
AC 2012-4713: SUMMER BRIDGE: AN ENGINEERING DIVERSITY COLLEGE INDUSTRY PARTNERSHIP INITIATIVE BETWEEN NUPRIME AND RAYTHEON-IDS

Mr. Richard Harris, Northeastern University

Richard Harris is Assistant Dean for Academic Scholarship, Mentoring, and Outreach, and Director of Northeastern University Program In Multicultural Engineering (NUPRIME), College of Engineering, Northeastern University, Boston, Mass.

Dr. Bala Maheswaran, Northeastern University

College of Engineering, Northeastern University, Boston, MA 02115.

Ms. Rachelle Reisberg, Northeastern University

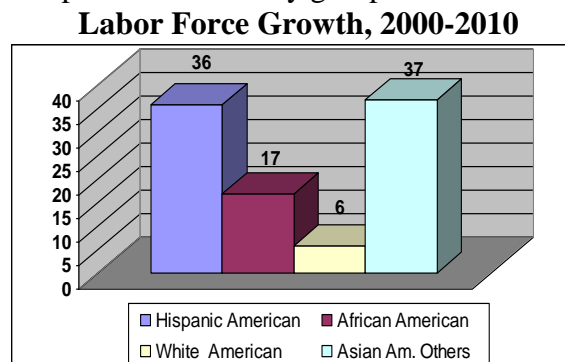
Rachelle Reisberg is Assistant Dean for Engineering Enrollment and Retention, as well as Director of Women in Engineering at Northeastern University. Prior to joining Northeastern University, Reisberg held a wide range of management positions in IBM and Hanover Insurance and was the President of a high tech start-up company.

Mr. Chet Boncek Jr., Raytheon

Chet Boncek is a Senior Principal Engineer with a B.S.E.E. from Northeastern University and M.S.E.E. Georgia Tech. In addition to the engineering, Boncek held the role of Raytheon Campus Manager for Raytheon/Northeastern relations from 2008 through May 2011. During that time, he hosted Summer Bridge students for yearly all-day programs at Raytheon and worked to make Summer Bridge part of Raytheon's student pipeline by encouraging students to apply for summer internships prior to going for their first COOP job and by encouraging managers and HR to take a close look at the potential of these students. Boncek is actively involved in community activities related to STEM and works with students in Middle School and High Schools. In partnership with the educational branch of the New England Patriots, Boncek runs engineering competitions and educational events at "The Hall" at Patriot Place in Foxboro, Mass.

Summer Bridge: An Engineering Diversity College-Industry Partnership Initiative

We face a major demographic imperative. As a result of the U.S. Census Bureau projections showing a steady decline in the White population (from 81% in 2000 to 72.1% in 2050) and a correspondingly slight increase in the African American population (from 12.7% in 2000 to 14.6% in 2050), and a large increase in the Hispanic population (from 12.6% in 2000 to 24.4% in 2050)¹, relative to the near term projections in the Labor Force Growth, 2000-2010 graph below, it is clear that the science and engineering workforce of the future must come from the ranks of currently under-represented minority groups.



(Occupational Outlook Quarterly, Winter 2001-02)

In fact the following data shows that “underrepresented minorities now comprise over **25%** of the U.S. Population, yet still comprise only **6.4%** of total engineering labor force.”² While this data is especially true for racial/ethnic/gender minorities identified as Native American, African American, and Hispanic; Asian Americans, which comprise 3.6% of the U.S. population, are well represented in the U.S. engineering labor force at 10.9% overall and 15.7% by gender. It should be noted, however, this data does not differentiate among distinct Asian American ethnic/cultural groups within the United States.

<u>US Population By Race/Ethnicity</u>	
Native American:	0.7%
African American:	12.1%
Hispanic:	12.5%
Asian American:	3.6%
Non-Hispanic White:	69.1%

(2000 US Census)

<u>US Engineers in Labor Force By Race/Ethnicity</u>	
Native American:	0.3%
African American:	2.6%
Hispanic:	3.5%
Asian American:	10.9%
Non-Hispanic White:	82.7%

(National Science Foundation, 2000)

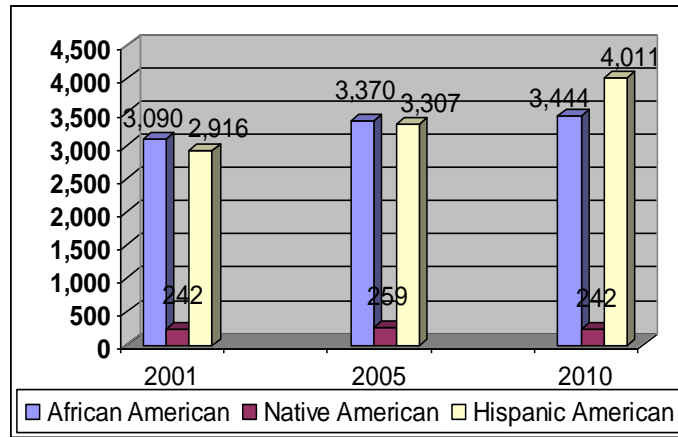
Ethnicity of Women B.S. Engineers, 2000

Hispanic:	8.5%
African American:	9.1%
Native American:	0.7%
Asian American:	15.7%
Non Hispanic White:	65.9%

