

## **Electrical Engineering and Computer Science Enrollment Trends and Issues Summary of Interviews with 14 Major U.S. Universities and the University of California Schools System Administrators, Conducted May – June 2004**

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### **Purpose**

Since 1998 the Engineering Workforce Commission has reported increasing enrollments in the fields of Electrical Engineering and Computer Engineering. Anecdotal evidence from various media is indicating a decline in current undergraduate enrollments for 2004 and a decline in foreign national applicants to the graduate programs. The purpose of the interviews was to hear from a selected number of schools a first hand report on the status of their enrollments at both the undergraduate and graduate levels in these majors.

### **Format and Participants**

All interviews were conducted via phone with myself as the discussion leader. Participants typically included the Department Heads or Chairs for Electrical Engineering and Computer Engineering and Computer Science. In many cases the Heads of Graduate Student Affairs and the Career Services Directors from the selected schools also participated in the calls.

Based on the informal nature and my agreement with the participants I will only report information in a summary format with no reference to specific schools.

### **Participating Schools**

**Schools participating in the interviews make up approx. 11% of the nation's undergraduate populations in EE, CE & CS.**

- Arizona State
- Berkeley
- UNC Chapel Hill
- Georgia Tech
- Michigan State
- MIT
- Univ. of Wisconsin
- NCA&T
- Notre Dame
- Purdue
- UCLA
- UC Schools System
- Univ. of Penna.
- Texas A&M
- Univ. Of Tenn.

## Undergraduate Comments and Issues

- When asked to describe the enrollment trends in these majors for 2004 vs 2003: 13 schools reported a decline, 1 school reported an increase and 1 school did not have the data readily available.
- The consensus was that enrollments for 2004 in EE, CE, CS were showing declines of from -5% to -15% lower than the 2003 levels. This view is consistent with the latest EWC data for 2003 and provides some insight into the current status and what can be expected in 2005.
- The Taulbee report of 2003 reports a decline in Computer Science enrollments from 2003 to 2003 of approx. 20%.
- SAT test takers with high school GPA's of B+, Math scores of 530+, and Verbal scores of 520+ indicating interest in Electrical Engineering are down 15% and for Computer Science are down 34% (Rochester Institute of Technology data).
- All schools reported that they had seen a big run up in enrollments in these majors from 1999 – 2002 primarily due to the media driven perceptions coming from the dot.com boom years that jobs were plentiful and pay was excellent in these fields.
- A number of schools pointed out that first and in some cases second year engineering students are enrolled in a general engineering program and do not declare their majors until after year 1 or 2. This makes the tracking of enrollment trends in specific majors more difficult.
- View is that the primary drivers for the current decline are the weak job market in those fields, a perception on the part of students and parents that the high tech job demands of the late 90's are over, a sense that many of these kind of jobs will be done outside the U.S. and an increase in 2000-2002 of students deciding to go on to graduate school to get advanced degrees and wait out the weak job market.
- A number of schools also commented that many students who contributed to the increases in enrollments in the 1999 – 2002 time frame dropped out of these programs once enrolled due to the difficult nature of the programs, changing interests, lack of funding or poor pre-college preparation in the core math and science courses.
- There was a consensus that the level of pre-college preparation in the math and science courses was weak for many entering students. And that assistance was required to get these students to a level that is needed for success in these majors.
- Unlike the graduate programs discussed later in this report most of the schools reported that the Foreign National (FN) component of the undergraduate population was very low and not showing signs of increasing ... figures in the 5-10% range were common.

- Nearly all schools reported difficulty in attracting and retaining URM students into these programs. Retention rates of below 50% were common.
- Some schools reported that state budget cuts are contributing to the decline in enrollments with the schools being unable to meet the demand from students for increased seats in these disciplines.
- The consensus is that this decline in enrollments will continue for at least one more year and possibly beyond with the primary factor being the students and parents perception of the economy and offshoring.
- Many participants worry that the interest level in these fields at the early grade levels continues to be a major problem.
- Schools with a reputation as being top in their fields will see a slower decline in enrollments in both undergraduate and graduate programs as students narrow their school search to fewer schools.
- There is rising interest in the fields of Bioengineering and in some cases security related fields like Criminal Science and Justice. There was a sense that these fields are siphoning off some of the students from EE/CE/CS.
- There was a sense from all schools that the job market for these majors had improved in 2004 and they were optimistic about the prospects for 2005. Improvement was welcomed and I heard a number of comments that the demand for these majors is just about in line with the supply. With the exception of URM graduates which remain in very short supply.

