Technology Awareness Program:
Adventures in Wireless Telecommunications

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Abstract

The current paper describes a program to integrate Secondary with Post-Secondary Education in the fields of Math and Science and increase the quantity and quality of individuals entering into the High Tech Workforce. Components include curriculum development and instruction by community college telecommunications professors, corporate sponsorship and mentors, as well as support from the American Radio Relay League, local ham radio clubs, and local radio-controlled aircraft organizations. The TAP Program includes workshops for training teachers in wireless telecommunications and summer camps for middle school (grades 7-9) students with game-based activities that teach the fundamental technologies that will prepare them to enter further studies in Residential Broadband Wireless, Voice over IP · TCP/IP Wireless Networks, and Voice, Video and Data Integration. Plans also include transmissions to and from the International Space Station and other projects coordinated with the help of NASA.

Background:

The U.S. Census Bureau reveals that less than twenty percent of all new jobs created in the twenty-first century will require a four-year degree or higher. Greater than eighty percent will require different post-secondary training. There are presently over 346,000 technology positions unfilled today due to a lack of technically skilled labor in the United States. The US economy is expected to produce 95,000 additional technical positions each year for the next eight years.

According to the US Labor Department the average income in the United States for Information Technology (IT) core positions is approximately double non-IT core positions. It is estimated that there will be six high-paying technician positions created in America for each engineering position that is filled. Surveys show that few secondary level students are familiar with the term: Engineering Technology. Less than three percent of high school students in Collin County would identify CCCC with the term: Engineering Technology.

Efforts to recruit students to CCCC’s division of Engineering Technology have not brought in the desired number of students to this major. We need to implement a technology awareness program.

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Purpose of the Technology Awareness Program:

To expose middle and high school students to high paying careers available in Engineering Technology.
To introduce these same students to an assortment of exciting engineering technology subjects that lead to these career opportunities.
To aggressively utilize numerous for-profit and not-for-profit resources in the implementation of the technology awareness program.
To establish and develop an annual Summer Technology Camp (STC) for these students, with an initial opening to take place June 2000.
To tap qualified students from local high schools, less than 20 years of age, for enrollment in the division of Engineering Technology.
To achieve an annual goal of increased enrollment in this area of ten percent per year over the next decade.
To influence corporations in the Telecom corridor to establish several Engineering Technology scholarship endowments at CCC.

Identified Emerging Technologies:

TAP students will receive an introduction to fundamental technologies that will prepare them to enter further studies in the following emerging fields.

- Residential Broadband Wireless
- Voice over IP · TCP/IP Wireless Networks
- Voice, Video and Data Integration

Timeline:

TAP roll out was planned in five phases.

Phase I: Corporate exposure and the securing of sponsors (Summer 1999)
Phase II: Technology presentations to students and student recruitment (Fall 1999)
Phase III: Student technology training, licensing and certification (Spring 2000)
Phase IV: Summer Technology Camp [Let the games begin!] (Summer 2000)
Phase V: Student build-out of inter-school wireless network (Fall 2000)

Strategy:

TAP will appeal to a student's desire to communicate and interact with other students. TAP will use modalities that are designed to be fun to expose students to basic concepts in Engineering Technology.
Teacher Training in Wireless Communication

Twelve teachers from four school districts (Allen, Anna, McKinney, and Plano) and one private Dallas school have attended one-week training sessions in Telecommunications technology. They now have the knowledge necessary to pass the FCC Part 97 Technician Class Ham Radio license test. Upon receiving their licenses they will be able to transmit to satellites from their campus sites. Schools with FCC licensed teachers will be able to have their students participate in the following events and programs starting this fall:

The National Science Foundation LIFT (Looking Intently into Future Technologies):

- Project #1: The Fox Hunt
- Project #2: The Wireless PC Challenge (E-Net)
- Project #3: The International Phone-less Fax
- Project #4: The Space Game (ISS & PD3)

The Technology Awareness Program, funded by Carl Perkins

E-Net terrestrial digital “wireless” networking experiments

Organizations (Telecom. Games/clubs for students) for emerging technologies, events, and activities

The ARISS project

A project sponsored by NASA, AMSAT, and the ARRL. With the ARISS project middle and high school students will participate in communication research experiments with astronauts aboard the International Space Station.