(Engineering Workforce Commission, 2001)

In an effort to address the underdevelopment of our engineering talent pool, it must become an important national priority to tap into the large pool of potential human resources in the U.S. It is imperative to increase the numbers of Women, African Americans, Hispanics and American Indians who follow STEM educational pathways in high school, major in science, math and engineering in college, continue on to pursue graduate degrees in these disciplines and eventually enter the science and engineering workforce as researchers, academicians and practitioners. The exigencies of diversity are economic and technological, as well as, social and moral cannot be ignored as the demographic population shift that is projected to take place has already started. This can be seen in the school age population of underrepresented groups in the following 2000 U.S. Population Census Graph and State Growth Projection. When available, it will be interesting to note the results of the recent 2010 U.S. Population Census.

Population Shifts, 2001 – 2010, Ages 15-19



Fastest Growing States

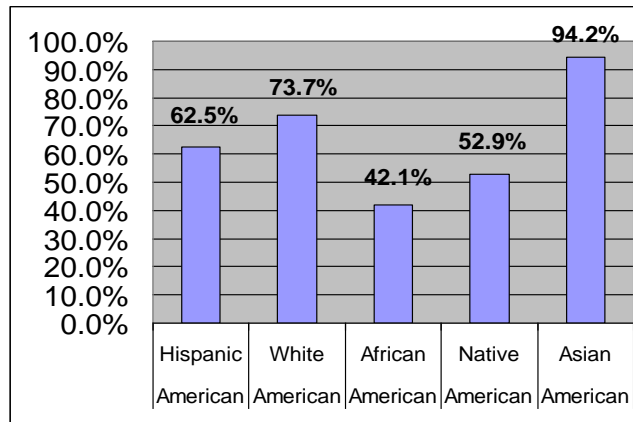
High School Age Population, 2000-2010

Nevada	70%
Arizona	48%
North Carolina	31%
Florida	28%
Georgia	23%
Connecticut	23%
California	20%
Massachusetts	21%

(2000 U.S. Census)

Retention on a national scope, in higher education, is defined as the percentage of enrolled students at a college or university who achieve satisfactory results and return to campus after their first year (i.e. matriculation to official sophomore status), which positively impacts their persistence toward graduation and earning their degree. However, this challenge of retention is significantly greater for underrepresented minority students than their white or even Asian American counterparts, as seen by the NSF/EWC Retention of B.S. Engineering Students Graph.

Retention of B.S. Engineering Students



(NSF/EWC, 2002)

“In order to retain minority students several researchers contend that the campus must provide a warm, supportive and nurturing environment from the moment these students arrive on campus” (Lavant, Anderson & Tiggs, 1997, p.43)³. Many colleges and universities have established various intervention models in an attempt to retain underrepresented minority students. Despite this effort, underrepresented minority students continue to fall below the requirement to matriculate to sophomore status.

In an effort to deal with this challenge of increasing the recruitment and the retention of underrepresented populations many universities have investigated various methods. One such method or undertaking is **mentoring**. In the study by Lavant, Anderson & Tiggs (1997), they show how mentoring is a valuable and effective tool. Mentoring already has a long tradition in education and allows “the mentor to serve as a guide in introducing the mentee to the new environment he or she is about to enter” where “mentoring from a higher education perspective has been defined as an intentional process where role modeling is expected and requires direct interaction between the mentor and the protégé” (p.44).

While numerous studies report that the interaction of faculty and students is an important determinant of student retention and may therefore be especially critical for underrepresented minority students, according to Lavant et. al “the literature suggests that it is very difficult to mainstream underrepresented minority (male) students into mainstream campus life, thus making it even more important to actively have a formal mentoring process to involve them in” (p.45).

Lavant et. al (1997) cited a study to “examine the perceptions and attitude of undergraduate African American students on mentoring, where eighteen African American students (11

women and 7 men) were interviewed and surveyed after participating in a nine week summer research mentoring program at a large university. The study attempted to address two questions:

1. What type of student-faculty relationships are expected for those students in formal programs?
2. What associated effects does a faculty's race or gender have on the perceptions and attitudes of underrepresented minority students participating in mentoring programs?" (1997, pp.44-46)

The interview results were quite telling, "those with black or women mentors had more positive perceptions and attitudes toward research and the research environment than those with white male counterparts" (p.46). These findings help to highlight the importance of having faculty that the students can strongly identify with, thereby providing the students with a heightened positive attitude toward both research and academic careers.