### **Graduate Program Trends and Issues**

- Schools reported consistently that a large part of their graduate student population in these majors were FN's. The ratios ranged from 35% to over 80%. Schools were unanimous in reporting that the FN's in their programs were among the best students available.
- All are concerned about the lack of U.S. student interest in pursuing advanced degrees particularly PhD's. There were many reasons indicated for this including the need to pay student loans after their undergraduate program, the length of time it takes to get an advanced degree, a view that an advanced degree is not well rewarded vs the investment by industry, and the perceived low levels of school provided financial support for students in these programs.
- Some schools commented that a typical graduate student could expect a stipend for their research in the \$15-25K per year range vs a salary in industry of \$50+K with their undergraduate degree.
- A number of schools commented that the perceived value of a Masters or PhD degree is much higher to FN's than for U.S. students. FN's understand that an advanced degree greatly improves their chances of remaining in the U.S. for employment.
- Many schools have programs designed to generate interest in U.S. students going on to grad school and active nationwide recruiting programs to attract top students to their programs. But all indicated much more work was needed to rebuild the U.S. grad school populations in the years ahead.

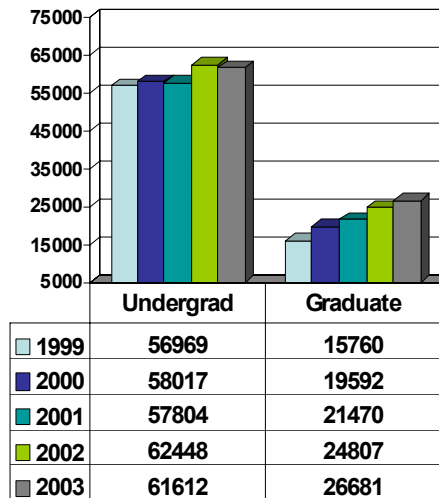
- Of particular concern to the schools was the dramatic decline in 2004 of FN applicants to their programs. All 14 schools reported dramatic declines in FN applicants in 2004. In many cases the decline vs 2003 is over 50%. Applicants are declining from all countries but the most acute decline is from China and India.
- There were many theories expressed to explain this decline. Those included an improving graduate school infrastructure in other countries, active in country recruiting efforts in China and India to keep the students there, a real and perceived problem with getting the needed visa's to enter the U.S., much improved job prospects in many countries for the graduates and a mention that China might be intentionally blocking access to U.S. graduate school programs web sites for students. It was common to hear that the very best FN students are being actively recruited by graduate programs in the U.K, Canada, Germany and Australia.
- All schools indicated that the visa situation was problematic. In some cases students that went home for a holiday or visit were blocked at reentry to the U.S. and missed valuable class sessions waiting for the clearances to arrive.
- Many schools reported that a number of their current graduating FN's are having a very difficult time finding work in the U.S. and are being both forced to return home and recruited by countries outside the U.S. to take jobs offshore. There was no specific mention that these problems were caused by the H1B cap being reached in Feb. of this year. However the consensus was that FN students are very unlikely to raise this issue to the schools faculty or administration.
- All schools are concerned that making it so hard for FN advanced degreeed students to remain and work in the U.S. is as a huge threat to continued U.S. innovation and prosperity.
- All schools indicated support and appreciation for the work SIA is doing on trying to exempt Masters and PhD's from the H1B Visa cap.
- No school reported that they have ever seen a case where a U.S. Masters or PhD graduate was denied a job due to a company hiring a FN instead.
- All schools felt that the current job market for all their graduates was improving slightly over 2003.

## **Engineering Workforce Report**

- We have enjoyed an increase in EE, Electronic and Computer Engineering / Science enrollments from 1999 thru 2002. The data in both charts below reflects a similar situation to that described in this report with 2003 enrollments showing modest declines.