Plans for Tech Camp 2000: (Summer Technology Camp)

Each student will compete in several contemporary games during the summer. The games will be similar to Capture the Flag or Kick the Can, except with one twist. Every student will be taught the fundamentals of several high technology concepts and he will be exposed to different leading edge technology subsystems. Equipped with new knowledge, each student will be encouraged to apply any and all new information he has received to improve his abilities at competing in each game. The individual motivation to learn difficult concepts will be generated by personal relevance, immediate application and real purpose.

Tactics for Tech Camp 2000:

- Use the process of learning from mistakes
- Use mentoring by engineers from the telecom corridor companies
- Use discovery-learning techniques.
- Use students who have mastered the material as teachers for the other students

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Planned Middle School Campus Activities

A student-constructed "wireless" PC packet radio network will serve as the building block for advanced technology discovery learning. With the financial assistance of the Brandenburg Foundation, each participating school will be provided the necessary equipment to build a "wireless" network node, which will become part of an inter-school PC radio network. High schools offering the Cisco Networking Academy Curriculum would serve as starting points for inter-school network nodes. Students will use the radio PC network to investigate technologies surrounding wireless systems, i.e. TCP/IP & X.25 protocols over wireless channels.

Packet Radio "Wireless" Network Node Equipment: $12,000.00

Eleven Identical Wireless PC Network Nodal Stations. (Ten for the schools plus one unit to be used as a demo station and later installed in the network as a "wireless" node at CCCCDD.)

Eleven 144Mhz FM Transceivers capable of transmitting digital data via AFSK
Eleven Terminal Node Controllers w/AX.25 and TCP/IP capabilities
Eleven 2-meter Antenna w/mounting and transmission cables
Eleven licenses of Packet Radio software
One Handheld FM transceiver with (TNC & APRS) built-in to be used as a test monitor

Objectives:

To establish the first ten nodes in the inter-school PC radio network by the spring of 2000. (The design of the E-Net packet radio PC network is already complete.)
To target special populations traditionally absent from the high tech marketplace and increase participation of other gender populations in nontraditional high skill areas.
To enroll 120 students into the Summer Technology Camp.
To have 24 students certified in the "wireless" field by earning the FCC Part 97 Technician Class License by the end the spring of 2000.

Ultimate Goal:

To interest between 50 to 100 community colleges in such technology workshops. The TAP program should be able to increase their enrollment in high tech courses by as much as 10% a year, once the students pass through the start up phase.
Session 2793

TAP Organizational Chart

SIGMA GAMMA EPSILON
Emerging Technology Clubs

LIFT PROJECTS
NSF Funded

- Fox Hunt(1)
- Wireless PC Challenge
- Intl' Phone-less Fax
- Space Game

SCHOOLS INVOLVED
Active and Pending

TEACHERS INVOLVED
Licensed & Non-Licensed

STUDENT LICENSING CLASSES
Provided by Amateur Clubs

TEACHER TRAINING
Provided by CCCC

TECHNOLOGY DEMOS
Provided by Local Amateurs

INDIVIDUAL BUILD-UP PROJECTS
Provided by Engineering Tech. Div.

- Antennas
- Tuna Can TVR Rigs

SUPPORT TECHNOLOGIES
Hardware, Software & Organizations

E-NET
Wireless Networking Equipment

- AX.25 Experiments
- TCP/IP Experiments
- APRS Experiments

SATELLITE GROUND STATIONS
Satellite Tracking Equipment

- ARISS Project
- AMSAT PD-3 Project
- Analog Satellites
- FM Satellites & SSB Satellites
- Digital Satellites

- PSK Satellites
- AFSK Satellites

LOCAL AMATEUR CLUBS
Supporting the SGE Clubs

- NASA, AMSAT, ARRL, TAPR, TPRS & IEEE
  "Wireless Organizations" Providing Programs & Services