Additionally, Lavant et. al (1997) cited several mentoring models (i.e. The Black Man's Think Tank, The Student African American Brotherhood (SAAB), The Black Male Initiative, The Meyerhoff Program, The Bridge, Project BEAM, etc.) that were identified and referenced for their effectiveness. While many of these mentoring programs primarily focus on the underrepresented minority freshman undergraduate, the Meyerhoff Program primary purpose is to increase the number of African American men who earn doctorates, in engineering, medicine, and the sciences. The Meyerhoff Program helps to highlight the similarly stagnating fate that blacks at the graduate and professional school level continue to still face and how this problem doesn't go away even after having secured their undergraduate degree.

While Lavant, Anderson & Tiggs refer to the mentoring process as an "interaction between two or more individuals" (1997, p.44), they rightly concluded in their summary that there must be a combined and collaborative effort between several participants. This collaborative effort must include administrators, faculty, staff, community leaders, and parents who must continuously strategize and implement programming that positively affect the retention of these students, especially the African American male student, immediately upon arrival to college and university campuses.

In conclusion, mentoring appears to be an effective tool in helping many students, but particularly historically underrepresented students, to overcome the barriers that oftentimes prevent them from completing college successfully. Mentoring therefore appears to empower underrepresented students to develop into and become role models that can help to create a cycle of success, within higher education, that in turn ultimately benefits all of society.

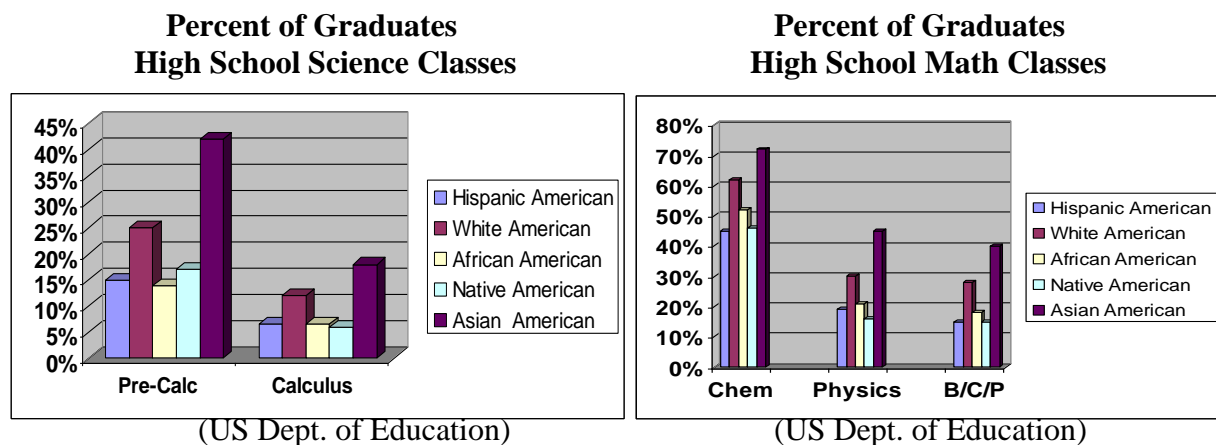
There are social cognitive factors that may hinder the academic achievement of URM students in science and engineering which also need to be taken into consideration. Some scholars and educators who have predicted the barriers that discourage underrepresented minorities from achieving success in science and engineering, pointed to such factors as:

- inadequate academic preparation
- substandard educational resources
- mismatched social and academic expectations

- lack of encouragement
- psychological intimidation
- unstable familial and financial circumstances
- inadequate peer support
- lack of role modeling/mentoring
- low expectations by science and engineering faculty
- poor/uninspired instruction and advising by science/engineering faculty
- racism

(Reichert & Absher, 1997)⁴

Mathematics and science are the primary languages of science, technology, engineering and mathematics. Students with inadequate grounding in mathematics and science, as seen in the graph from the US Dept. of Education, are not well prepared for future academic and/or career opportunities, resulting in some colleges and universities experiencing difficulties in their recruitment efforts for under-represented minority (URM) students. In addition, they may find an even greater burden to not just recruit but to retain underrepresented students in their engineering program(s).



It is precisely because of the challenges highlighted earlier in this paper that the Northeastern University Program In Multicultural Engineering (NUPRIME), in partnership with Raytheon Integrated Defense Systems (IDS), launched an engineering education diversity initiative in an effort to stimulate broader industrial participation in undergraduate programs. In an effort to address the social and/or cognitive factors that may hinder the academic achievement of URM students in science and engineering, this initiative includes an annual Summer Bridge Program designed to Generate Academic Performance (GAP). This paper discusses the corporate partnership as well as the Summer Bridge Program strategies, implementation methods, outcomes, and on-going development. These results include the recruitment, retention, graduation and post-graduation performance of the Summer Bridge cohort and the development of the Bridge Program as part of an innovative college industry partnership with Raytheon-IDS.

Our Bridge Program began in the Summer of 2002 as an engineering diversity initiative without any direct corporate involvement. We began a corporate partnership, during the 2003 Summer, by introducing a site visit to one of our corporate co-op partners. Subsequently, we established

additional Summer Bridge site visits, with additional industry partners, for the Summer bridge cohort of 2004 and 2005.

