Montgomery College
Science, Engineering and Mathematics

Working with Community Colleges

Engineering Dean's Institute
ASEE

April 17, 2012

Eun-Woo Chang
Dean of Science, Engineering and Mathematics

The role of community colleges in the education of scientists and engineers

- Community Colleges are important institutions in the education of science and engineering graduates
- Almost **50 percent** of science and engineering **bachelor's and master's graduates** have attended community colleges
- **12 percent** of nation's science and engineering **doctoral degree recipients** have attended community colleges (varies significantly by race/ethnicity)

Source: National Science Foundation, Division of Science Resources Statistics (2004-2006)

The role of community colleges in the education of scientists and engineers

- Hispanics and American Indians/Alaska Natives have attended community colleges in higher numbers than have Whites, Blacks, or Asians/Pacific Islanders

- Female graduates in S&E fields are far more likely than male counterparts to have attended community Colleges

- **Open admissions, proximity to jobs and family, and low tuitions and fees make community colleges attractive to a large number of S&E students**

Source: National Science Foundation, Division of Science Resources Statistics (2004-2006)

Montgomery College

- Founded in 1946
- The largest undergraduate institution in Maryland serving more than 60,000 students
- More than 160 countries are represented and no majority race in the student population
- Three campuses;
  Rockville, Germantown, Takoma Park/Silver Spring
- New STEM related construction project
  Science Center building (RV) – completed in 2011
  Bioscience Education Center (GTN) – in progress
  Science and Math Center (TP/SS) – future plan

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MC Engineering Program

- The largest University transfer program in the country
- Designed to provide the first two years of a four-year program leading to a B.S. in engineering
- Concentrations include aerospace, bioengineering, chemical, civil, computer, electrical, fire protection, materials science, mechanical, and nuclear engineering.
- Fall 2011 enrollment is about 1,250 students
  52.2% are Montgomery County Public Schools graduates
- Average age is 23 years
- 13 FT faculty, 22 Adjunct faculty, and 5 FT/PT staff
  11 out of 13 FT faculty hold Ph.D.
  5 Asian, 2 African American, 6 Whites, and 6 female

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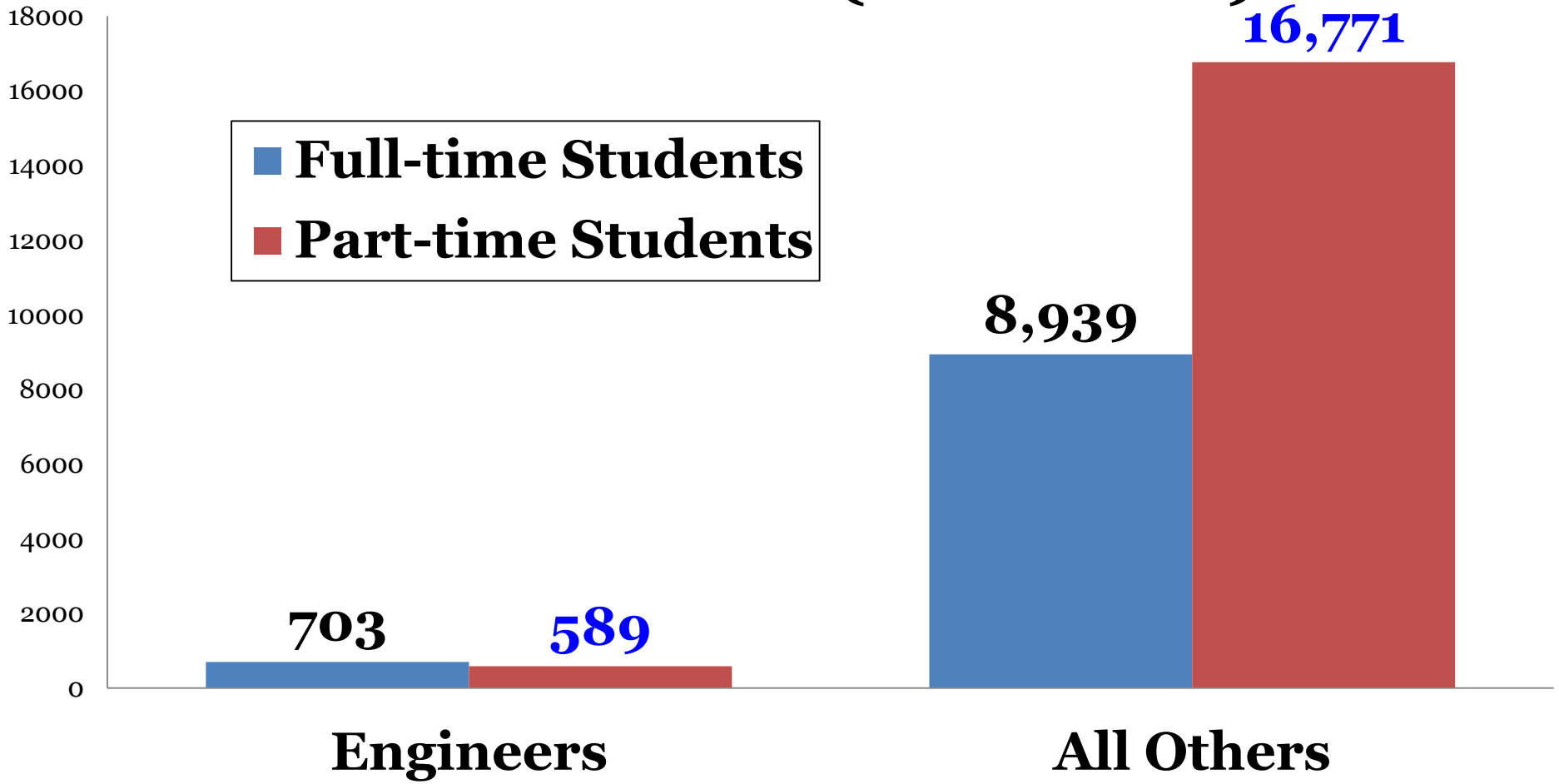
Enrollments (Fall 2011)



