

I. Abstract of Project/Activity

In the fall of 2005, the Career and Technology department at Coppell High School (CHS) implemented major changes to the Engineering Technologies Pathway (ETP). Through the generous support of the Coppell Education Development Corporation, CHS was able to add new courses, such as the Infinity Project, and upgrade existing labs to meet current technologies. Since that time, the Engineering Technologies Pathway at CHS has grown tremendously.

Through partnerships with several universities, the ETP at Coppell High School has quickly become a showcase of secondary engineering education in North Texas, preparing students for careers in the 21st century. To maintain this level of rigor and relevance, it is important to continue to develop the programs providing a seamless transition for our students into competitive universities across the nation. Therefore, to continue the success of the program Coppell High School is requesting \$35,000.00 from Coppell Education Development Corporation.

The innovative engineering curriculum has been developed with the assistance of engineering professors from Texas Christian University (TCU) to provide exposure to new engineering technologies while expanding problem solving skills. In this partnership, CHS has developed the Coppell School of Engineering. Through this coherent sequence of courses students develop a strong engineering foundation while building on existing knowledge and skills in math and science. A perfect example is the new Suborbital Aerospace Studies course for fall of 2007. This is a combined Engineering/Physics course where students, through approval from NASA, will design, build, test and launch a real rocket. In the first year, students will launch a 25' rocket to

an altitude of 1 mile. Within three years, the program will be working to launch a 30' rocket to an altitude of 100,000 feet. The ETP project based curriculum is designed to emulate the working environment to develop communication, management and thinking skills.

II. Description of Proposal & Nature of Request

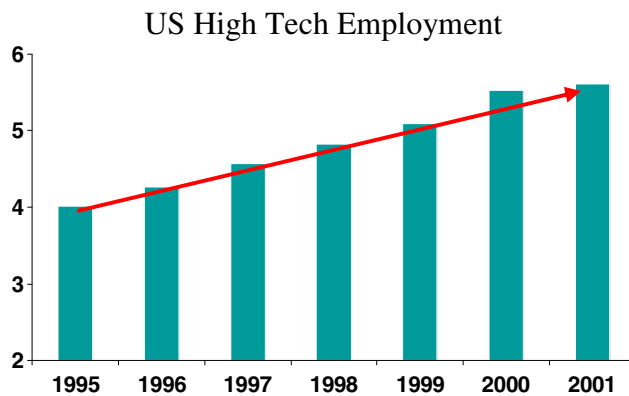
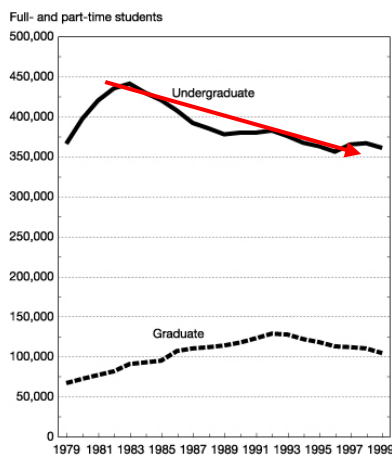
As the world and economy move into the 21st Century, students must be ready to embrace the changes. The need for engineers has never been greater, with the demand steadily increasing while the number of engineers graduating from US colleges is dropping. There are approximately 12 million people in the US with an engineering/science degree. All of these people say their degree is paramount to their job, yet only 1/3 of these people actually work in engineering/science fields. Engineers can be found in almost any field of work, law, medicine, business, you name it.

Coppell High School continues to prepare students to meet these demands. With in two years we have taken a common technology education cluster of courses and created a showcase in engineering education. The key separating CHS from the rest is the understanding that engineers do not work in isolation. To be a successful engineer a person must have strong math, science, communication, and problem solving skills.

Work has already begun on the CHS School of Engineering program with the support and cooperation of Texas Christian University. The TCU Department of Engineering and the Department of Education are currently assisting CHS with curriculum and mentoring opportunities. Students will have the opportunity to work with university engineering programs on projects such as the new Suborbital Aerospace Studies course beginning in the fall of 2007. TCU is using the program being developed

at CHS as a model for other school districts in the North Texas area. As one professor stated, “the program at CHS is on the leading edge of where high school engineering programs need to be.”

There is a growing need for engineering students. Technical innovation has fueled the growth in demand for engineers. Unfortunately, there are not enough new engineers coming out of the universities to fill these new jobs.