We then initiated an opportunity, with the support of our development office, to secure Summer Bridge funding and increased participation from our industry partners. This effort resulted in Raytheon-IDS offering to provide funding for the 2006 Summer Bridge Program along with an established site visit and the eventual offer of summer internships at the conclusion of the student freshmen year. This site visit included engaging with University alumni who are employed with Raytheon-IDS and provided an overview of the organization and its culture. Members from the Company's various Employee Resource Groups (ERGs) participated by interfacing and providing a relevant image of students seeing someone like themselves in the roles they might aspire to fulfill professionally. This is referred to as "you will be what you see". As a result of this and other interactions, a number of summer bridge students identified with NUPRIME secured co-op opportunities, which have now resulted in permanent full-time positions.

Raytheon-IDS decided to provide multi-year funding, after funding the 2006 Summer Bridge GAP program, where the return on investment (ROI) was confirmed by the academic results and retention of the Summer Bridge engineering student cohort first academic year. This multi-year funding included expanding the Summer Bridge Program to support up to 30 students and an expendable scholarship for Summer Bridge participants, annually. Thereafter, Raytheon-IDS made the decision that they would define an internal rate of return (IRR), by increasing the number of underrepresented students that applied and were hired into co-op positions first, then ultimate became full-time employees. Additionally, Raytheon-IDS decided to provide an early access point for the Summer Bridge cohort into the corporate organization by providing them with the opportunity to secure paid Summer internships at the successful conclusion of their freshmen year and prior to the beginning of their Sophomore year or the formal co-op program.

From a company perspective it is important and valuable to establish continuity once a first contact has been made with an individual who demonstrates interest and ability in the company's area of expertise.

A model for continuity is given below in Fig.1. It recognizes that the first exposure to the company, which occurs during a tour of its facilities, is only the first step in creating and establishing a "pipeline" which has as its beginning, a site tour for a group of incoming engineering students, and has as its end a job offer and acceptance for full-time employment.

From a company perspective the job does not end even with an acceptance of the offer-for-employment. For the purposes of this paper, which partly deals with the successful transition from high school to college to full-time employment, as a corporate employer, we define success as the offer for full time-employment and an acceptance by a qualified candidate. Raytheon-IDS recognizes that the job does not end there, as there are several support models in place once an employee begins work including several types of formal mentoring programs, additional education and training and Employee Resources Groups. These additional support items are not the purpose of this paper so other than noting their importance as tools for employee retention and development they will not be discussed further. The College-Industry Partnership Bridge

pipeline model is shown below. The Bridge spans several risk areas where students could be lost along the way without the support of a program like Bridge.