Web Sites
On CCCC Web Server

- Sigma Gamma Epsilon
- Teachers
- Amateur/Engineers
- Summer Tech Camp

SUMMER TECHNOLOGY CAMP
"Wireless Technologies"

- COMPANIES
  STC Sponsors

- MEMBERS
  "Wireless Design Engineers"

- RF ENGINEERING
  Games

- Foxhunts (5)
- Astronaut Splash Down
- Spy Hunt
- Anti-submarine Warfare
- Five Downed Pilots
- The Battle of Midway

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Tech Camp 2000 Review

The Preston Ridge Campus of Collin County Community College in Frisco was the host site for an exciting adventure in technology this summer: Tech Camp 2000. Sixty-one sixth through ninth grade students attended the camp this summer. The camps were held in two three-week sessions, June 5-23 and June 10-July 28. Campers attended from 9 a.m. to 4 p.m., Monday-Friday. The cost of the camp was $250 and included a T-shirt and directional antenna that the campers would build. Eleven of the campers were females. Fifty-seven of these students will be attending two McKinney schools, three Allen schools, five Dallas schools, two Frisco schools, and fourteen Plano schools in the fall. Three of them are “home-schoolers”. One student was from Tahlequah Jr. High in Oklahoma.

Tech Camp 2000’s major corporate sponsor was Nortel Networks. Additional funding was provided by the National Science Foundation’s Advancing Careers in Technology and Science (ACTS) Project, Collin County Community College’s GlobalEDGE/Tech Prep office, Southwestern Bell, the Communications Workers of America, Kimley-Horn and Associates, Inc., Sunbelt Plastics, Inc. and ST Microelectronics.

Bringing math and science skills to life through high tech games, more than sixty mentors from Nortel Networks and other area businesses guided the campers through orienteering (the use of map and compass skills), radio direction finding, radio propagation and antenna characteristics. The camp instructors, Jeff Fant and Tom Mobley, as well as many of the mentors, are licensed amateur radio operators themselves.

During the camp weeks, the students were invited to participate in Field Day activities with Collin County Community College’s K5CCC Radio Club and the North Texas RC Club which demonstrated radio controlled airplane and helicopters. The students were also involved in Ham Com activities – a national annual conference of amateur radio operators held in Arlington, Texas in June.

Campers who had obtained a technician class amateur radio license by the end of the camp session were also awarded a Kenwood Th-D7A transceiver, valued at more than $400. A total of 37 student campers (18 from Session I and 19 from Session II) tested on the last day of camp and qualified to receive or upgrade their FCC Amateur Radio licenses! The transceivers that were not awarded at the end of camp were held in trust until January 1, 2001 for any former campers who pass the test and receive their licenses. As of December 15, 2000, three more students passed the test and have received their licenses and transceivers.
Tech Camp 2000 planned follow-up activities include:
Tour of Nortel W/ALL campers, their parents and teachers who have completed training in Wireless Communications
Meeting with mentors for evaluation and suggestions
Amateur Radio Clubs training of SGE club students for Emergency Assistance
Recruitment of additional sponsors for TAP Program activities.
Training more teachers to work with SGE Clubs at their campus sites.
Coordinating mentors from local radio clubs to work with the SGE clubs.
Establishment of Ham Radio Stations at campus sites through Brandenburg Foundation support
Plans for future introductory and advanced Tech Camps
Training of other site’s faculty members to teach Tech Camps in their area.

Sigma Gamma Epsilon Clubs:

SGE chapters (Telecommunications clubs) are established at school sites. Some of the scheduled events include building the E-Net, a unique inter-school digital network used by students to explore wireless communication. In the ARISS project students will establish communications with astronauts aboard the International Space Station. This is an excellent opportunity for exposure for those students that have no previous knowledge in technology.

SGE Clubs function in association with the Engineering Technology Division of Collin County Community College. Learning activities in the clubs are designed to enhance a student’s math, science and reading comprehension. Students in the clubs will compete in a series of games, which are based on emerging technology.

