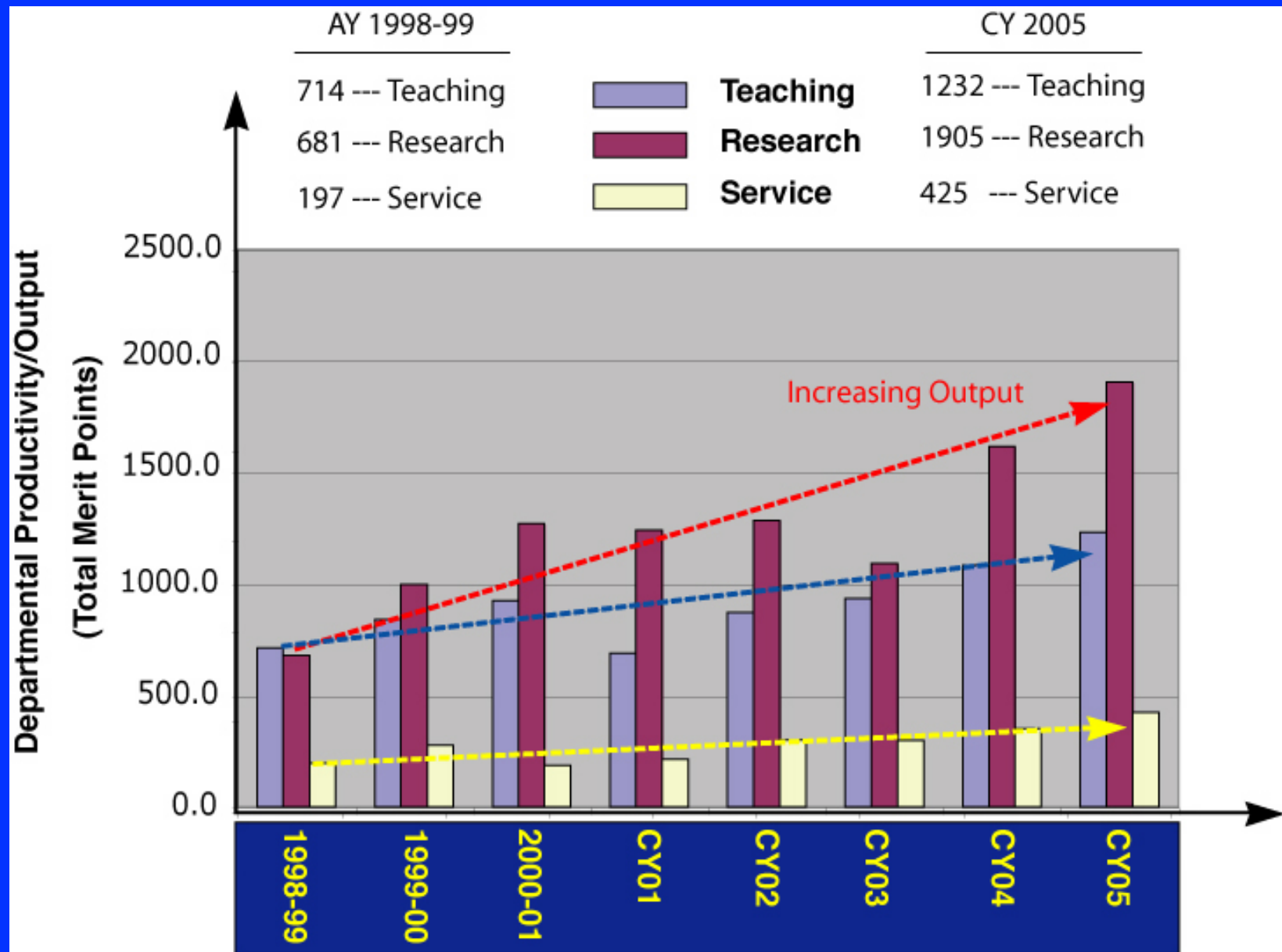
**Mechanical Engineering Workload Effort Trends**  
 (Data Compiled by P.G. Charalambides, in preparation for  
 March 14, 2007, Faculty Meeting on Faculty Workload)

Year	Number of Faculty	Merit Points Per Faculty (Average)	Average per Faculty Merit Points			Total Merit Points			% Effort		
			Teaching	Research	Service	Teaching	Research	Service	Teaching	Research	Service
AY98-99	8	199	89	85	25	714	681	197	45	43	12
AY99-00	10	192	76	91	25	839	998	276	40	47	13
AY00-01	12	199	77	106	16	926	1271	187	39	53	8
CY01	11	215	69	124	21	691	1242	214	32	58	10
CY02	11	224	79	117	28	871	1286	303	35	52	12
CY03	11	212	85	99	27	937	1092	299	40	47	13
CY04	15	204	72	108	24	1085	1616	353	36	53	12
CY05	15	237	82	127	28	1232	1905	425	35	53	12