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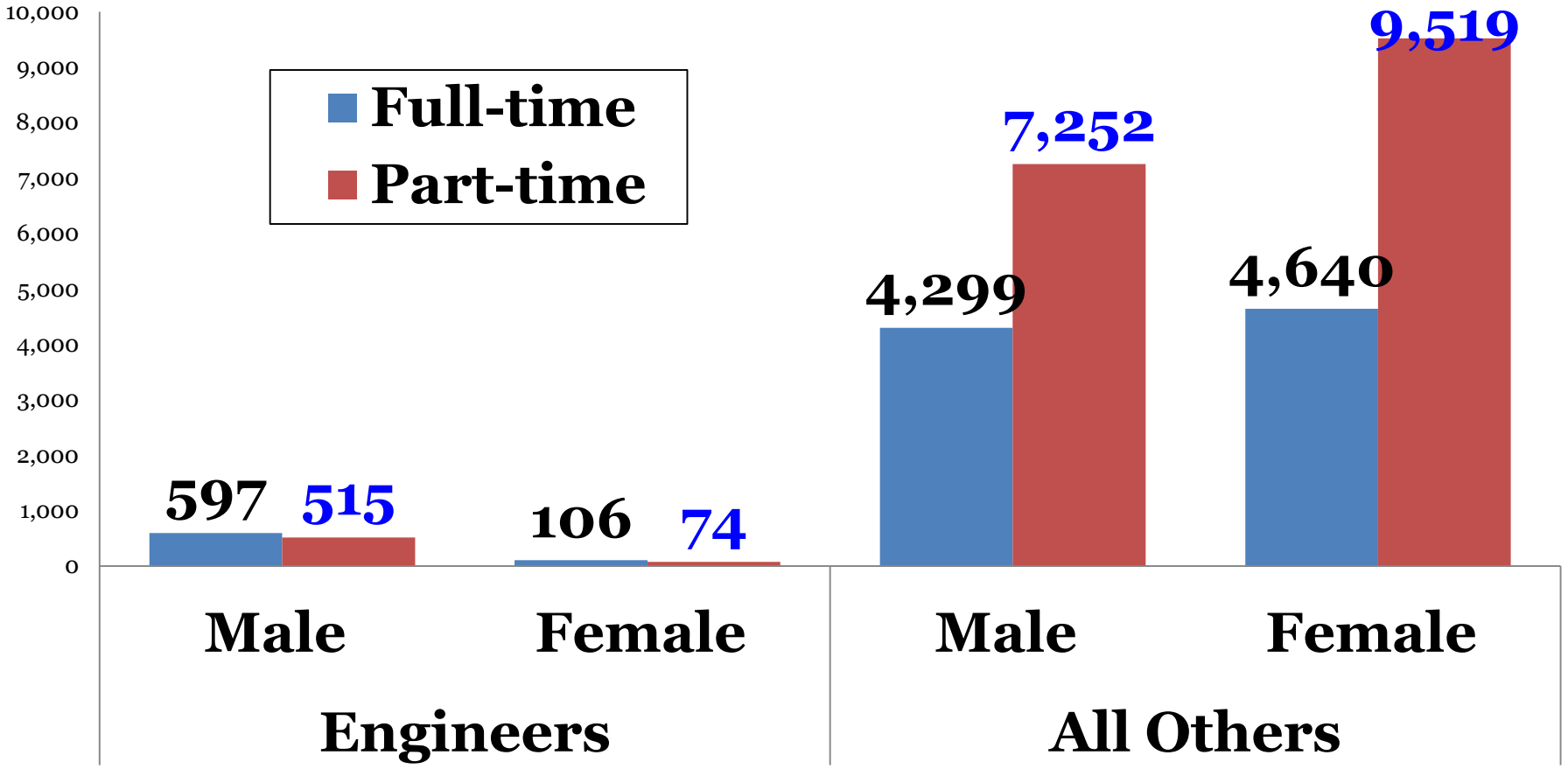
Gender (Fall 2011)



