

## HeadsUP and the What is Engineering? Fair

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### Abstract

HeadsUP, the Hopkins Engineering ADvanced Summer University Program, is a summer program of introductory college credit courses with internship opportunities. More than 60 high school students have participated in the program to date, taking courses in electrical engineering, computer science and biomedical engineering. This paper discusses in detail the strategy for course selection, the student profiles and demographics, the recruitment and selection of internships, the marketing and public relations programs being used to promote engineering and HeadsUP to high school students, and the effective use of an external advisory group to aid in forming the program.

### Introduction

Now entering the recruitment period for the third summer of HeadsUP, the Whiting School of Engineering of Johns Hopkins University is reaching out to high school students in the Washington DC area to spread the word about engineering.

**HeadsUP**, the Hopkins Engineering ADvanced Summer University Program, is a summer program of introductory college credit courses with internship opportunities. More than 60 high school students have participated in the program to date, taking courses in electrical engineering, computer science and biomedical engineering. New during the summer of 2003 will be a subject matter survey course called What is Engineering?, as well as courses in environmental engineering and a variety of biotechnology-related courses from the Krieger School of Arts and Sciences of Johns Hopkins University.

The unique quality of HeadsUP is enhanced by the internship component. This aspect of the program pairs qualified high school students with internships at area engineering/technology companies. For example, participating organizations during the 2002 summer session included the ITA Corporation (a systems integration firm in Maryland), the Washington Suburban Sanitary Commission (the area water utility company), Virion Systems (a biotechnology company in Maryland), ManTech Advanced Systems (an international systems engineering, information engineering and information processing technology company), SoftMed Systems (an international healthcare services company), Sytel, Inc (an information technology services company in Maryland and Virginia), ISN Corporation (a national information technology consulting firm), OrthoSpot ( a Maryland-based e-commerce firm), Software Productivity

Strategists, Inc (a Maryland-based e-applications management company), and two divisions of Johns Hopkins University: the Whiting School of Engineering (Department of Biomedical Engineering) and the Applied Physics Laboratory.

Each December, the HeadsUP recruitment season is launched with a What is Engineering? Fair. This event introduces Washington area high school students and their families, teachers, and counselors to engineers from the region's companies. In December, 2002, attendance approached 350 with more than a dozen companies exhibiting their technologies and services. The event is promoted with print, radio and direct mail advertising focusing on the exciting accomplishments of engineers and scientists during this century and last.

This paper discusses the inception and development of HeadsUP, the staffing requirements and challenges, the strategy for course selection, the student profiles and demographics, the recruitment and selection of internships, and the marketing and public relations programs being used to promote engineering and HeadsUP to high school students.

### Project Concept

The HeadsUP program concept was initially developed in 1998 at the suggestion of the dean of the engineering school, Ilene Busch-Vishniac. Her thought was to create a summer high school program for the Washington, DC area modeled after the successful summer programs on the main Homewood campus of Johns Hopkins in Baltimore. Committed to the mission of undergraduate engineering education, Dean Busch-Vishniac's vision for the expansion of the summer programs was connected to this mission. Not only did she hope to introduce more high school students to the excitement of engineering, but she was also interested in expanding the pipeline of potential undergraduates for the programs at Johns Hopkins.

At the time the idea of the HeadsUP program was suggested, the information technology market in the Washington DC area was robust and companies were scrambling for employees. Undergraduates were leaving the university mid-semester for tantalizing salaries and companies were recognizing the need to reach into the high school ranks to fill job openings with qualified and motivated employees. The concept of a program combining education and internship opportunities seemed like a win-win situation.

The proposal to expand the summer programs from the main campus to the Washington area was facilitated by the presence of the Whiting School of Engineering Part-Time Programs in Engineering and Applied Science. This very successful program of graduate and undergraduate programs for working adults was well established at six locations in the Washington-Baltimore area, including the Montgomery County Campus of Johns Hopkins in Rockville, Maryland. The presence of this significant satellite campus in the Washington DC area provided an excellent location for a new summer program for high school students. It was quickly realized, however, that the characteristics of the Montgomery County Campus were similar but obviously not identical to the main campus in Baltimore. Modeled after a business park, rather than a residential campus environment, the Montgomery County Campus lacked the facilities that would attract prospective students to the experience of a traditional campus. Hence, added value

was proposed to compensate for the lack of a traditional campus experience. The added value was the internship component – discussed in more detail in later sections of this paper.