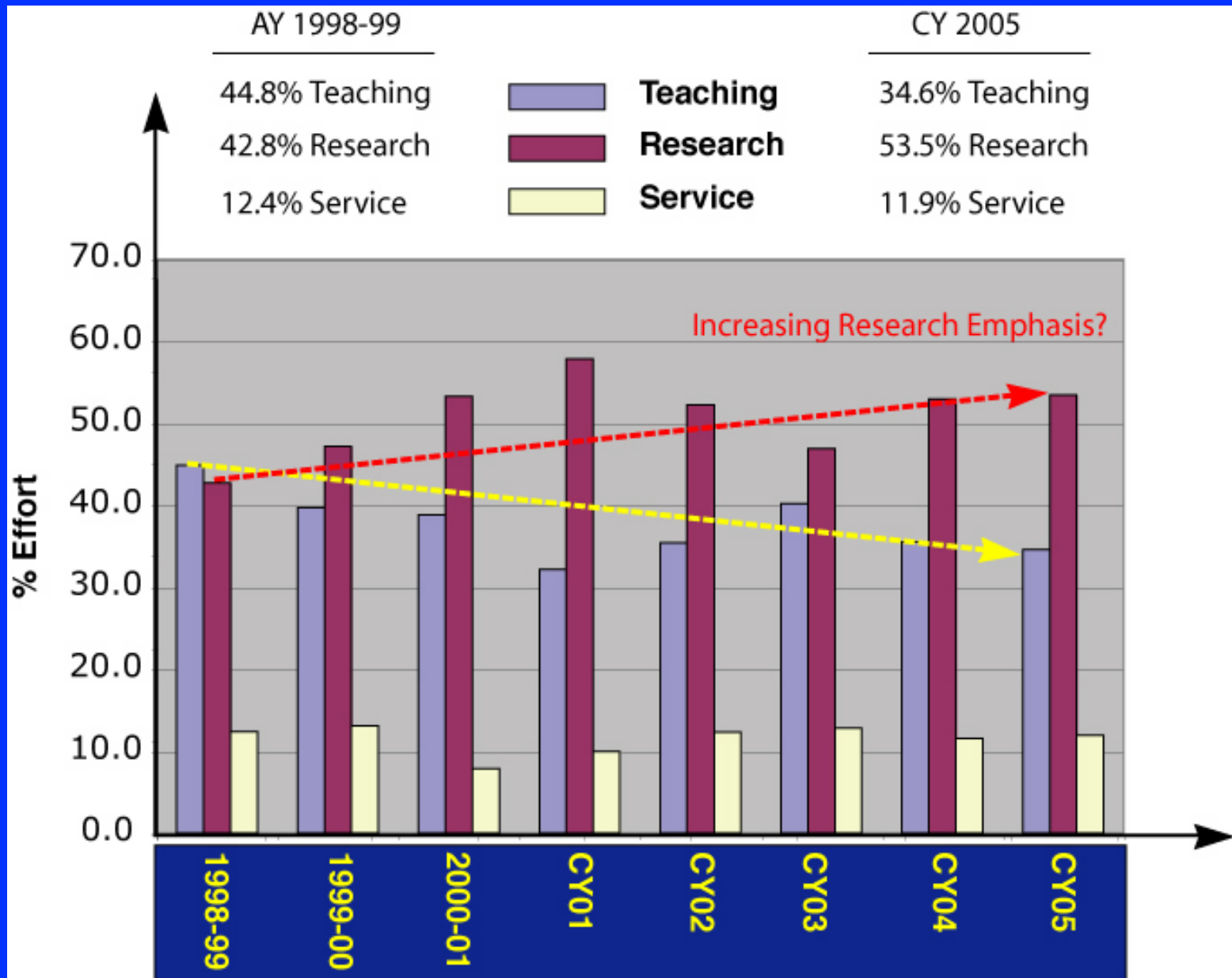
# Average Workload Trends



# Departmental Output



# % Effort

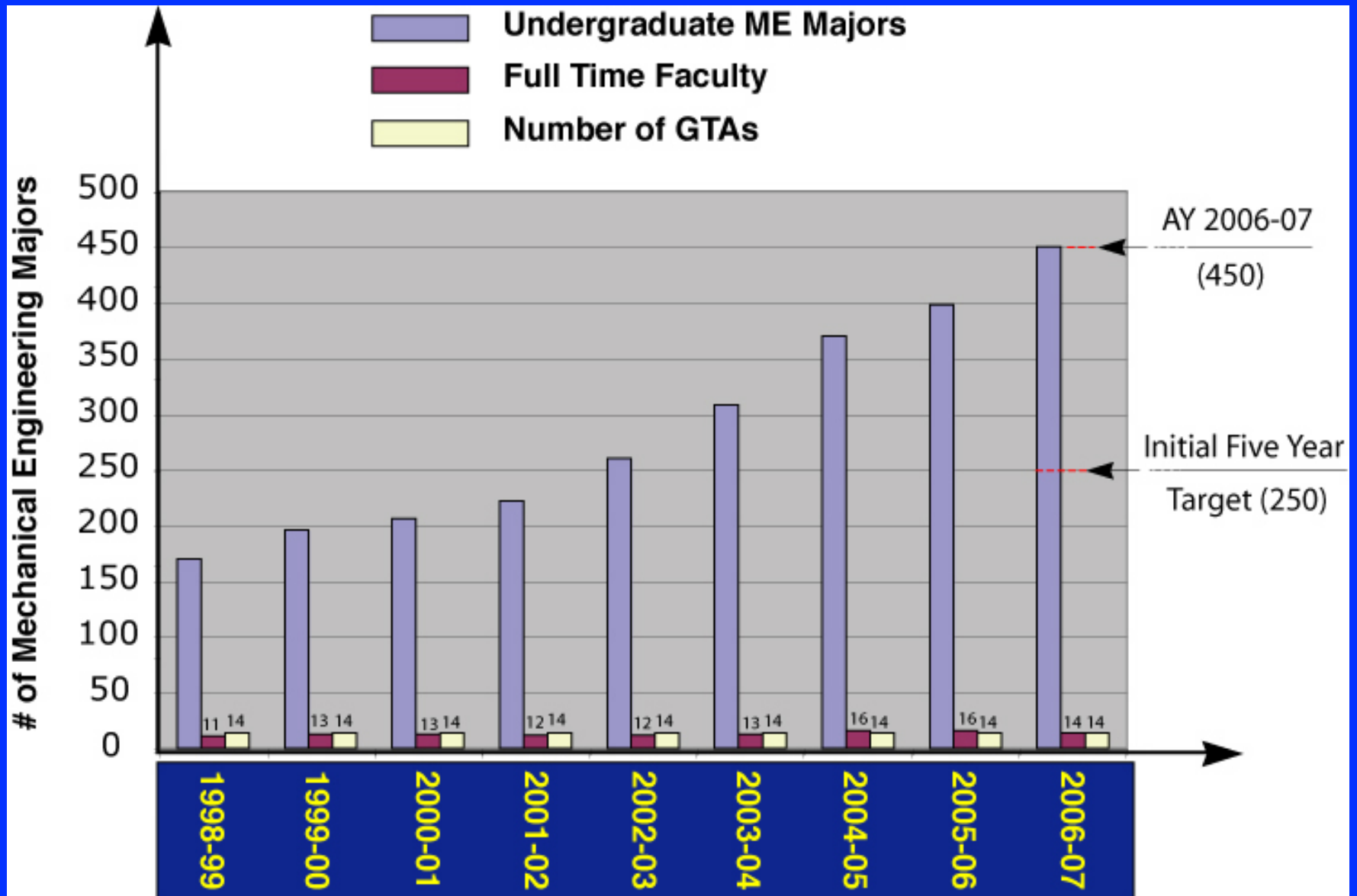


# Assessing Change

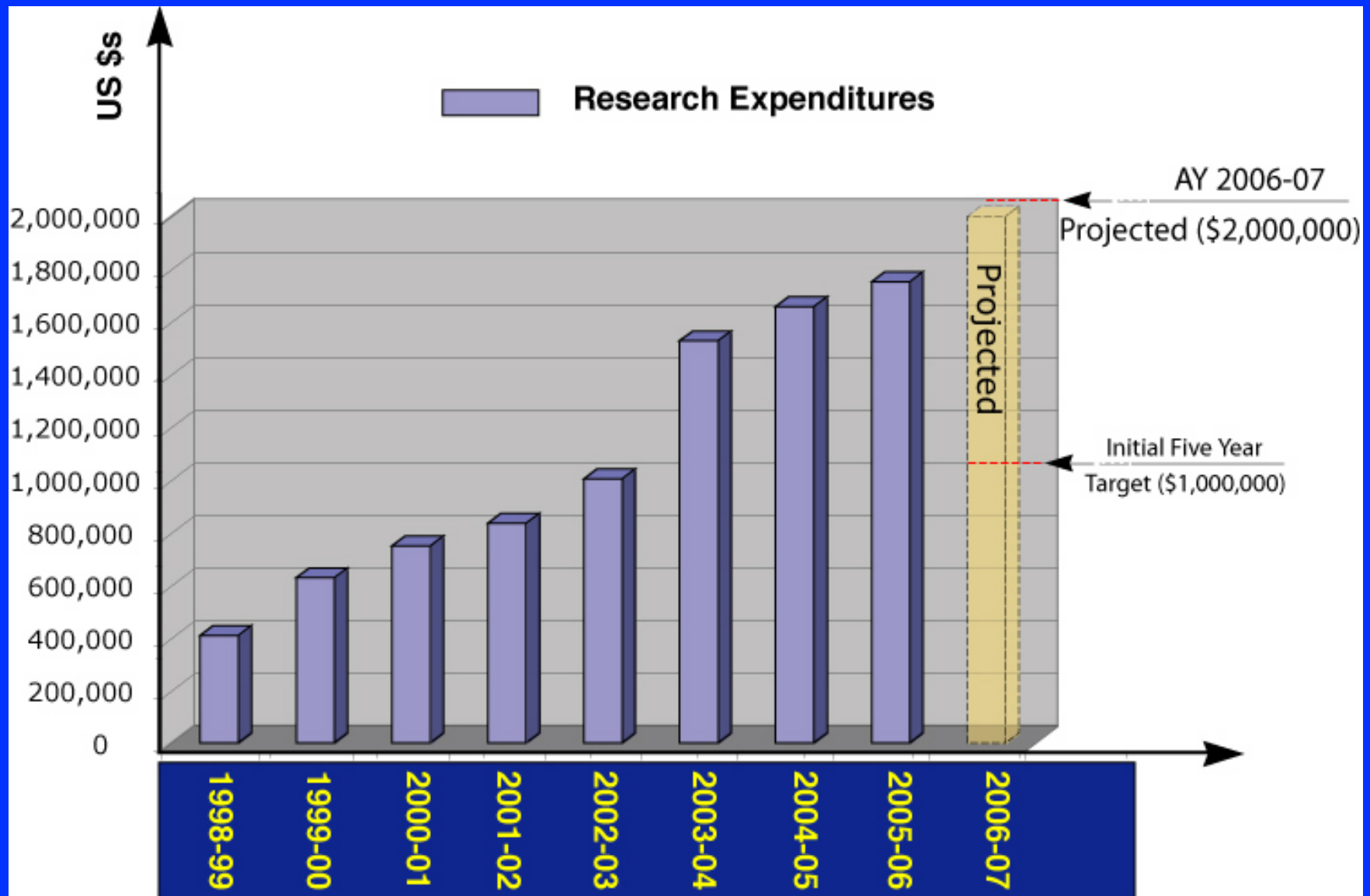
(Faculty Increased from 8 to 15)

	TEACHING	RESEARCH	SERVICE
Output (Productivity)	73% ↑	180% ↑	115% ↑
Average Workload	8% ↓	49% ↑	15% ↑
% Effort	45% → 35%	43% → 53%	12% → 12%