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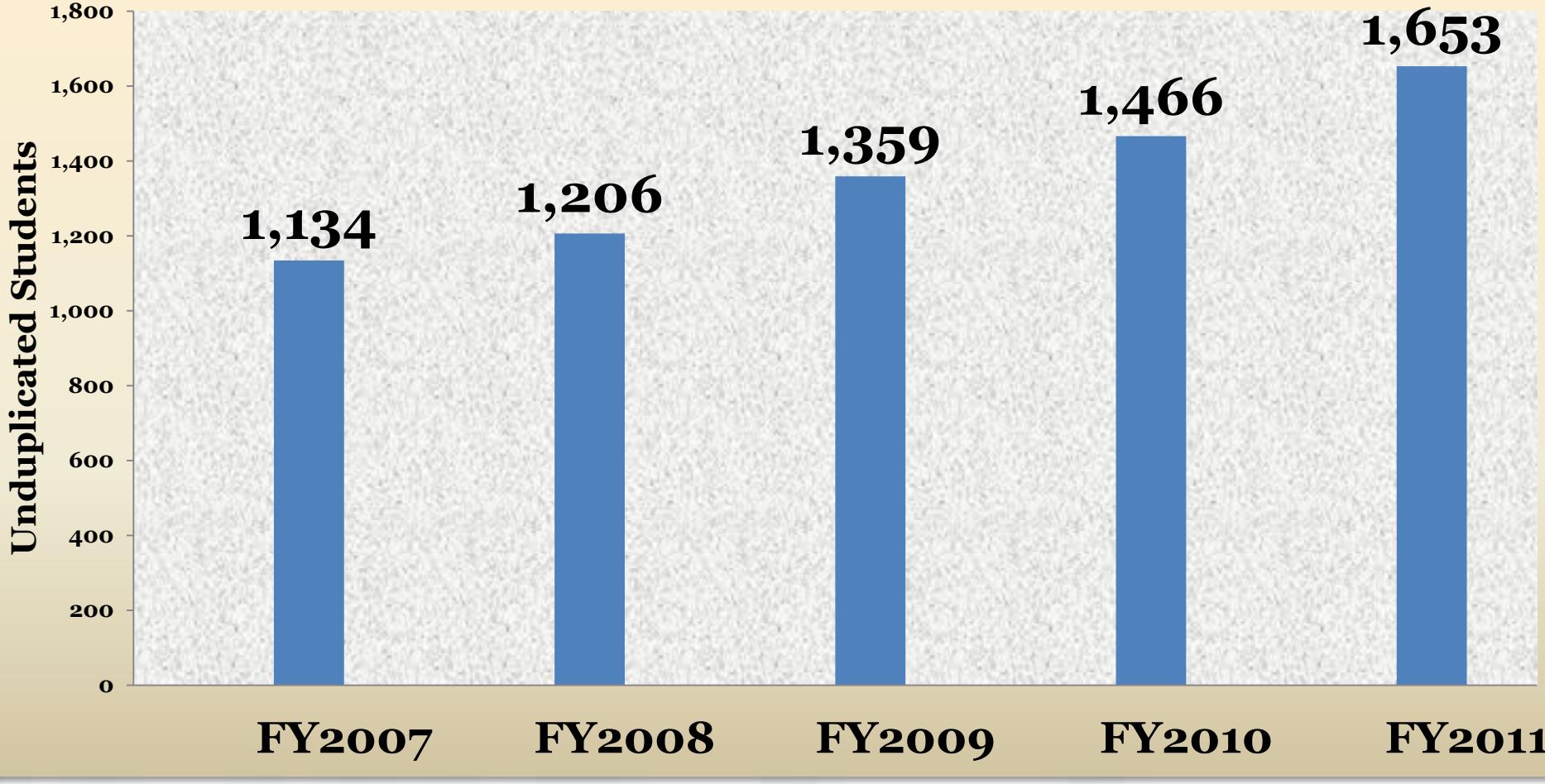
Engineering Majors at MC