From concept to implementation, the development of HeadsUP took approximately two and a half years. Not only did it take time to reach internal consensus on the specific goals and objectives, and to select the courses and recruit the faculty, but the most time consuming aspect of the development phase was the establishment of relationships with and commitments from the participating companies. An additional obstacle was staffing. The program was developed by the authors – who were fully engaged in other responsibilities related to the Part-Time Programs in Engineering and Applied Science. Although some temporary help was available, no new, permanent staff was hired in the early phases of the project to support the program development. This had some affect on the speed at which progress was made and relationships were built.

### Project Goals

As mentioned previously, the project goals recognized existing market conditions and grew out of the mission statement: *Provide a unique summer educational and work experience at the JHU Montgomery County Campus and in local technology/engineering companies to introduce high school and early-college students to the field of engineering.* Ancillary to the mission statement was the unofficial goal of turning away no qualified student based on his or her inability to pay.

By locating in Montgomery County, the program had the potential of reaching a very diverse population of students, a highly educated population of parents, and a nexus of companies in information technology and the biosciences, very much in need of qualified employees at that time. The program would also be able to build on the existing population base familiar with Johns Hopkins in the Washington DC area through the established presence of the Part-Time Programs in Engineering and Applied Science.

To meet the goals, HeadsUP was built upon four essential elements:

1. College level, for credit, engineering courses
2. Limited internships for qualified students
3. What is Engineering? Fair
4. Scholarships/Financial Aid

The intersection of all four of these elements has made the program unique and appealing to high school students and tailored the program to the off-campus environment.

### Administrative and Academic Infrastructure

#### Staffing

The HeadsUP program was placed from the beginning under the oversight of the Part-Time Programs in Engineering and Applied Science (PTE). Already well established as a leader in graduate engineering education for working adults, PTE offered existing admissions and

registration systems that could accommodate the needs of the new program. Through PTE, the HeadsUP developers could also expand existing relationships with area organizations to include the HeadsUP partnerships that would be necessary to develop the internships.

What was missing, however, in the PTE model was sufficient staffing to handle the extra work related to HeadsUP. As a consequence, the program developed slowly over two and a half years through the assistance of existing staff and some temporary staff support.

Prior to the first summer of course offerings in 2001, the staffing consisted of the part-time services of the executive director, the director, the academic program director, and a student liaison and temporary staff as needed. As the first summer ended, the authors were successful in allocating half time of an existing administrative staff member to provide secretarial and administrative support services. This allowed outreach to potential students to increase because there was assistance available for mailings, phone calls and event support.

As the second summer of course offerings approached in 2002, a part-time staff member was added to work on the relationships with the high schools and the area companies during the year.

Now, as the third summer approaches, it is still evident that the project is understaffed. Ideally, the internship development and recruitment aspects, as well as the public/private school relationships require full-time involvement and hopefully it will be possible to address the staffing issues in future budget cycles.

#### External Advisory Group

Another very important feature of HeadsUP is the External Advisory Group. Using contacts already established by the part-time engineering program and other contacts developed in the community and within the university, a group was formed in the fall of 2000 that consisted of a dozen members. Representatives from local corporations, the Montgomery County Public School System, nearby Montgomery College (a community college), the marketing/public relations firm and various programs within Johns Hopkins University were invited to join. In addition the Director selected a student representative to participate in the meetings. This group proved to be a key component during the early development of the project, providing enthusiasm, great ideas, encouragement, contacts, internships, and exhibits at the fair. During the first full year of the project, the Advisory Group met monthly, but presently, as things are more settled, the group meets quarterly to review all aspects of the program and to provide much needed external advice and counsel.

#### Academic Program Director and the Academic Advisory Group

The position of Academic Program Director was identified early on as a critical member of the project team - consistent with the academic oversight model utilized by all academic programs within the engineering school. The responsibilities of this position were to ensure academic quality, chair the Academic Advisory Group and oversee faculty hiring as well as course

selection and scheduling. Currently, the position is a part-time appointment reporting through the HeadsUP Director to the Associate Dean for Academic Affairs.

In seeking to fill this position prior to the start of the first summer of classes, the decision was made to look to the ranks of adjunct faculty teaching locally in the part-time engineering program. Fortunately, an individual was identified who not only satisfied the criteria of the position, but was also the chair of the engineering department at the local community college – Montgomery College. This provided a unique opportunity to bring on board a highly qualified individual while at the same time strengthening the important relationship with Montgomery College.