# Undergraduate Enrollments



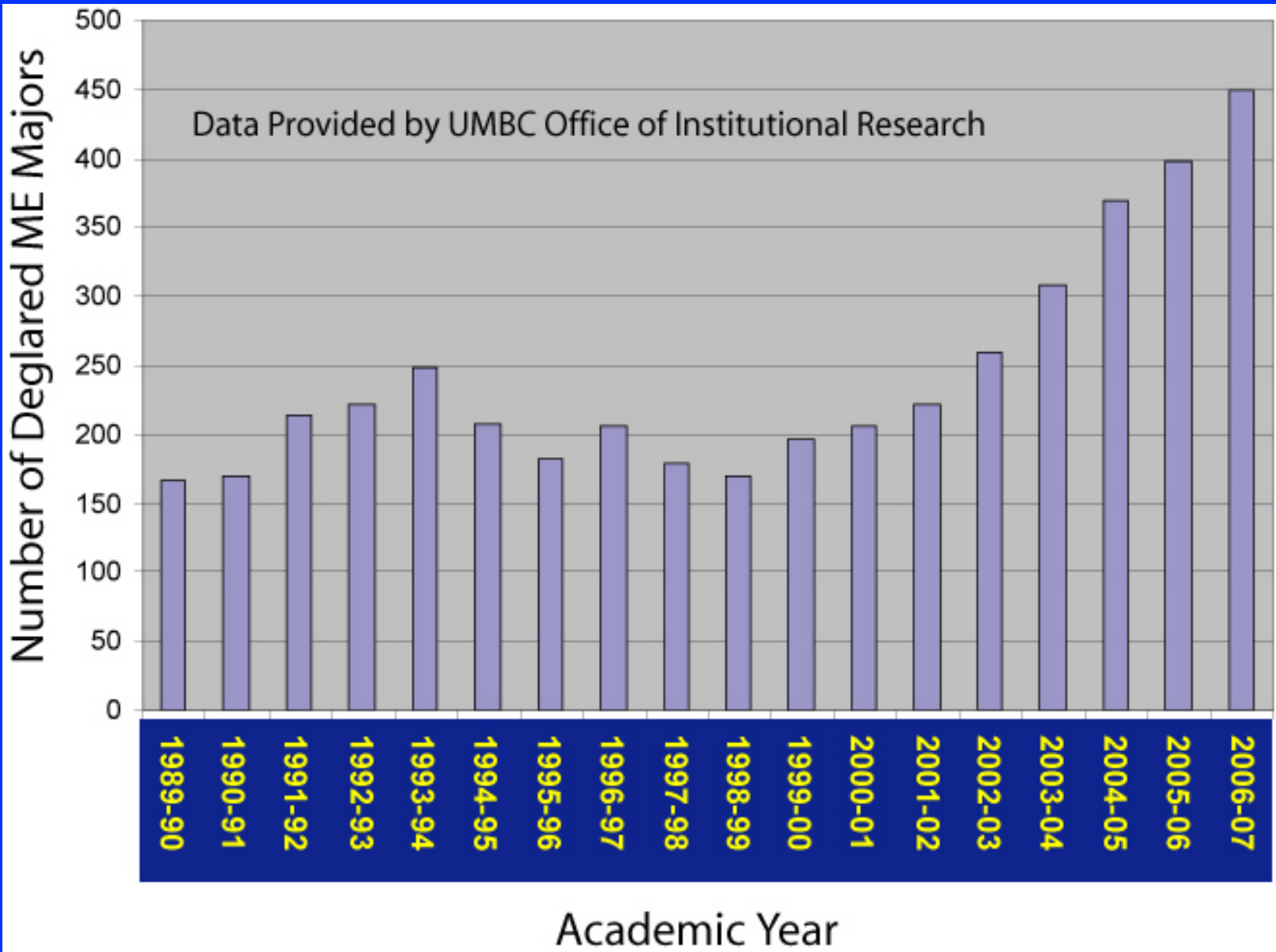
# Research Expenditures





## Example