

**Computer Aided Design (CAD),
Computer Numeric Control (CNC),
and Machine Shop Programs
Viability Review Study**

Final Report and Recommendations

Los Angeles Pierce College

**Presented to the Faculty Senate by the
CAD, CNC & Machine Shop
Viability Review Committee**

Thursday, August 26, 2010

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Executive Summary:

The CAD, CNC, & Machine Shop Viability Review Committee was convened in March 2008 to review factors impacting the success of these programs. Of the typical possible outcomes, it is the collective opinion of this committee that the existing programs be modified and improved to reflect anticipated employment and technology trends. The justifications for these recommendations are contained in the body of this report and we believe that they significantly support our recommendations. The committee identified several areas where changes and enhancements are recommended. These are summarized briefly here in bullet-point format and are detailed in the body of the report. They include:

- Staffing
 - Add two full-time faculty positions with broad-reaching skills
 - Hire part-time faculty to teach specialty courses that will enhance the program
 - Hire an Instructional Assistant or Instructional Assistant IT (preferred) to provide Lab and Technical support to the department
- Curriculum
 - Modernize and insure that all cert/degree program requirements are viable
 - Create cross-discipline paths between pre-engineering and automotive programs
 - Modify certificate programs to create a single foundational certificate that act as the starting point for multiple specialty certificate paths that meet industry needs
 - Make changes to degree programs and coordinate articulation and transfer options
 - Pursue sustainable manufacturing and green technologies
- Infrastructure
 - CAD lab needs immediate replacement of computers
 - The CNC and Machine Shops require upgrades, maintenance, or modernization
- The department needs to create strategic partnerships to build program enrollments
 - Project Lead the Way (PLTW)
 - Outreach courses and Industrial Technology Days
 - Commerce and Industry
 - Transfer Institutions
 - Possible joint ventures with manufacturers and software vendors
- Marketing
 - Develop communications targeting prospective students
 - Work with surrounding high schools and industries to create synergy
 - Build and maintain interactive website featuring desirable technologies and make sure surrounding schools and businesses know about the website
- Finances
 - Multiple funding sources need to be explored, including grant opportunities
 - Create collaborations with industries as potential funding sources
- Program sustainability
 - These technologies change rapidly so faculty have significant needs for ongoing professional development
 - The variety of technologies will require the campus to allocate sufficient hourly allocations to the department to build and maintain a robust program

- Campus-wide initiatives
 - Work with counseling to insure knowledge of these programs
 - Create synergy between academic and vocation programs
 - Improve integration of basic skills
 - Career and Technical Education Dean to manage and monitor departmental progress and implementation of recommendations as appropriate

The body of this report will describe the processes and justifications which have led us to the recommendations shown above. This will include committee formation, the information gathering process, a review of the existing programs, and the details of the recommendations outlined above.

In summary, in order to insure the future success of the CAD, CNC, & Machine Shop programs, this committee is recommending an integrated, holistic effort to provide programs that will create highly skilled students who will be ready to meet the needs and demands of the surrounding industries.

Dedication in Memory of Dr. Sharon Levick:

This report is dedicated to Dr. Sharon Levick, one of the original members of this task force who sadly is not with us to see the improvements she helped create. This past July, Sharon passed away too soon and words cannot adequately describe the void left in our hearts. Sharon was vital to this process, setting an unmatched level of hard work that was not surprising to those that knew her.

Sharon Levick was a force of nature on campus, giving herself entirely to every task that was presented. In addition to serving as a faculty member, Curriculum Committee Chair and Accreditation Coordinator, Sharon found time somewhere to be a part of our team. Her guidance was invaluable and irreplaceable.

Sharon's contributions are seen in every part of Pierce; in every classroom, committee, and building on campus. It is going to be difficult to find many reports that Sharon did not have a part in, including this one.

Sharon was an Economics professor that cared about Pierce so much that she gave her time to this task of improving the CAD/CNC program on campus. This dedication is testimony to her legacy at Pierce, that hard work endures and can improve the lives of all around you. The profound loss we feel reminds us of this every day. Luckily, the results of her excellent, sincere contributions to this campus, and all of the people she touched, will long outlive the sadness we feel about losing her.

Committee Formation and Methodology:

The committee was formed at the request of the Academic Senate as a result of concerns over enrollments, curriculum relevancy, appropriate infrastructure, and related issues. The first meeting of the committee was held in March of 2008.