The purpose of the Academic Advisory Group, chaired by the Academic Program Director, is to oversee and maintain the academic integrity of the program. The group is comprised of faculty from each of the departments from which the courses are drawn as well as the Associate Dean for Academic Affairs. The Academic Program Director works with the members of the Academic Advisory Group and other of the full-time Whiting School faculty throughout the course development process to ensure that the courses offered in HeadsUP are equivalent to those offered in the full-time programs. The group meets once a year in late winter to review plans for the coming summer courses and to offer their guidance on the academic directions for HeadsUP. All academic aspects of the summer program are open to their scrutiny and their input is strongly encouraged.

#### Course Selection

Needless to say, course selection is among the most challenging, yet critical aspects of the HeadsUP planning each year. The challenge is to balance student interest with the company demand for education in certain areas against the desire to offer appropriate freshman level engineering courses. Over time, a strategy has developed that is based on offering as wide a variety of introductory engineering courses as possible – allowing students to explore their interests and thereby aiding them in choosing an academic direction in engineering. The success of this strategy has been confirmed thus far by the fact that demand continues to be spread fairly evenly among the introductory courses. Each year, at the What is Engineering? Fair the student interest in course offerings is surveyed. The survey results have not yet affected our decisions to offer particular courses, but the results give us a sense of how enrollment will spread across the courses offered.

The courses that have been offered to date are shown in the table below. Not shown are two courses that were offered in the course schedule but did not receive sufficient enrollment. These were Introduction to Environmental Engineering (summer 2001) and Intermediate JAVA (summer 2002).

Summer 2001	Introduction to Programming in JAVA Digital Systems Fundamentals
Summer 2002	Introduction to Programming in JAVA Digital Systems Fundamentals

	Models for Life (Biomedical engineering) Introduction to Electrical and Computer Engineering
Summer 2003 (proposed)	Introduction to Programming in JAVA Digital Systems Fundamentals Models for Life (Biomedical engineering) Introduction to Electrical and Computer Engineering What is Engineering? Introduction to Environmental Engineering

Not only will a new survey course be introduced in 2003 entitled “What is Engineering?”, but several related courses offered by the School of Arts and Sciences will also be added to the course offerings to significantly broaden the array of course offerings. These include: Bioinformatics; Introduction to Biological Molecules; Bioethics; Special Effects Technology in Film and Media; and Science Writing.

### Internships

As mentioned previously, the internship component of HeadsUP was incorporated as an important feature of the program to compensate for the lack of a traditional campus environment at the Montgomery County location. It was also added during the peak of the information technology boom to attract company interest and potential partnership in the program. Although the IT bust began just shy of the start of the first summer, we have been successful in placing nearly one half of the students in paid and unpaid internships during the past two summers.

To offer a flavor of the experiences gained by the students in their internships, the following examples are given:

1. Bechtel Power Corporation – the student wrote a software application to calculate the size of a pipe needed in a power plant construction project. The software is now used throughout the company on many different projects.
2. Quanta Systems – the student wrote a software program to manage the procurement process. The success of the software changed the company’s original skepticism about interns to a more positive perspective.
3. ManTech Advanced Systems – eight students working for this company obtained secret security clearances and provided assistance in pulling network cable at the Pentagon.
4. JHU Whiting School of Engineering Department of Biomedical Engineering – student comments: “Through a lot of hard work I learned an incredible amount about teamwork and doing research. Until last summer I wasn’t sure what the day-to-day work of an engineer would entail and I still wasn’t certain that I wanted to be one, but the internship resolved any doubts. This new knowledge gave me the confidence and determination to succeed in engineering.”

## Student Admissions and Demographics

Admission to HeadsUP is based on a minimum, unweighted high school grade point average (GPA) of 3.0, standardized test scores and letters of recommendation from a teacher and guidance counselor or principal. The average high school GPA for the summer 2002 class was 3.55 with test scores averaging above the 90<sup>th</sup> percentile on mathematics.

A profile of our students in 2002 is below. As can be seen, the student population is beginning to reflect the diversity of the area and the market being targeted. Efforts will continue to be made in future years to impact these demographics more significantly.