## Semiconductor Workforce Challenge ... EE / Electronic Engineering Enrollments

- ❖ Undergrad + 8%
- ❖ Graduate + 69%
- ❖ Dot Boom effect
- ❖ Increased H1B cap
- ❖ 2003 data shows slight decline in BS -1.3%
- ❖ Some schools reporting declines



Source: Report from the Engineering Workforce Commission of the American Association of Engineering Societies: 2003 Engineering and Technology Enrollments



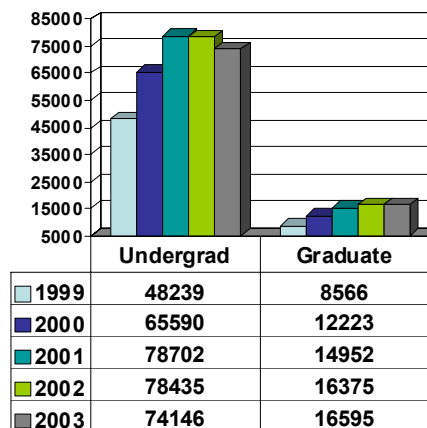
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## Semiconductor Workforce Challenge ... CS / CE Engineering Enrollments

- ❖ Undergrad + 54%
- ❖ Graduate + 94%
- ❖ Dot Boom effect
- ❖ Increased H1B cap
- ❖ 2003 shows decline in BS -5.4%
- ❖ Some schools reporting declines



Source: Report from the Engineering Workforce Commission of the American Association of Engineering Societies: 2003 Engineering and Technology Enrollments



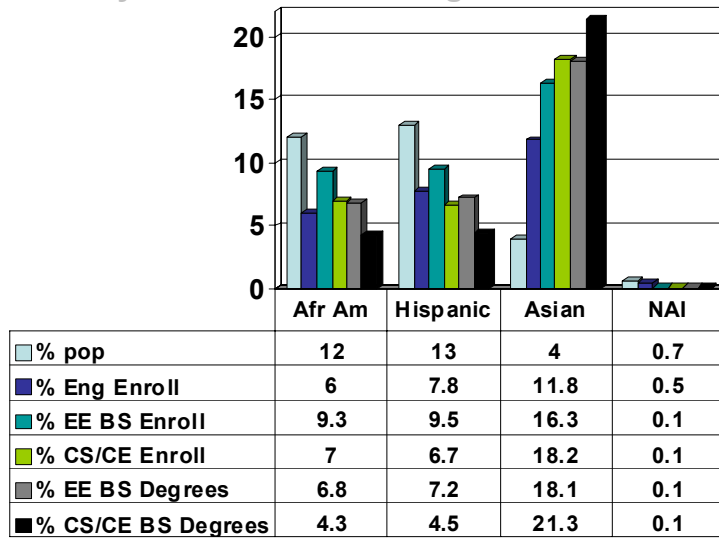
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- Another problem area for industry is the lack of enrollment and graduation of URM's in these majors. As shown in the table below African Americans and Hispanics are particularly under represented in these fields.

## Diversity Enrollments and Degrees In EE / CS/CE



Source: Report from the Engineering Workforce Commission: 2003 Engineering and Technology Enrollments, 2003 Degrees, and 2000 Census Data



## Summary and Call to Action

The current demand for EE/CE/CS employees in our industry can be met given the anticipated supply of these graduates in 2004 and 2005. Add to this workforce a high number of experienced engineers and programmers that are either unemployed or looking to switch employers. With careful and effective staffing operations our industry companies should be able to fill their requirements in 2004 and 2005.

However there is evidence that the enrollment levels in these majors is going to decline. How far is any one's guess but I expect that we will see modest declines of 5 to 15% for at least 1 more year.

The interest level in these fields appears to be declining as well. And the proficiency level of high school students in math and science is very weak especially when compared to other countries.

All high tech companies need to keep their focus on K-12 programs that improve math and science education. We also need to insure efforts are targeted at improving the perception, enrollment and retention of students into these majors. Underserved populations require particular attention here as their retention rate in the critical first two years of the program is below 39% on a national level. Increasing this by just 10 points would result in over 540 new African American and Hispanic BS graduates in EE/CE/CS.

The lack of U.S. students going on to graduate school in these majors is also a problem for both industry and the school systems. I would encourage each member company to support available programs to increase U.S. students going to graduate school including the Undergraduate Research Program run by SRC.

Finally I would suggest that member companies need to look at their university staffing operations to insure the right people, tools and investments are in place to enable them to build a strong, ongoing relationship with targeted schools. With a supply that is likely to decline in the next few years those kinds of relationships with schools and faculty are very important for success on campus.

For universities the focus areas are similar: outreach to K-12 math and science teachers to improve the entry level skills of new students, a focus on bridge and support programs to increase the retention rate of underserved students and an organized effort to encourage and support the numbers of U.S. students going on to graduate school. I would also ask that each school in the study contact its Government Affairs office and encourage them to lobby on behalf of exempting Masters and PhD's from the H1B cap. Supporting the efforts of Compete America ([competeamerica.org](http://competeamerica.org)) is a practical way to help us get this exemption passed.