Likelihood that a High School graduate obtains an engineering degree

- All Students: 2.1%
- Women: 0.9%
- Minorities: 0.8%

Some of the problems:

- Lack of preparation
- Lack of exposure
- Lack of interest
- Relevance of engineering not clear

According to a Congressional study Conducted by the Committee on Prospering in the Global Economy of the 21st Century, “It is the unanimous view of our committee that America today faces a serious and intensifying challenge with regard to its future competitiveness and standard of living. Further, we appear to be on a losing path.” They

went on to say, “Because other nations have, and probably will continue to have, the competitive advantage of a low wage structure, the United States must compete by optimizing its knowledge-based resources, particularly in science and technology...”

Students need to be exposed to engineering and how math and science impact their lives well before college. Programs are needed to provide more quality engineering students to university programs. Furthermore, these students need to be able to work in the rapidly changing environment of a shrinking world economy. Engineers do not simply sit at a desk and work alone. They must be able to communicate effectively with both clients and co-workers around the world.

An important aspect of U.S. efforts to maintain and improve economic competitiveness is the existence of a capable scientific and technological workforce. A January 2004 report of the National Science Foundation (NSF), *Science and Engineering Indicators 2004*, states that between the years 2000 and 2010, employment in science and engineering fields will increase at more than three times the rate for all other occupations. In addition, approximately 86% of the increase in science and engineering will be in computer-related positions. Simultaneous with predictions of the future scientific workforce is data reporting a decline in the number of students seeking degrees in certain fields. While 33% of the undergraduate degrees awarded are in science and engineering, the portion of degrees earned in the physical sciences, mathematics, computer science, and engineering has been static or declining. Disciplines that have witnessed an increase in degrees earned have been primarily psychology and the biological sciences. There is growing concern by many in the scientific community, industry, research-driven federal agencies, and Congress about the production of the nation’s science and engineering

personnel. ([CRS Report for Congress: Science and Technology Policy: Issues for the 108th Congress, 2nd Session; September 2004](#))

In a recent report released by Education Week, Texas students will face serious economic and workforce hurdles throughout their lives and will have a less-than-average chance for success. (Appendix A)

The mission of the School of Engineering at Coppell High School is to expose students to the engineering profession and prepare interested students to be successful in engineering studies beyond high school. Students will have the opportunity to employ the engineering design process through numerous short-term and long-term design projects and to acquire a skill set that is usually not developed until the junior or senior year of college. These skills include:

- advanced implementation of Microsoft Word and Excel
- communication skills (written and oral)
- familiarity with and ability to use standard scientific and engineering instrumentation
- principles of data acquisition, analysis, and evaluation
- programming logic and principles of computer programming
- mathematical modeling of engineering systems
- familiarity with
 - engineering ethics
 - engineering economics and business principles

The CHS School of Engineering will offer several opportunities to meet the needs of the students. Courses and activities are directed at encouraging participation not only

in engineering, but also math and science. Programs will be aimed at students from elementary through high school. Examples include:

- A rigorous 4-year Pre-College engineering program at Coppell High School, designed to provide a strong educational foundation
- A second, shorter engineering pathway for students not sure about engineering or have decided to pursue an engineering education later in their high school career
- Summer camps for students to enrich their studies in a particular area or activity
- Mentoring programs between high school engineering students and students in lower grade levels
- Activities and lessons for Elementary and Middle School teachers that bridge the gaps between math, science, and technology.

The CHS School of Engineering will focus on 3 main goals throughout the program to meet the challenges facing students:

- Increasing the number of students successfully pursuing engineering and technical degrees in college
- Increasing the number of women and minority students participating in the CHS School of Engineering
- Increasing the communication skills of students through participation in the CHS School of Engineering

Engineering Courses:

Introduction to Engineering (1 year)

Students will learn how to apply the engineering design process as they work in small groups on multiple short-term design problems and one long-term project. Students will learn drawing and visualization techniques as well as communication, both written and verbal.

Data Acquisition & Analysis (1 year)

Techniques for acquiring a variety of engineering data will be investigated along with ways to analyze the data and draw conclusions as to the quality of the data, relationships between variables, and the methods used for data acquisition. Students will become familiar with standard scientific and engineering instrumentation and will work in the context of engineering design problems in disciplines such as mechanical, electrical, civil, materials, and biomedical engineering.

Pre-AP Chemistry (concurrent)

Students will be concurrently enrolled in Pre-AP Chemistry. This concurrent course is specifically tailored to correspond with Data Acquisition & Analysis. Students will not only cover the base Pre-AP Chemistry curriculum, but they will spend time learning about material science.