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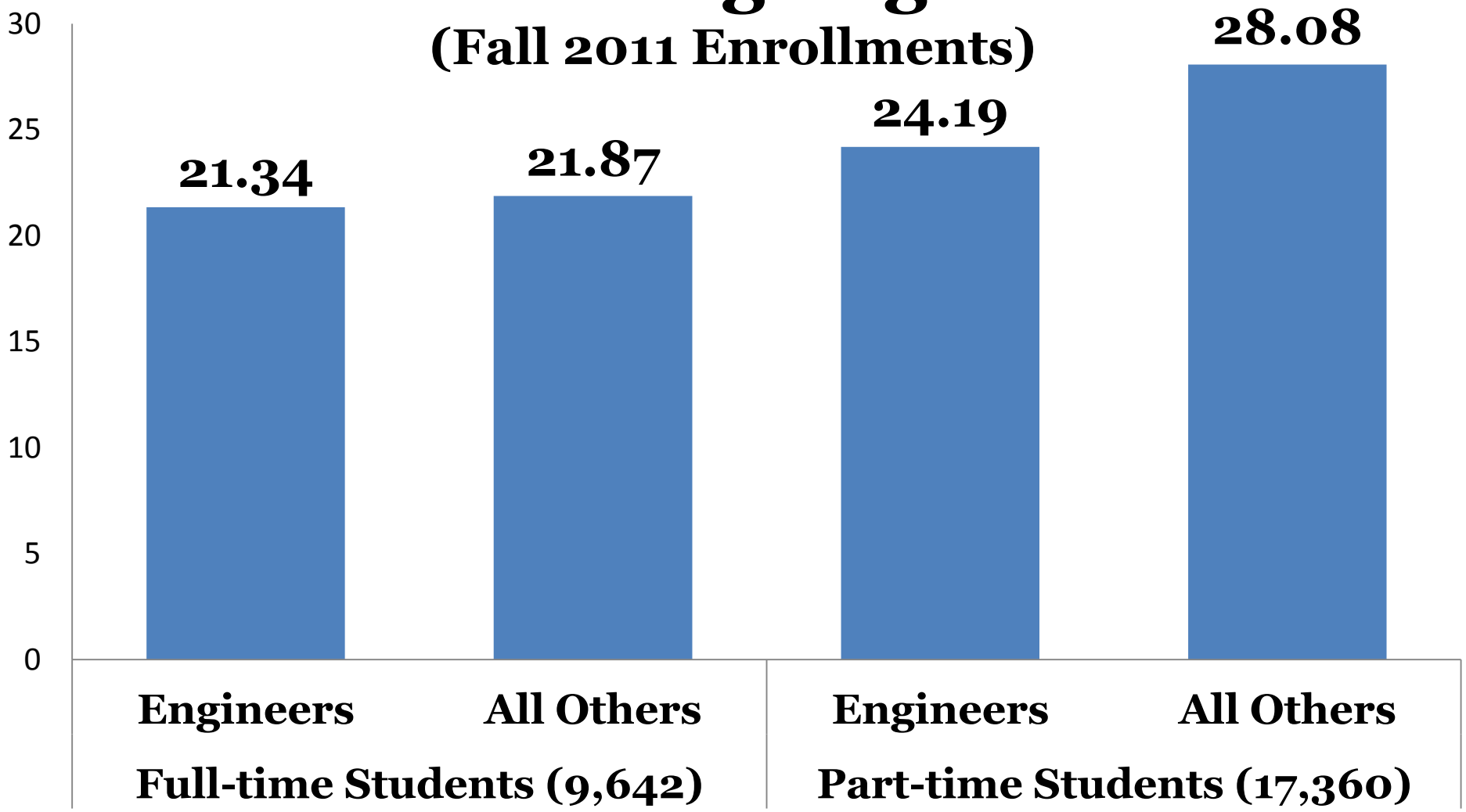
Average Age
(Fall 2011 Enrollments)