Committee membership:

Initially the committee was comprised of the members shown below in accordance with Senate guidelines for viability review committees. Please note that the committee membership changed as a result of staffing changes. Changes are shown in parenthesis.

- Academic Senate President: - Tom Rosdahl
- Two Educational Planning Committee members
 - Mark Pracher
 - Brian Walsh
- Two Department Chairs selected by the APC
 - Jill Connelly
 - Barbara Anderson (Tom Fortune replaced Barbara, who became a Dean)
- The Curriculum Committee Chair - Sharon Levick
- Two AFT representatives
 - David Schamus (elected unanimously to chair this committee)
 - Mitra Hoshiar
- A designee of the VP of Academic Affairs - “JR” Jacquinita Rose, Dean of Academic Affairs
- One Academic Dean: - Paul Whalen (replaced by Jose-Luis Fernandez)

Methodology:

The committee used a combination of data gathering processes, reporting, and discussions to analyze the current status of the Industrial Technologies department and create recommendations accordingly. Sources of information reviewed included:

- Reports from Economic Modeling Specialists, Inc. (EMSI) which integrates data from a variety of sources and gathers data which provided the depth and specialization used in this report.
- The California State University of Northridge (CSUN) San Fernando Valley Economic Report
- Reports from the Los Angeles Economic Development Corporation (LAEDCO)
- Interviews and discussions with Ron Smetzer, the former Chair of the Industrial Technology Department
- Interviews and discussions with four Adjunct faculty in the Industrial Technology (IndTech) Department who have current, full-time experience in local, related industries

- Reviews of programs offered by other institutions of higher education
- Review of the local high school environment for IndTech programs

The committee reviewed projected job trends, the current curriculum, enrollments, emerging trends in the disciplines, and a variety of related factors as part of its review. Additionally, input was solicited from the impacted department’s faculty (both full time and adjuncts), a student survey, and information from advisory meetings. The Academic Senate specifies the purpose, methodology, and outcomes that are typical for Viability Reviews (Pierce College Viability Review of Educational Programs – Adopted April 25, 2005 by the Academic Senate).

Review of Existing Programs:

In this section, factors such as previous enrollments, staffing, equipment, curriculum, degree offerings, certificate offerings, and marketing of the existing programs will be reviewed. Brief comments regarding recommendations may be included, but the details of the recommendations will follow later in this document.

Enrollments:

Low and wavering enrollments were one of the factors that served as a catalyst for the formation of this review. A total of seventeen courses covering the disciplines of Mechanical Computer Assisted Drafting (CAD), Computer Numeric Control (CNC), and Machining were evaluated. The date range for evaluation ranged from the Fall 2003 term to the Fall 2007 term, inclusive. In a typical semester, one or two of the seventeen courses were not offered. During the evaluated period, the 15 to 16 courses produced total enrollments ranging from 65 to 133. It should be noted that several of these courses were offered on a “combined” basis, where multiple courses were led by the same faculty member at the same time. The total enrollments are represented in the chart below and represent all courses in Industrial Tech (IndTech) except automotive and electronics.