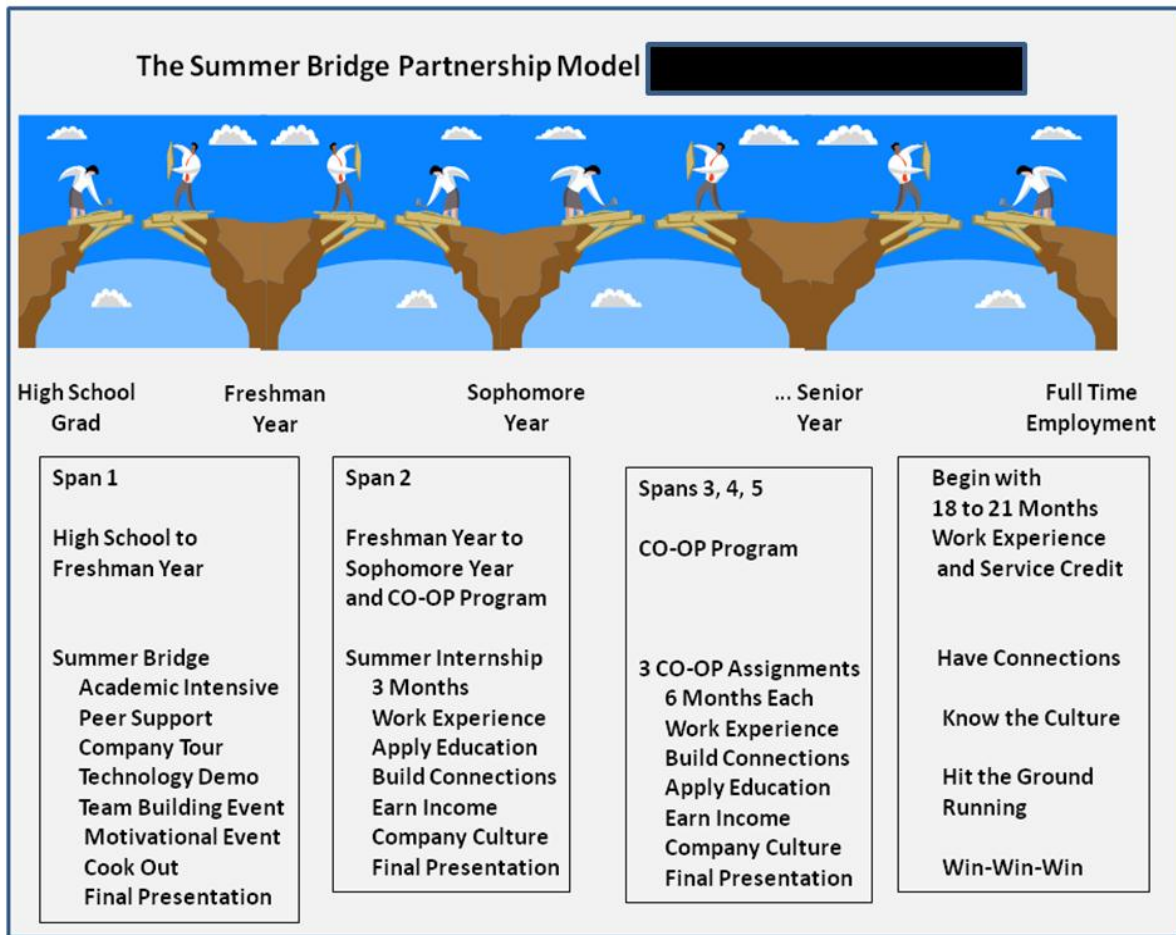


Fig. 1 College-Industry Partnership Model

This college-industry partnership seeks to provide a first step on the road to success for historically under-represented students who have qualified for admission and will be attending the College of Engineering (COE) at Northeastern University. Participants interact with University faculty, staff, students and Raytheon employees who are COE alumni in a variety of academic, professional, social and leadership development activities. The GAP component includes workshops that provide a preview of calculus, physics, and chemistry as well as hands-on engineering demonstrations and site visits to Raytheon's facilities. These activities are designed to set the students up for a head start to success in an engineering curriculum. Upon completion of the Summer Bridge, students are mentored throughout their freshman Fall and Spring semesters. Additionally, Summer Research Experiences for Undergraduate opportunities are available at the conclusion of the freshman year along with internship/pre co-op employment.

In an effort to address the social and/or cognitive factors that may hinder the academic achievement of URM students in science and engineering, the Summer Bridge Program provides a first step in helping to set students up for success, especially students who are identified by the

National Science Foundation (NSF) as historically under-represented students (African American, Hispanic and Native American). After having qualified for admission into the College of Engineering, we help these self-selected students to begin the process of moving ahead of the curve in the demands of an engineering curriculum.

These students are encouraged to develop cohort relationships with each other, while having the opportunity to work with our physics, math, chemistry and engineering faculty. Students are exposed to upper class, graduate engineering students and faculty as mentors. Students are taught how to develop effective self advocacy skills and the intrinsic value in being one's own best advocate.

Our Summer Bridge GAP Program has yielded encouraging quantitative and qualitative results for 10 years from 2002 thru 2011. These results include the recruitment, retention, graduation and post-graduation performance of the 2003 Summer Bridge cohort that graduated in 2008, in addition to each previous and succeeding Summer Bridge cohort. The Summer Bridge Program strategies, implementation methods, outcomes and on-going development, allow us to reference back to the national data which informs our need to provide achievable and measureable responses to this national concern of the underdevelopment of URM students in STEM.

In reference to President Hrabowski's comments recently featured in Science⁵: "Over the long term, it is imperative that the United States improve the quality of science and math instruction for minorities through the pre-college years. Better teacher preparation would particularly benefit minority students, who still have substantial achievement gaps in math and science as compared to white students. It is also necessary for schools to provide advanced science courses and proper academic advising to ensure that more students are prepared to succeed in college science. In the United States, with the new Common Core State Standards Initiative for mathematics, universities and school systems can together strengthen teaching and develop appropriate curricular and assessment materials. Such collaboration will be critical as the nation strives to engage more students in science and engineering." – Freeman A. Hrabowski III

- **Five Recommended Areas for Generating Academic Progress (GAP)**
- **Academic**
 - Develop and establish early faculty-student relationships
 - Provide peer-taught supplemental academic instruction opportunities
 - Facilitate undergraduate research opportunities via research centers/faculty
- **Corporate/Cooperative Educational Partnership(s)**
 - Teradyne, General Electric, Raytheon Site Visits
 - Early employment exposure prior to start of official co-op cycle(s)
- **Student Leadership Development**
 - Summer Bridge Student Presentation @ COE Leadership Retreat
 - Engineering Student Organizational (NSBE, SHPE, SWE, etc.) Activities
- **Cohort Relationship Development**
 - Team Building Ropes Challenge Course Activities
 - Group social activities
- **Mentorship**
 - Academic, Social, Cultural, Developmental, Organizational

The Steps taken to begin the process of supporting URM students include but are not limited to the following:

- Identify and recruit academically prepared, historically under-represented students for COE undergraduate admission
- Develop/identify scholarships and nominate academically strong, yet financially challenged, historically under-represented engineering students
- Formulate and implement academic success support programs for traditionally under-represented students (e.g. **Summer Bridge Program**)
- Develop collaborative research (undergraduate/graduate) opportunities for under-represented students to take advantage of at the end of their freshman year via NSF ERCs, NASA Research Labs, LSAMP, and independent faculty research area(s)
- Advising role to NSBE (National Society of Black Engineers) and SHPE (Society of Hispanic Professional Engineers) student chapters in partnership w/ Advisor to SWE (Society of Women Engineers) and Director for Women In Engineering
- Leadership Development - Summer Bridge Student Presentation @ Annual COE Student Leadership Retreat (i.e. – IEEE, ASME, IIE, ASCE, EWB, AIChE, NSBE, SWE, SHPE)
- Corporate/Cooperative Educational Partnership
- Cohort Relationship Development - Team Building Ropes Challenge Course Activities
- Mentorship - Academic, Social, Cultural, Developmental, Organizational

Gateway/Engineering Summer Bridge Academic Preview

- Calculus
 - Physics
 - Chemistry
 - AutoCAD
 - Civil Engineering/Earthquake Simulation
-
- 2002 Summer Bridge Highlights (Funded by Hewlett Packard – DEI)
 - 11 self-selected students participated
 - First Year Student Success examples:
 - Summer Bridge Student was 1 of 3 students, university wide, awarded the coveted Charles Irwin Travelli Full Scholarship
 - A freshman student achieved 2.75 GPA overall, after only achieving a 1.8GPA at end of the Fall Qtr. (Student is now pursuing an M.S. Degree in Mechanical Engineering at Howard University)
 - Student accepted into the honors program has continued to maintain honors status at the end of the first year
 - 2003 Summer Bridge highlights (Funded by Helwett Packard – DEI)
 - 14 self-selected students participated
 - 2 - Dean's Scholars
 - 3 - Excellence Scholars
 - 2 - Achievement Scholars
 - 3- Summer Research Experiences for Undergraduates (SREU)

- Added Corporate site visit for Co-op Partnership
 - Teradyne Company provided presentation & tour
- Added new academic preview module
 - Chemistry/Chemical Engineering
- 2004 Summer Bridge highlights (Funded by Distinguished Engineering Alumnus)
 - 10 self-selected students participated
 - 2 - Dean's Scholars
 - 2 - Achievement Scholars
 - 3 – Research Experiences for Undergraduates
 - Second year Teradyne Company provided presentation & site tour
 - **Introduced non-URM “first generation college women”**
 - **3 non-URM students accepted invitation to participate**
 - **Added to provide add'l female cohort for URM women**
- 2005 Summer Bridge highlights (Funded by LSAMP)
 - 21 self-selected students participated
 - Several students are Dean's Scholars
 - Several students are Achievement Scholars
 - 6 – Research Experiences for Undergraduates
 - First Year of General Electric Aircraft Engines provided presentation and site tour
 - 95% Freshman Retention Rate / 90% Engineering Retention Rate
 - Declaration of Major: (Note: There is some rounding error)
 - 42% EE or ECE
 - 26% Civil Engineering
 - 16% Chemical Engineering
 - 5% Mechanical Engineering
 - 5% Industrial Engineering
 - 5% Arts & Sciences
 - Average GPA:
 - 3.0 – 4.000: 47.6%
 - 2.5– 2.999: 14.2%
 - 2.0 – 2.499: 14.2%
- 2006 Summer Bridge highlights (Funded by Raytheon-IDS)
 - 22 self-selected students participated (7 Female/15M)
 - 16 Students were merit-based scholarship recipients
 - 2-Honors Students,
 - 2-Deans' Scholars,
 - 2-Lewis Scholars,
 - 9-Achievement Scholars
 - 1- Torch Scholar
 - 5- Research Experiences for Undergraduates
 - First Year Raytheon-IDS provided a presentation and tour
 - 1) Tewksbury, MA 2) Andover, MA
 - 95% Freshman Retention Rate / 90% Engineering Retention Rate

- Average GPA:
 - 3.0 – 4.000: 57.0%
 - 2.5– 2.999: 19.0%
 - 2.0 – 2.499: 5.0%

- 2007 Summer Bridge highlights (Funding by Raytheon-IDS)
 - Student Participants
 - 15 self-selected students participated (7 Female/8 Male)
 - 15 Students were merit-based scholarship recipients
 - 2-Lewis Scholars, 2-Honors Students,
 - 2- Deans’ Scholars, 9-Achievement Scholars
 - Torch Scholar
 - 4 – Research Experiences for Undergraduates

 - Second Year Site visit to Raytheon-IDS
 - 1) Tewksbury, MA 2) Andover, MA

 - Declaration of Major: (Note: There is some rounding error)
 - 29% EE or ECE
 - 7% Civil Engineering
 - 29% Chemical Engineering
 - 21% Mechanical Engineering
 - 7% Industrial Engineering
 - 7% Arts & Sciences