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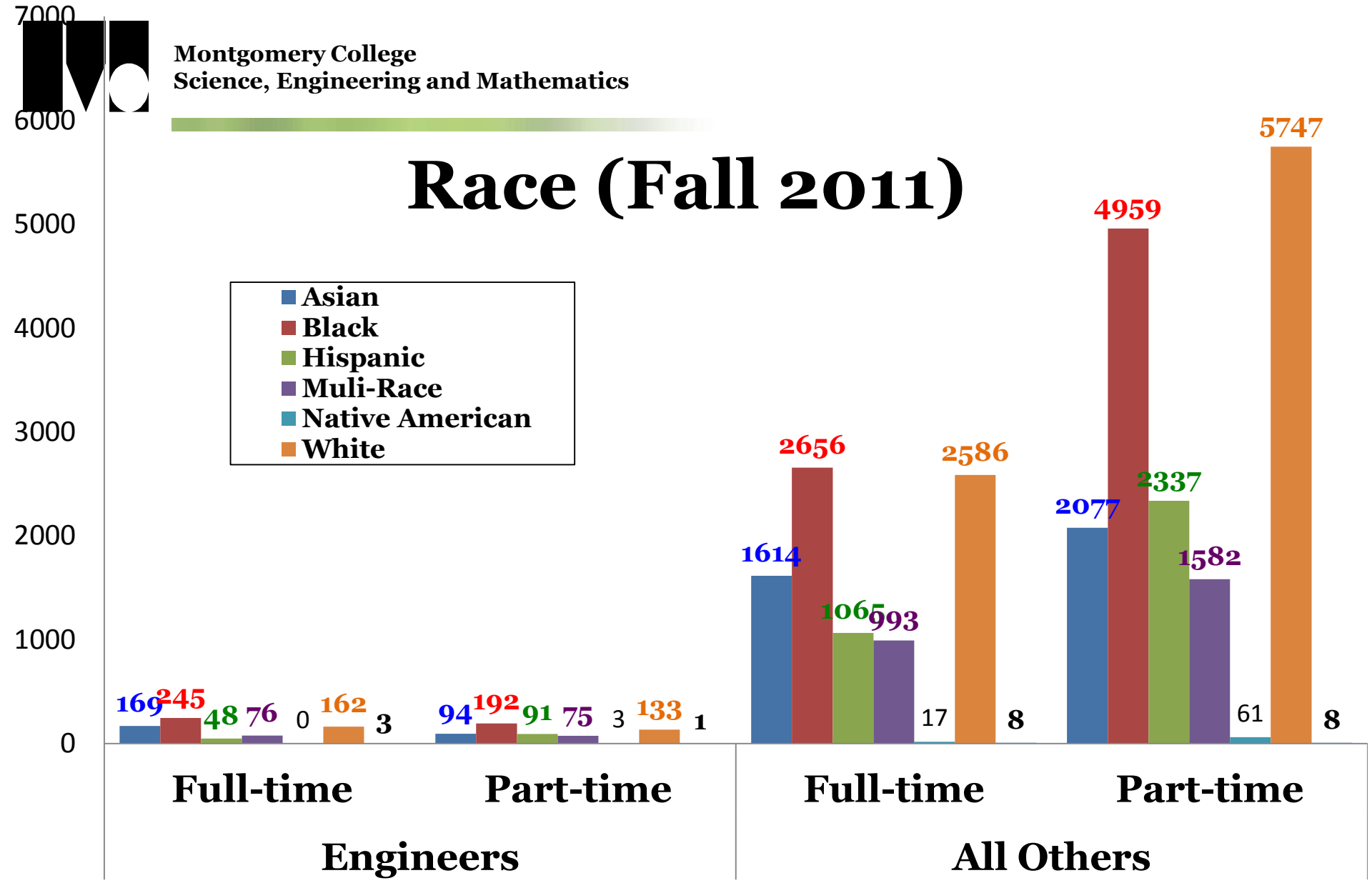
Race (Fall 2011)