Support from the Brandenburg Life Foundation

The purpose of the Brandenburg Life Foundation (BLF), founded in 1996, is to benefit children. The Brandenburg Life Foundation (BLF) is a 501C3 non-profit Texas corporation. A major new project just initiated is the HAM Radio for Schools Program (HRSP). HAM radio and amateur radio are synonymous. This program is designed to keep children interested in learning, staying in school, pursuing avenues of higher education, and learning about a new hobby that is both fun and beneficial to society. This program is especially targeted at encouraging children to pursue careers in electrical engineering, mathematics, and the computer sciences through an initial introduction using amateur radio and computers for communications. Both private and public schools, which qualify as non-profit organization, are welcome to apply for the HRSP funding.

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Student Graduates’ perceptions of the Tech Camp 2000 experience:

“I thought that Tech Camp was very fun, but in the midst of fun, there was also a lot of learning going on. For example, during the first few days of Tech Camp, we all went outside and we mapped a section of the campus. On the Friday of the first week, we got to speak to and question the president of the ARRL, Jim Haney. During this we learned a lot of things about radio communications and how sun spots can affect them, satellites, and a whole lot more about radios. The next week, Tom Mobley and Jeff Fant set out boxes with words and numbers on them and marked a spot on the maps that we made where they were. We then had to go and find them by using the maps, and to prove that we found them, we had to write down the word and the number that was on the box. The third week, we actually got to use the radios and we had to go outside and find where the "foxes" were using antennas and the radios. Foxes are hidden transmitters that you have to find. In our case, the foxes were people. Since I took my test before Tech Camp, I got to be a fox. I got my call sign at the beginning of the first week. During all of this time, we were also learning Morse Code and about different things that have to do with radio and radio communications. We also did a lot more things, but this is just a vague overview of how Tech Camp was. I thought that it was really fun and if there will be a Tech Camp for General Licenses, then I will definitely go. My favorite part of Tech Camp was being a fox, but I also thought that learning more about ham radio was very fun and educating.”

Wendy Masters
(Grade 8)

“My name is Jordan Goldblatt. I am a graduate of Tech Camp 2000, Session 1. I had many good experiences there and learned a lot of things about Amateur Radio. Probably the best experience was being the "fox" in the fox hunts. Being the fox means that I transmit a signal for about 20 seconds to allow people to get a "fix" on my location. During the first week, we made maps of the surrounding area so everyone could know where good hiding spots were located. We also learned how to use a compass and find our bearings.

Another thing that I learned from Tech Camp was Morse code. Each day, the class would do half an hour of Morse code practice after lunch. On the final day of Tech Camp, testing day, I passed my FCC Morse code exam and got HF privileges on 10 Meters.

I would recommend Tech Camp to other kids because they get exposed to a lot of neat things. Amateur Radio is very important because it can help students get a job in radio communications and they can also help their community in disasters when all other types of communications are down.

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Also, Amateur Radio is not all work. I had a lot of fun playing the learning games at camp. Other neat things that you can do with an Amateur Radio license is operate remote control vehicles and be a net control operator on repeaters. Because of Tech Camp and the Plano Amateur Radio Klub (P.A.R.K.), there are a lot more kids on the air and we are talking to each other on a regular basis."

Jordan Goldblatt, KD5KQM
(Grade 8)

Comments from parents:

"Tech Camp 2000 was an exceptional learning environment that constantly challenged students with new ideas and hands-on situations to reinforce the material. While it may not be for every student, it is a wonderful blend of classroom, laboratory and field activities that engages learners at a lot of different levels.

Our son, Jordan Goldblatt, worked very hard to earn his FCC Technician license prior to the camp session. During the session, he learned a lot about radio frequency (RF) technology and how to work effectively in a group to achieve a goal.

Jordan earned his Morse code certification at end of the first camp session and received his General license the following October. He could not wait to get to camp each day so he could "learn something new."