of Success

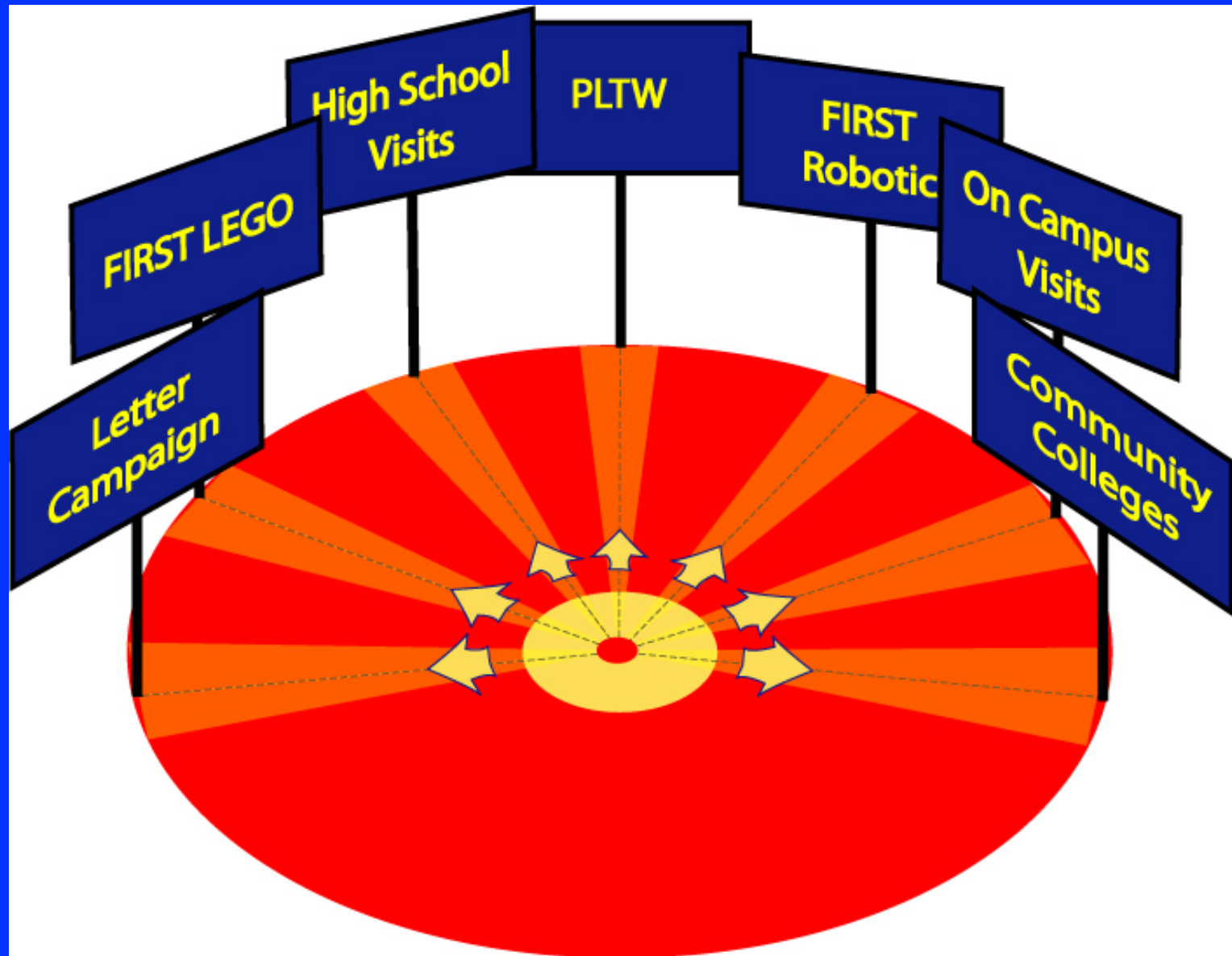
Increasing UG Enrollments by  
over 110% over 5 years