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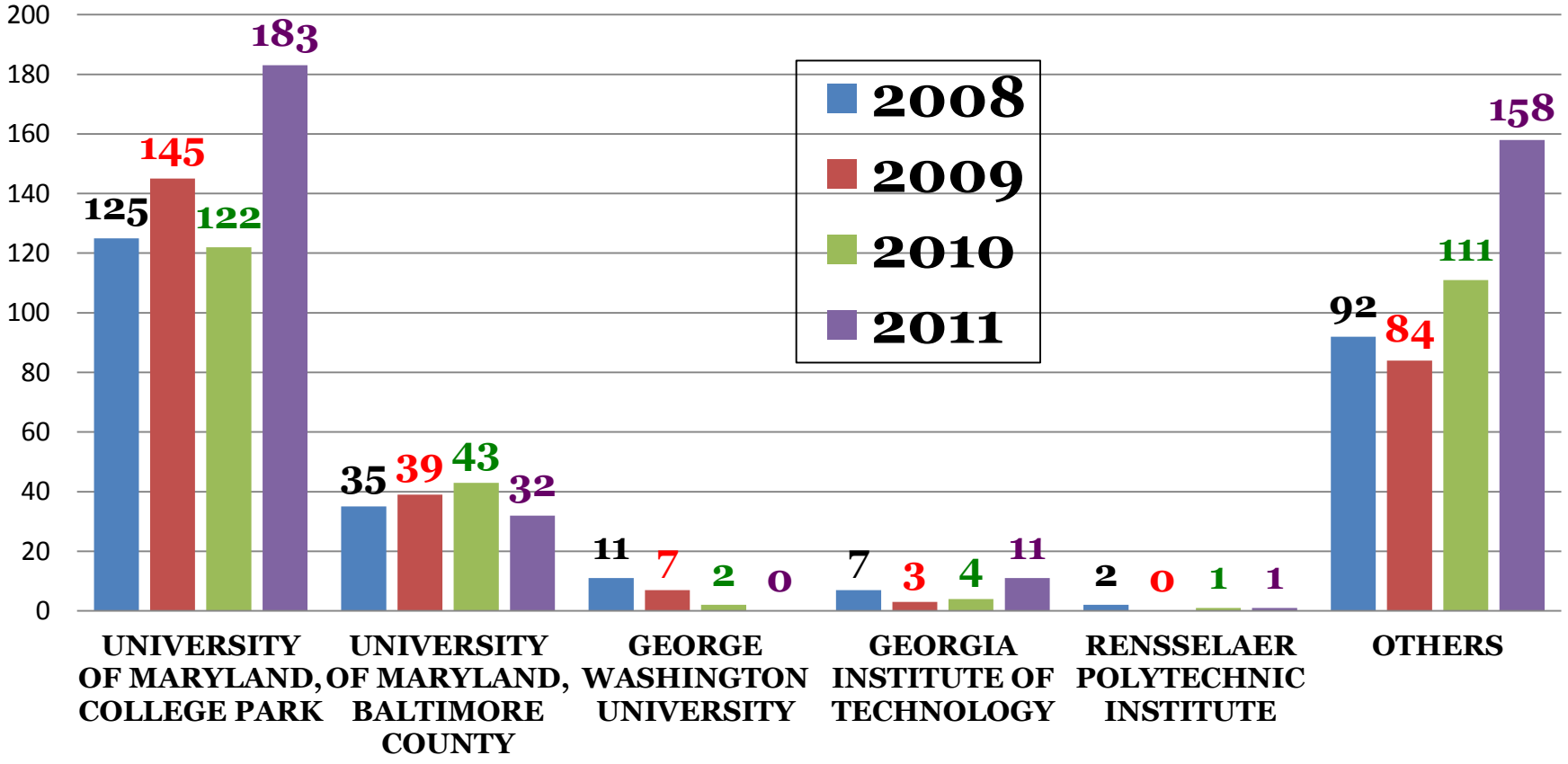
MC Engineering Transfers to 4-Year Institutions (2008 -2011)