<b>Demographic</b>	<b>Percent of Students</b>
Attending private/parochial schools	12.5%
Attending community college	2.5%
Male/female	70%/30%
Underrepresented minorities	35%
Students with internships	55%
Returning students	7.5%
Students receiving financial aid	20%

The HeadsUP Student Liaison is a 33 year veteran of the public school classroom and is a teacher and intern coordinator in a local high school. Her impressions of the HeadsUP students are that “they are hungry for knowledge and particularly the practical applications to the present and future; they are willing and eager to actively contribute and participate in classroom dynamics rather than individually compete; they employ a multi-dimensional approach to problem solving - these students have not narrowed their focus ( i.e., just thinking in terms of only their major) but use a variety of academic subjects to solve a problem. For instance, in the bio-med class students use algebra, trig, calculus, and physics to solve the same problem. They are not as self-conscious as older students but more open and refreshingly communicative yet extremely competent and self-confident.”

## Challenges

### Changing Economic Conditions in the Region

At the time the program was conceived the economy was expanding rapidly. In initial conversations with companies desperately seeking employees, it became evident that it was extremely difficult for the firms to recruit college students for summer jobs. The companies were happy to consider hiring high school students for summer internship positions with the hope of retaining them as part-time employees once they returned to school. For example, in September, 2000 one area telecommunications company indicated that they would be able to hire 12 interns from HeadsUP. As the first summer of HeadsUP approached, however, they were only able to take a single student. By the summer of 2002 this company had laid off thousands of employees world-wide and was unable to take even a single intern. Two other companies who

had hired an intern each in the summer of 2001 were unable to hire any in 2002 as they had employees collecting unemployment and, by law, couldn't hire temporary summer help.

Despite these challenges, but largely due to persistent calls and direct contact with companies, 12 students were placed in paid and unpaid internships during the first summer (2001). Again, with an enormous amount of effort and in spite of the continuing economic downturn, we were able to place 22 students in internships in the summer of 2002. A significant amount of time is spent screening students and companies with the intent of creating the best possible experience for both. Thus far the quality of these internships has been universally high with no adverse reports from either students or companies.

### Competition

There is a significant number of high-quality, competing summer programs both locally and nationally. If a student (and his/her parents) wants a residence program and/or wants it to be located away from home, obviously they will make their selection accordingly. Of the competing programs located in the Washington area, however, only a small number offer the opportunity for an internship. We are told time and again that students join HeadsUP for two reasons: the reputation of Johns Hopkins University and for an opportunity to have an internship. Last year, of the 51 students accepted into the program, 42 requested internships and 22 were matched with companies. Only four of those not receiving internships decided not to enroll. The final class size was 38 with one additional student dropping out prior to completion for reasons of personal over-commitment.

### Scholarships and Financial Aid

Although Montgomery County Maryland is among counties with the highest per capita income in the country, it is an ethnically diverse county with more than 80 languages spoken by students in the public school system. Additionally, more than 25% of the public school students receive some type of meal-assistance funds. As a result, although many parents are able to underwrite the cost of sending their children to high-end summer academic experiences, many others are on food stamps and have little or no funds for their children's education.

All financial applications for HeadsUP are reviewed by the central financial aid office. Based on a rating of the level of need of the family, an estimate is made of the amount a family has at their disposal for the student's education over the coming year. Our financial aid committee ranks the students eligible for acceptance according to need and divides the available financial aid funds among them. All students, regardless of need, are expected to pay some portion of their tuition and books. Fortunately, to date, every student who required financial assistance to enroll was awarded enough for them to do so – and all have been successful academically.

The financial aid is made available from two sources: 1) an external gift by the Bechtel Power Corporation and 2) internal funds in the form of discounted tuition. We continue to seek additional sources of funding for needy students as this has been recognized as an important aspect of the program.



## Budgeting

To cover operating expenses (including: faculty and administrative salaries, facility costs, and marketing/public relations) and to provide student financial aid, the estimated number of students needed each summer to break even is approximately 90. Since this enrollment has yet to be reached, supporting operating funds have been necessary. The source of these funds has been internal and external entities. The internal sources are the dean's discretionary budget and the budget of the Part-Time Programs in Engineering and Applied Science. The external sources include scholarship money made available by the Bechtel Power Corporation and grant money from the State of Maryland Applied Information Technology Initiative (MAITI). Without these infusions of money, it would not have been possible to launch HeadsUP.