# Increasing UG Enrollments

## Underpinnings of Success

# Facing The Realities



# Factor 1: Making Strategic Choices



## Factor 2

# Embracing Scholarship in Engineering Education



- PT Lecturer 2001-04
- Active in Outreach
- Focused on Engineering Education
- 2004--Tenure Track Appointment
- Director of PLTW
- PI-\$10 Million NSF grant on STEM Education

## Outcome

Increased UG Enrollment?

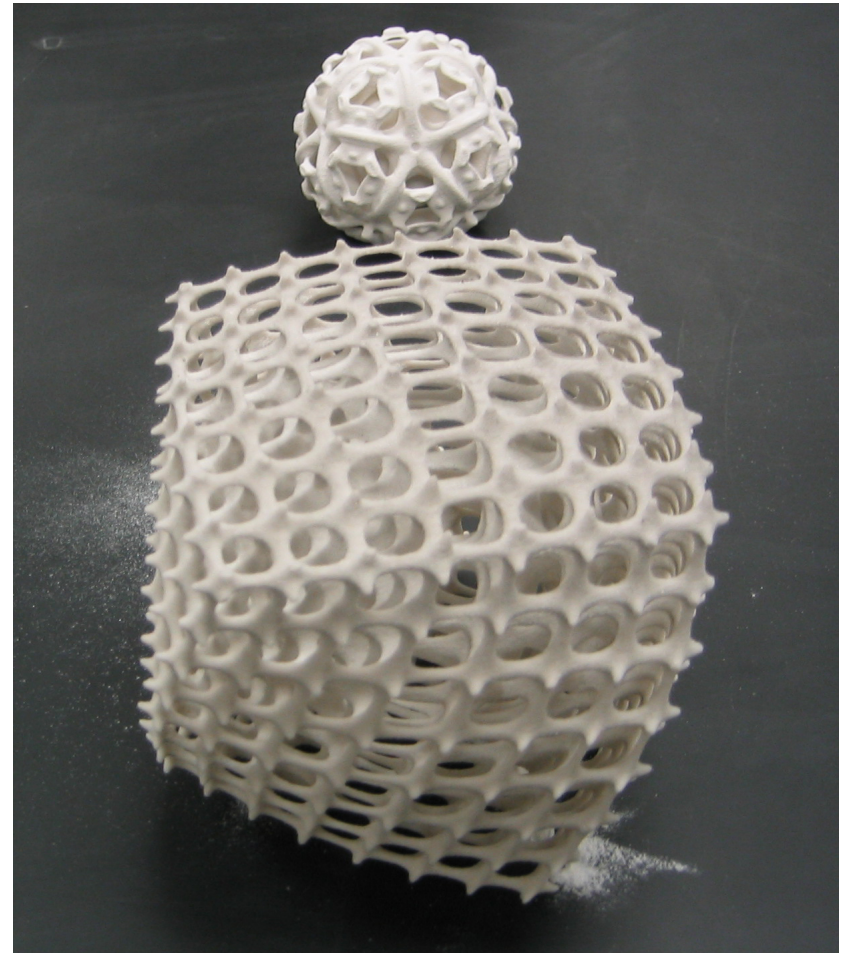
We Believe so!

Too Early to Support Through Data.