Jordan plans to attend Tech Camp 2001 and is looking forward to the experience. As parents, we can't wait to see his face after the first day of camp. Would we recommend the camp to others? Absolutely! We continue to support CCCCD in this activity hope that it becomes a model for other communities throughout the U.S."

Barry & Sharon Goldblatt
Plano, TX

“Tech Camp opened a huge door of learning for my son, David Darrow. It was the process of studying for his Ham radio licenses and learning basic electronic theories that made such an impact in his life. Once he learned a little bit about the world of electronics, he wanted to learn more. He began to check out electronics books from the library and read them as I might read a novel. One day I saw him with a calculus book and was startled. He told me that he had come to an impasse with the electronics because he didn’t know enough math. Rather than give up, he felt as though he could study the subject on his own and gain the knowledge he needed to continue.
David found that his high school did not offer electronics courses. He was determined to learn more. He discovered that Collin County Community College taught the course he wanted to take, and he took steps to gain entrance into the college. As a freshman at Vines High School in Plano, he had to consult his counselor and also receive permission from the principle of Plano Senior High School. In addition, he had to study for and pass the Texas Academic Skills Program (TASP) to be accepted into the college. David was taking geometry at the time, and the TASP required proficiency in Algebra II, a class he would take the following year in high school. Because of the previous Ham radio FCC exams he had passed, he felt that he could learn the math that was required. On his own, he studied and passed the college entrance exam. He is currently taking an AC circuits class in the evenings at CCCCD and enjoying it immensely.

I believe that Tech Camp and his experiences studying for the FCC examinations were instrumental in giving David confidence to do things on his own and exposing him to a whole new world of electronics. As a parent, seeing my son filled with confidence and a passion to learn is a priceless gift.”

Heather Darrow
Plano, Texas
Author’s Biography: Jeff Fant

Title:
Telecommunications Professor
Division of Engineering Technology
Collin County Community College

Professor Fant teaches wireless telephony, as well as serving as a regional-level Cisco Networking Academy Instructor.

Past Positions:
Cisco Networking Academy Coordinator
McKinney Skills Grant Information Technology Coordinator
Tech Prep Academic Coordinator

Education:
Bachelor of Science in Engineering Science from the University of New Orleans

Certifications: Cisco Certified Academy Instructor, Cisco Certified Networking Associate

Licenses: FCC Part 97 Technician Class Amateur license

Military Service: Vietnam Veteran serving in the United States Navy in the field of Ballistic Computers and Tracking Radars. Awarded the Outstanding Performance Commendation, which was presented by Vice-Admiral J.L. Holloway III, the Commander of the U.S. Naval Seventh Fleet

Academic Awards: Awarded the Faculty Member of the Year (1999)

Research: Work as a member of Offshore Navigation’s research and development team developing the first Atomic Clock Radio Positioning System used in ocean exploration.

Design Work: Worked as a member of the original design team developing the first 5.25” hard disk drive for the PC industry. Wrote the hard drive specifications for Texas Instruments’ inaugural 5.25”hard drive product line.

Presently: Mr. Fant serves as Collin County Community College’s Technology Awareness Program Coordinator. He is developing an inter-school wide-area digital “wireless” network called E-Net. Middle and high school students will use this network to investigate emerging “wireless” technologies.

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He also serves as Collin County Community College’s Summer Technology Camp Coordinator. Last year’s first annual event entitled Tech Camp 2000 trained 60 of the Dallas area middle and high school students in the field of high-tech “wireless.” It was hosted by CCCC, and sponsored by several high tech companies in the Telecom Corridor with Nortel Systems serving as the primary sponsor. Forty of the sixty students obtained their FCC Part 97 licenses as a result of the Technology Camp.

**Papers Presented:** National Science Foundation, Technology Awareness Program, and “The key to successful educational programs.” Washington, D.C. October 28, 2000

**Speaker:** Texas Tech Prep Directors annual meeting, The Cisco Networking Academy, and “The success stories it has generated.” Plano, Texas, Fall 2000

**Speaker & Panel Discussion:** Hugh O’Brien Leadership Conference, Technology, The Future and You, Richardson, Texas, Fall 2000