 - 100% Freshman Retention Rate / 93% Engineering Retention Rate
 - Average GPA:
 - 3.0 – 4.000: 50%
 - 2.5– 2.999: 36%
 - 2.0 – 2.499: 7%

- 2008 Summer Bridge highlights (Funding by Raytheon-IDS)
 - Student Participants
 - 22 self-selected students participated (11 Female/11 Male)
 - Some students were merit-based scholarship recipients

 - Third Year Site visit to Raytheon-IDS
 - Andover, MA

 - Summer Bridge Barbeque
 - Raytheon-IDS Sponsor Keynote Speaker:
 - Dir. Supply Chain/MSME/Harvard MBA/African American Male
 -

 - **Research Experience for Undergraduate EOY Summer Bridge participants**
 - **30% participated in 2009 Summer REUs @:**
 - **Northeastern University**
CenSSIS – Center for Subsurface Sensing and Imaging Systems
(Boston University, Rensselaer Polytechnic Institute, University of Puerto Mayaguez)

CHN - Center for Highrate Nanomanufacturing
(University of Massachusetts-Lowell, University of New Hampshire)

- **Harvard University**

- Research Experience for Undergraduate EOY Summer Bridge participants-TBD
- Student Leadership/Organizational Activities - TBD
- 100% Freshman Retention Rate / 95% Engineering Retention Rate
- Declaration of Major:
 - 30% EE or ECE
 - 10% Civil Engineering
 - 15% Chemical Engineering
 - 35% Mechanical Engineering
 - 5% Industrial Engineering
 - 5% Arts & Sciences or College of Business
- Average GPA: (Overall College Average of 2008 Summerbridge Participants: 3.130GPA)
 - 3.0 – 4.000: 80%
 - 2.5– 2.999: 10%
 - 2.0 – 2.499: 0%
 - 0.0 – 1.999: 10% Average GPA: TBD

BACK TO THE BEGINNING WHERE IT ALL STARTED
AND WHERE ARE THEY NOW!!!!

The following spreadsheets reflect those students who came through the Summer Bridge Program experience, have completed their degree requirements and have selected to go to graduate school and/or enter the engineering work force.

Fig.2 reflects the 2003 URM engineering students who chose to participate in Summer Bridge with a lower combined SAT of 1168 and the URM students who chose not to participate with a higher combined SAT of 1204. However, at the conclusion of the Summer Bridge program academic year, the lower SAT URM students completed their freshmen engineering year with a higher overall GPA of 2.92, which was statistically significant when compared against the overall 2.56GPA of Non-Summer Bridge URM students.

Fig.3 reflects the ongoing URM engineering Summer Bridge students and their academic performance relative to their GPAs, retention rates and ultimately their graduation rates.

NU College of Engineering
Fall 2003 Incoming Freshman Profile

	All	URM
SAT - Total	1253	1192
SAT - Math	655	617
SAT - Verbal	598	575
GPA	3.6	3.5

URM = Summer Bridge & Non Bridge URM

NU College of Engineering
First Year Academic
Performance Comparison

	2003	2003	2003
	Summer Bridge URM	Non-Bridge URM	All
College GPA	2.92	2.56	3.09
%GPA >= 2.0	92%	76%	93%
%GPA >= 3.0	53%	28%	63%
% >= 600 SAT- M	46%	72%	NA
SAT-Total	1168	1204	1250

FIG. 2

	Summer Bridge Year										
	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	N(total)
SB Freshmen Retention Rate:	TBD	100%	100%	100%	100%	95%	95%	90%	93%	82%	
n:	19	30	15	20	15	22	21	10	14	11	177
	10M/9F	16M/14F	10M/5F	11M/9F	8M/7F	15M/7F	12M/10F	5M/5F	10M/4F	8M/3F	
SB Engineering Retention Rate	tbd	90%	100%	95%	93%	90%	86%	90%	85%	82%	
1st Year SB Freshmen GPA:	tbd	3.04	3.013	3.130	2.986	2.877	2.939	2.851	2.919	2.535	
SB Quality of Retention Rate:											
>= 3.0 - 4.000gpa:	tbd	57.0%	67.0%	80.0%	50.0%	60.0%	43.0%	50.0%	50.0%	46.0%	
>= 2.5 - 2.999gpa:	tbd	23.0%	33.0%	10.0%	36.0%	20.0%	33.0%	20.0%	7.0%	27.0%	
>=2.0 - 2.499gpa:	tbd	7.0%	0.0%	0.0%	7.0%	0.0%	10.0%	20.0%	29.0%	9.0%	
>=0.0 - 1.999gpa:	tbd	13.0%	0.0%	10.0%	7.0%	20.0%	14.0%	10.0%	15.0%	18.0%	
SB Engineering Grad. Rate:	tbd	tbd	tbd	tbd	tbd	85.0%	100.0%	100.0%	86.0%	100.0%	
						(81%)	(86%)	(90%)	(80%)	(82%)	