Engineering Systems (1 year)

Students will engage in projects that will demonstrate the integration of different systems. Students will have to opportunity to work with the Texas Christian University Engineering Department on various projects.

Suborbital Aerospace Studies (concurrent)

In this class, students will design, test, build and launch a suborbital rocket every year. In the first year of the program, the rocket will be approximately 25 feet in length and will fly to an altitude of 1 mile carrying a 1 pound payload. Eventually, the rocket will fly to an altitude of 100,000 feet.

AP Physics B / AP Physics C (concurrent)

Students will work on the curriculum for the College Board's AP Physics program.

During the course, students will also design, test, build, and operate at full size solar car.

The car will be entered in the Dell-Winston Solar Car Competition each summer.

Engineering Design & Entrepreneurship (1 year)

Engineering Design & Entrepreneurship is designed as a capstone course, providing students with the opportunity to apply what they have learned in the context of a long-term engineering design project. Principles of business and economics pertinent to the engineering profession will be taught and incorporated into the design project.

LEGO Engineering (1/2 year)

The first semester of the course will be populated entirely of female students. The goal of this type of scheduling is to encourage more women to take engineering courses.

Students will explore team work, problem solving, programming, and design through a series of activities. The course utilizes the LEGO Mindstorms NXT Robotic kit.

III. Detailed Budget

Detailed Description of Items Needed for CHS Engineering Technologies Pathway CEDC Grant Proposal	#	Cost	Extended Cost
Sherline 4000A Lathe Package	4	\$675	\$2700
Sherline 500A Mill Package	4	\$950	\$3800
Mill and lathe accessories	4	\$500	\$2000
Innovation First Vex Robotics Kits	1	\$375	\$375

Innovation First Vex Parts	1	\$2691	\$2691
First Vex Registration/Entry fees	2	\$475	\$950
Vernier SenorDAQ Deluxe package	6	\$865	\$5190
Labview 8.1 Student Edition	10	\$80	\$800
Vernier Sensors	6	\$711	\$4266
Digital Video Camera	1	\$500	\$500
Tools	1	\$2563	\$2563
Digital Camera	1	\$700	\$700
SolidWorks Network License & Training	1	\$3800	\$3800
Lego Books	1	\$150	\$150
Industrial Stock Truck	1	\$212	\$212
Lego Engineering II Class Kit	1	\$3595	\$3595
Lego Resource Kit	12	\$59	\$708

\$35,000

IV. Project Measurements and Evaluation

In two years CHS has developed a showcase for engineering education, attracting school districts from across the region. CHS Career and Technology Education (CTE) department with CEDC funds will continue to support new and existing courses in three CTE labs, as we strengthen the programs for greater student success. Students ranging from freshmen to senior grade levels are eligible to take these courses. Funding this grant will provide a direct impact on as many as twenty-one classes of up to 24 students each enrolled in Infinity Project, Technology Systems, Electricity/Electronics, Cowboy Tech Force, Introduction to Engineering, Data Acquisition & Analysis, Suborbital Aerospace

Studies and Engineering Systems, with the potential of reaching 504 students. This provides a 1:5.85 ratio of students served versus total student body of 2,950. The projected cost per student served by the Engineering Technologies Pathway grant will be \$69 if the expenditures are incurred over only the first year of implementation. However, it is more realistic to average the program expenses over a three year period considering **yearly consumable expenses of \$3,550** which brings the cost per student served to just over \$27.50.

On-going evaluation will be critical to ensure pathway effectiveness and facilitate improvements in the Engineering Technologies Pathways program. End-of-year evaluations developed by TEA and Infinity Project, as well as post-graduation follow-up evaluations will be given to instructors and program participants to critique the following:

- Effectiveness of the ETP program to increase students' interest in pursuing engineering or other technology-related studies at the post-secondary level and as a career choice
- Effectiveness in achieving the TEKS established by TEA in all classes in the Engineering Technologies Pathways program
- Effectiveness of course curriculum, activities, and assessments in meeting the educational goals set forth for the students
- Effectiveness of the resources provided for the courses, including, but not limited to: Sherline equipment, robotics kits, data collection instruments, engineering competitions.

Information will be gathered and evaluated by the Career and Technology Advisory Committee. The Coppell ISD Career and Technology Advisory Committee is a

group of community professionals in careers related to CHS career pathways. Recommendations will be documented regarding career focus, curriculum, course content, course management, and resources. Strategies for program expansion, development and improvement will be based on the recommendations of the advisory committee.