# Increasing UG Enrollments

Factor 3:  
Renovating The Curriculum

# Rapid Prototyping







MECHANICAL  
ENGINEERING  
UMBC

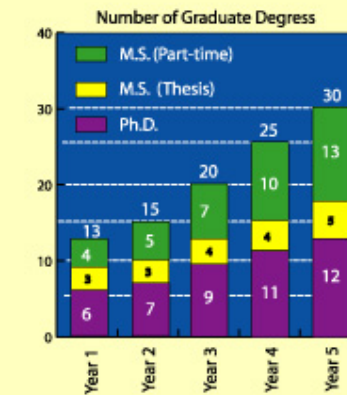
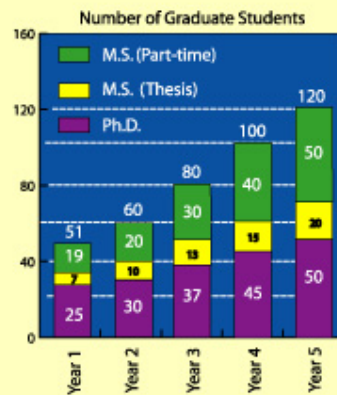
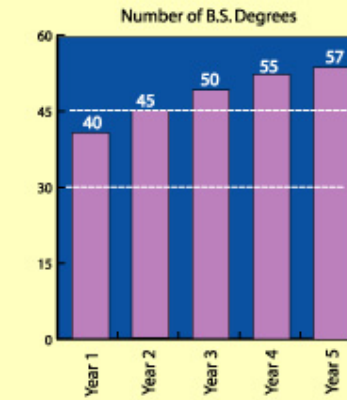
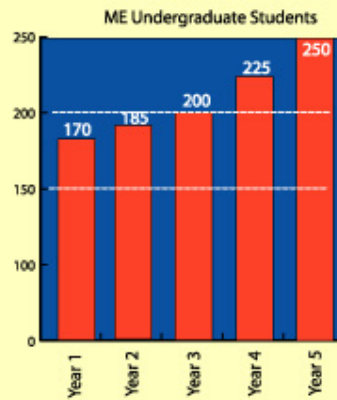
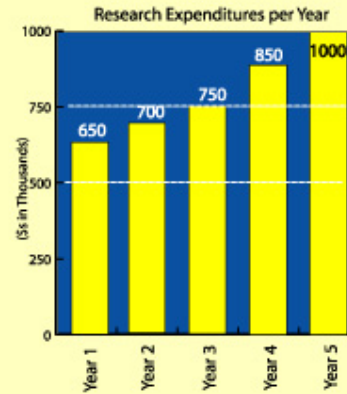
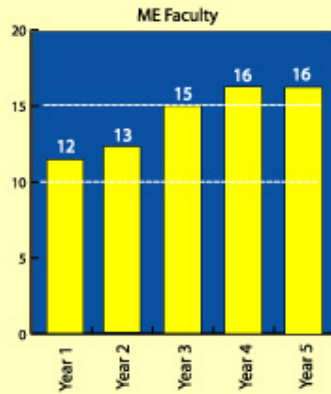
# Design Realization in ENME204



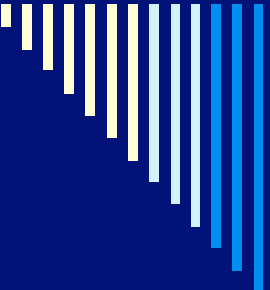
Example of  
Unrealized Success

The ME China Initiative

# A Five Year Strategic Plan for ME (Fall, 2001: Year-1 is AY 2002-03)



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*A Draft Proposal on a New*  
UMBC Mechanical Engineering  
Initiative

**OFFERING**

**A UMBC NON THESIS MS DEGREE IN**

**MECHANICAL ENGINEERING**

**AT BEIJING UNIVERSITY OF TECHNOLOGY**

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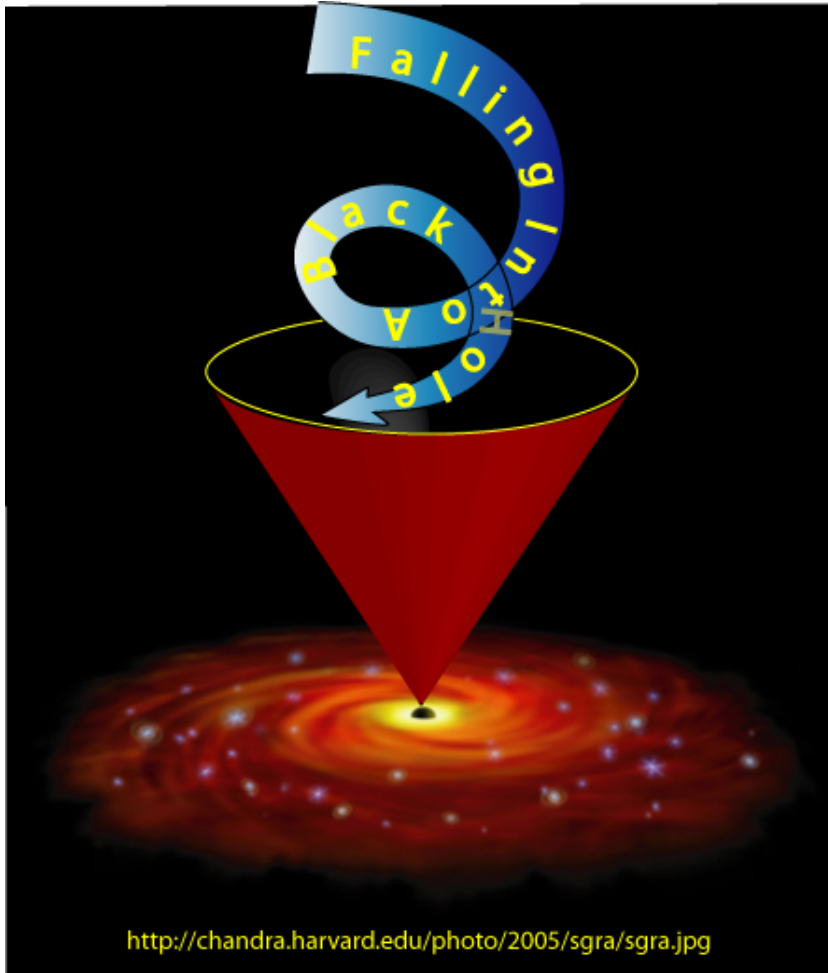
# Expected Outcomes