## Marketing/Public Relations

Launching a program from scratch requires a significant investment in marketing and public relations. This is a very costly challenge. Not only is it necessary to build awareness in a high school population of students, teachers, counselors, and parents generally unaware that JHU facilities exist more than 50 miles from the main campus in Baltimore, but this same population is regularly besieged by the advertising of extremely popular and well established competitive programs locally and nationally.

With considerable assistance from an outside agency – Jill Tanenbaum Graphic Design and Advertising – a marketing plan was developed based on the theme of introducing high school students to the excitement of engineering. The plan is based on reaching three target markets – students (and teachers and counselors), parents, and companies. We employ a slightly different marketing strategy for each target market, but each relies, essentially, on six important elements:

1. Print advertising in local newspapers
2. Radio advertising on local stations
3. Press releases, calendar listings, TV and print interviews
4. Printed materials, including: posters, fliers, and brochures
5. Premiums such as: CD cases, t-shirts, and calculators
6. Website for HeadsUP ([www.headsup.jhu.edu](http://www.headsup.jhu.edu))

One means of distinguishing between the different target markets is to use different printed materials for different groups. For example, this year a new campaign was launched, encouraging students to: “Enter the world of engineering *now*.” The print campaign consists of four pieces: a pocket folder that can be opened into a poster for display in a classroom; a brochure explaining the elements of the program to students, parents, teachers, and counselors; a second brochure focusing on company partnerships and the benefits of the internships; and a separate flyer promoting the What is Engineering? Fair. Each piece has the same look and feel, yet each piece stands alone if necessary. A full discussion of the marketing plan is outside the scope of this paper, but the reader is encouraged to visit the website to review some of the elements of the branding campaign.

## What is Engineering? Fair

Each year the recruiting season for HeadsUP begins with the What is Engineering? Fair held in early December at the Montgomery County Campus. The fair draws students, parents, teachers and counselors to an event where they will hopefully find answers to their questions about engineering. Information is provided about HeadsUP and student's names and addresses are collected for follow-up opportunities. Students are also surveyed to determine how they heard about the program and to determine what areas of engineering are of interest. In 2002 a media survey was also distributed to collect information about popular radio stations, newspapers, magazines and websites for future advertising.

To help answer the questions about engineering, area companies are invited to set up their trade-show booths and to display their latest technologies and services. Exhibitors are given badges to wear indicating their own engineering disciplines so that students will be encouraged to ask more questions about the different fields of engineering. The exhibitors are also encouraged to bring hands-on demonstrations and displays. Recent examples include: remote controlled robotic arms, a Lego Robotic Competition winning entry, computer simulations of air traffic models, satellite communications equipment, digital phone systems, water treatment distillation plant models, electronic circuit boards, and telecommunications testing devices.

The What is Engineering? Fair gains in popularity each year. This year, with the help of increased public relations activities, the fair, and the recruitment of young engineers was an especially popular feature on TV and in the newspapers. For example, the HeadsUP Director was interviewed on the local news station the morning of the fair and the Washington Post ran two articles about the activities in the days following the fair.

## Summary

The momentum is building and word is spreading quickly about HeadsUP as it has become clear that we have created a niche, educational/work experience, in which there is a great deal of interest. More area high school students, of many diverse backgrounds, are being given the opportunity to learn about engineering and demand for the summer courses seems to be increasing. The signs are positive, but the program is still in its infancy and has yet to break even financially. The focus this year is on increasing public awareness, continuing to diversify the student population, increasing the number of available internships, and growing the staff to an optimal size. In addition, the planned collaboration with the Krieger School of Arts and Sciences to offer biotech courses under the aegis of HeadsUP promises to accelerate the growth of the program more rapidly toward breakeven status. The significant challenge with this new direction, however, will be to maintain the unique and clear identity of HeadsUP as an engineering career entry point while offering a variety of courses at best only loosely related to engineering. Under consideration are a number of ways of structuring the program to create a win-win situation for the students and for the two schools.

The goal of HeadsUP to provide students with an entry point into a career in engineering is facilitated by the mission of delivering to the community at large the answer to the question ubiquitous in all our materials, “What is Engineering?” As we answer that question, we educate them to the fact that engineering is an entrée to a wide, diverse, interesting, and potentially rewarding world, and we are offering the opportunity to project into that world by taking introductory engineering courses in HeadsUP and possibly receive an internship, as well. This seems to be a winning combination with students telling us of the difference it has made in their lives and with companies singing the praises of their interns, many of whom have continued to work part-time for the companies beyond the term of their internship.

#### Biographical Information

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