*(Note: There is some rounding error)

FIG. 3

2007 Graduates of 2002 Summer Bridge Program: Where are they now?

Name	Gender	Major	Degree	Status
Louis	M	Mech.Eng.Tech.	BSMET	MSME Program at Howard U. Joined
Christian	M	Civil Eng.	BS Civ.E.	N/A
Andrea	F	Chem. Eng.	WLS	WLS
Stanley	M	Mech. Eng.	BSME	Working in Iowa company as an engineer
Collings	M	Mech.Eng.Tech.	BSCiv.E	Employed with Jacobs (Civil Engineering firm)
Diaz	M	Elec. Eng.	BSEE	Hired by Deloitte-Touche (Attending Kellogg B-School)
Renee	F	Elec. Eng.	WFS	WFS
Stephanie	F	Civil Eng.	BS Civ.E.	BS/MS ChE LDP Employee at Raytheon Co.
Sergio	M	Mech. Eng.	BSME	PepsiCo LDP/Deloitte Consulting LLP/Harvard B-School and Kennedy School of Government
Stephen	F	Comp. Eng.	BSComp.E.	WLS
Tariq	M	Comp. Eng.	BSComp.E.	N/A

2008 Graduates of 2003 Summer Bridge Program: Where are they now?

Name	Gender	Major	Degree	Status
Corey	M	Elec./Comp.Eng.	BS ECE	2 nd Yr. MS/PhD Neuroscience Program at Johns Hopkins Univ. and GEM Fellow
Hector	M	Civil Eng.	BS Civ.E.	Civil Engineering Firm
Amara	F	Chem. Eng.	BS Chem.E.	N. Carolina Teach For America
Cristhian	M	Mech. Eng.	BSME	Hired by Hasbro Co. as engineer
Roodly	M	Mech. Eng.Tech.	BSMET	Engineer at Boston Water & Sewer Commission
Clifton	M	Mech. Eng.	WLS	Enrolled into Year-Up Program after WLS
Melissa	F	Elec. Eng.	BSEE	Engineer at AE Systems, Inc.
Joan	F	Civil Eng.	BS Civ.E.	New York City Civil Engineering Department
George	M	Mech. Eng.	BSME	NSTAR LDP/ GE - NBC Studios
Kristen	F	Comp. Eng.	BSComp.E.	Engineer at Raytheon Co.
William	M	Comp. Eng.	BSComp.E.	Engineer at IBM Co.
Sade	F	Chem. Eng.	BS Chem.E.	MS Genomics Program at Columbia U./PhD NYU Polytechnic
Cesar	M	Elec. Eng.	BSEE	Engineer at Empirix
Durell	M	Comp. Eng.Tech.	WLS	Enrolled into Year-Up Program after WLS

2009 Graduates of 2004 Summer Bridge Program: Where are they now?

Name	Gender	Major	Degree	Status
Christopher	M	Comp. Eng.	BSCE	Engineer at Northeastern University IT Department
Marques	M	Comp. Eng.	BSCE	Interviewing w/ Raytheon Co.
Hector	M	Civil Eng.	BS Civ.E.	Hired by Civil Engineering Co.
Sara	F	Elec. Eng.	BSEE	MSEE Boston University / Engineer at GE
Christy	F	English	BAEnglish	NA
Gabriel	M	Mech. Eng.	BSME	Math Teacher in New Jersey High School
Evan	M	Elec. Eng.	BSEE	Accepted into Research Program at Siemens Co.
Rebecca	F	Civil Eng.	BS Civ.E.	TBD
Kimberly	F	Mech. Eng.	BSME	TBD
Nicole	F	Comp. Eng.	BSComp.E.	TBD

In conclusion, it is our contention that the results of this presentation will have broader implications for undergraduate underrepresented minority engineering programs to have formal support systems in place. In addition to the contributions to research in the fields of engineering education, social cognitive psychology, career development, and diversity studies, this project has a number of broader impacts that have national implications. The results may provide engineering colleges with data-supported measures of the effectiveness of programs for historically underrepresented minority students. By empirically tracking the effectiveness of these contextual supports, the study will make it possible for engineering colleges to emphasize programs that work.

Bibliography:

1. U.S. Census Bureau, 2004, U.S. “Interim Projections by Age, Sex, Race and Hispanic Origin,” Internet Release Date: March 18, 2004
2. CPST, derived from U.S. Census Bureau 2000&Engineering Workforce Commission, 2000
3. LaVant, B.D., Anderson, J.L., & Tiggs, J.W. (Winter 1997) Retaining African American Men Through Mentoring Initiatives. *New Directions For Student Services*, 80, 43 – 53
4. Reichert, M., Absher, M. (1997). Taking another look at educating African American engineers: The importance of undergraduate retention. *Journal of Engineering Education* 86(3): 241- 253.
5. SCIENCE VOL 331 14 JANUARY 2011 *Published by AAAS*