MC Engineering Student Composition

- **Spring 2012 engineering enrollment = 1,226**
  U.S. Citizens: 704
  Permanent Residents: 308
  International Students (F-1 Visa): 73
  Other Foreign Students: 141

- **Declared Engineering Majors**
  Total (1250), New in fall 2011 (364)

  Mechanical (288), Computer (227), Electrical (218), Civil (160), General (106), Aerospace (98), Chemical (64), and Bioengineering (54), etc…

Keys for Success (Best Practice Models)

- Academic Advising and Mentoring
- Student Activities
- Resources
- Faculty qualifications and professional development opportunities
- Articulation agreement
- Academic preparedness of students

1. Academic advising and mentoring

- A dedicated engineering faculty advisor

- Currently developing on-line advising system

- SEM Internship Coordinator (FT):
Writing workshops, internship opportunity info, and partnerships with Montgomery County Public Schools, industrial partners, federal agencies, and universities

- Most faculty serve as Engineering student club advisors

2. Student Activities

- Student clubs:
Engineering Club, Women in Engineering, Science, and Technology (WEST) Club, Robotics Club, IEEE MC Student Branch, Engineers Without Borders (EWB)

- Engineering Seminars for Students

- Research Poster Session in spring

- Internships at NIST and several industrial partners sites (Patton Electronics, Innovative Biosensors, ATK Space Systems, etc…)

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MC Alumni Forum

3. Resources

- New Science Building facilities (4th floor):
6 physics/engineering/geoscience labs, 3 engineering computer labs, machine shop, and lab prep area

- Equipment/Instruments include:
CNC Milling Machine, CNC Lathe, Robotic Arm, Seismometer capable of detecting earthquakes anywhere in the world magnitude 3 and higher, Advanced Function Generators and Oscilloscopes, two 3-D Printer, Electric Hydraulic Press capable of delivering 30,000 psi of pressure

- **Resources (continued)**

- External Grants

Fund for the Improvement of Postsecondary Education (FIPSE) – six sets of Mobile Classrooms and Dimension 3-D Printer

NSF S-STEM

NSF STEP (Being negotiated, $1.8M for five years)

NSF Noyce Teacher Scholarship Program (submitted)

- Individual donors arranged by the MC Institutional Advancement Office

4. Faculty qualifications and professional development opportunities

- 11 out of 13 faculty hold Ph. D.s from U Penn, Ohio State, U of Illinois, etc…
- Professional development workshops for faculty and staff: e.g. SEM special lecture/ workshop series including:
"Peer-Led Team Learning", Pratibha Varma-Nelson, IUPUI
"Engineering Innovations in Engineering Education" Don Millard, NSF
"Community College Undergraduate Research Initiative", Jim Hewlett, Finger Lakes Community College, NSF-TUES

5. Articulation agreement

- Agreements in place with UMCP, UMBC, GWU, RPI, Georgia Tech, Capital College, and others.

- More engineering colleges approaching MC for articulation and MOU each year: West Virginia U, Frostburg State U, VCU, Catholic U, Syracuse U, Virginia State U, GMU, UVA, and others.

Challenges:

- Working with multiple 4-year institutions (Engineering curricula are constantly changed/updated)
- Faculty workload (15-20 contact hours per week)

6. Academic preparedness of students

- Math and Science Learning Center
- Small class sizes: 18-20 in “Introduction to Engineering Design”, “Statics/Mechanics I”, and “Introduction to Programming Concepts for Engineers” classes
- Encourage faculty to adopt and adapt active teaching/ learning pedagogies (SCALE-UP, PLTL, etc…)

- Two-thirds of incoming MC students are placed in developmental math or English
- Developmental students require more academic advising
- Recently initiated developmental math redesign project

- **Recommendation:**

Transition from 2-yr colleges to 4-yr colleges of engineering:

- Increase presence at CC transfer day events
- Participates in Engineering club meetings
- Communicate with community college advisors

- **Key Points for Success are…..**

  - Focus on Student Learning Gains

  - Dedicated Faculty and Staff

  - Innovation

  and

  - **Administrator's buy-in!!!**

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Thanks!

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