- **Outcome 1:** At steady-state (fourth year after the start of the new initiative) the ME department will be graduating an additional 60 M.S. students per year.
  - **Outcome 2:** At steady-state, the ME PhD program at UMBC will recruit at least 5 new highly qualified PhD students per year that have been identified through this new initiative.
  - **Outcome 3:** At steady-state, the ME Department will have built on existing collaborations and will have developed strategic partnerships with local offices of Black & Decker and Danaher Corporations
  - **Outcome 4:** Chinese graduates employed by the US or other international companies in China. Impact of the UMBC education on the global market.
-

# What Happened?

- “Morphed” into a 1-1-1 hybrid initiative.
- Academics & Program mechanics -worked out.
  - a) **The revised program does not need to be approved by the Ministry of Education in China.**
  - b) **The UMBC faculty do not need to travel to China, and the program does not incur much extra costs;**
  - c) **Could work simultaneously with many universities in China.**
- Requirement for “differential tuition”
- Could start during Fall 2007
  - **Initiative currently in “limbo!”**

# Why?



- Lack of an advocate?
- Lack of interest?
- No integral to mission?
- Lack of leadership?
- Lack of vision?
- Lack of resources?
- Lack of commitment?
- Lack of ()?



# Transforming Mechanical Engineering at UMBC

## Five Year Vision

- 17 Faculty
- 17 GTAs?
- 250-300 Undergraduate
- 80 Graduate (full time)
- \$1.3 M Res Expenditures
- 15-18 ME majors/faculty
- \$60-\$75K/faculty
- 3 courses/faculty

## Drivers of Change

Self awareness Persistence Opportunity  
 Vision Teamwork Hard work Leadership  
 Strategic goals Empowerment Perseverance

- 13 Faculty & 2 open lines
- 14 GTAs
- 200 Undergraduate
- 50 Graduate
- \$ 0.6 M Res Expenditures
- 15 ME majors/faculty
- \$ 45-50 K/faculty
- 3 courses/faculty

AY 2001-02

- 15 Faculty & 2 open lines
- 14 GTAs
- 450 Undergraduate
- 80 Graduate
- \$1.9 M Res Expenditures
- 30 ME majors/faculty
- \$126K/faculty
- 2 to 5 courses/faculty

AY 2006-07

Size

Diversity

Productivity

Quality

Morale

# ME Program

Size

Quality

Strategic, 20/20 vision

- 20 Faculty
- 20 GTAs
- 400 Undergraduate
- 120 Graduate
- \$3.0M Res Expenditures
- 18-20 ME majors/faculty
- \$150K/faculty
- 3 courses/faculty

- 16 Faculty
- 20 GTAs
- 288 Undergraduate
- 80 Graduate
- \$2.4M Res Expenditures
- 18 ME majors/faculty
- \$150K/faculty
- 3 courses/faculty

Optimal  
(Current resources+ 6GTAs)

Current

- 15 Faculty
- 14 GTAs
- 450 Undergraduate
- 80 Graduate
- \$1.5M Res Expenditures
- 30 ME majors/faculty
- \$100K/faculty
- 3 courses/faculty

Not sustainable

Program Mechanics

- Admission Criteria
- Transfer criteria
- GPA-Gateway
- GPA-Graduation
- Curriculum structure
- Pre & co-requisites
- D-grade
- Repeat rules

Program Delivery

Transmitting

- Pedagogy
- Methods
- Class size
- Competency
- Expertise

Receiving

- Student learning
- Student prepar.
- Student focus
- Student backgr.
- Student maturity

Outcomes Assessment

Inner Loop

Professional Success

Outer Loop