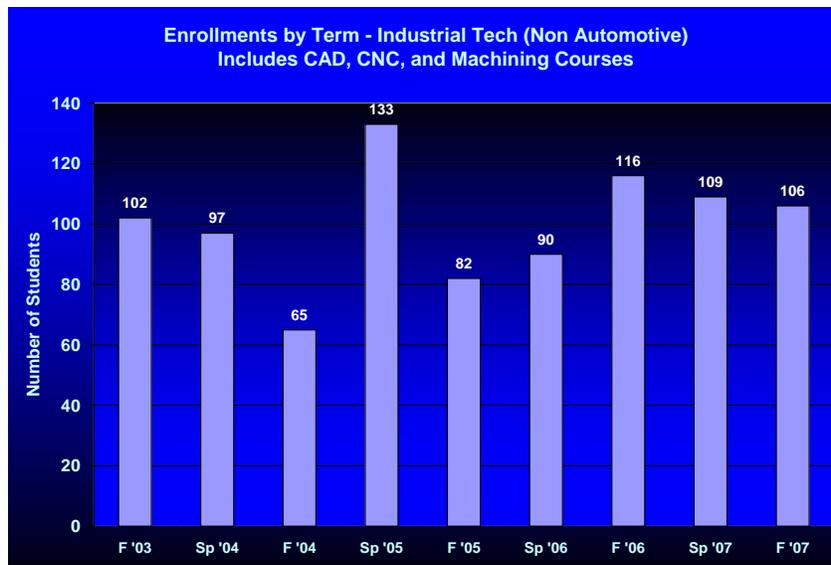


Figure 1: Industrial Tech Enrollment History

Even with the courses being offered under combined tickets, enrollments per combination ticket during the evaluated period averaged only 22 students. Additionally, enrollments on a per section basis ranged from a minimum enrollment of a single student, to a maximum enrollment of up to 19 students. Median enrollments on a per section basis ranged from three to 6.5 students per section and averages ranged from 4.33 to 6.81 students per section (see chart below). The sustainability of courses with enrollments of this nature is certainly of concern to both the Academic Senate and this committee and the bulk of our recommendations address mechanisms for creating a more viable Industrial Technology (IndTech) program.

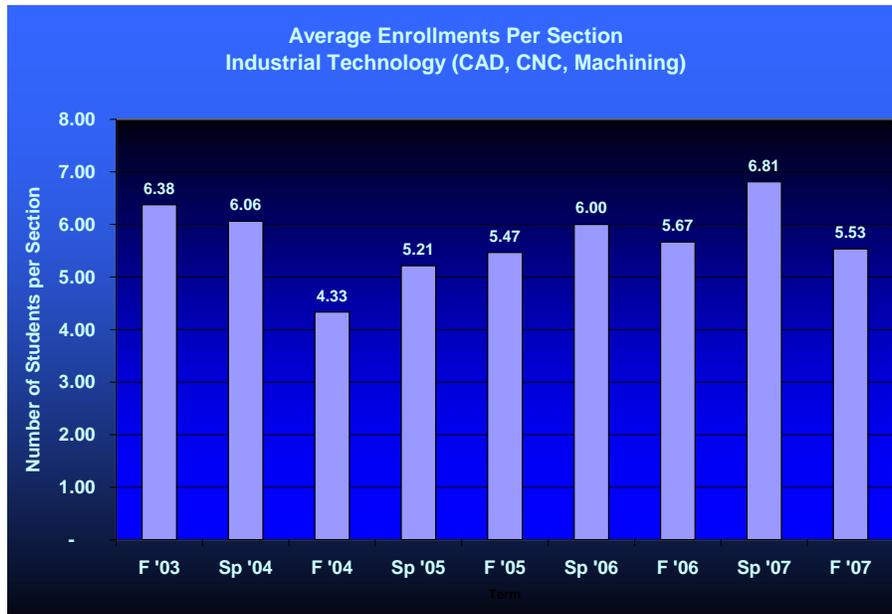


Figure 2: Average number of students per section

The committee believes that there are a number of factors that are contributing to the low enrollments described above. These may include the following:

- No full-time faculty member dedicated to Industrial Technology programs
- A need for enhancing marketing and outreach to draw potential students
- Curriculum that needs updating
- Facilities that need updating
- Other factors to be noted later in this document

Staffing:

Faculty: During the review period, industrial technology programs (CAD, CNC, and Machine Shop) lacked a full-time faculty member (not including automotive and electronics). All courses were taught either by adjuncts, or by a faculty member who had significant re-assign time. Prior to this review, Larry Humphry was the last full-time faculty member in IndTech, and he passed away several years ago. It was also noted that historically, there were times when the program was staffed with three full time faculty members.

Prior to his death, Larry had apparently predicted that the IndTech programs would die when he did. And, while our faculty has successfully prevented the program from dying and some of our adjuncts have breathed new life into the programs, it is clear that more needs to be done. This committee will recommend the hiring of full-time faculty members who will be tasked both with teaching and program development.

Support: At present, a 20-hour (dropped from 30 hour) Instructional Aide is assigned to the IndTech programs. It is the recommendation (detailed later in this document) that instructional assistance for this program be increased.

Equipment:

Equipment for the Industrial Technology programs covered in this review included personal computers (PCs) for CAD and related courses, machine shop equipment, and CNC equipment. Each of these will be reviewed.

Personal Computers: Computer Aided Drafting (CAD) is a resource-intensive computer operation that requires fast processors (CPUs), large amounts of random access memory (RAM), high-speed, 3D video capabilities, large monitors (perhaps even dual screen workstations), and large amounts of file storage space. As an indicator of how old the computers are in the lab, funds were being sought to add USB slots (can you imagine a PC so old it does not have USB slots?) as a replacement (or supplement) to floppy disks. Most CAD files are too large for students to save their work on a floppy. This committee will recommend the immediate replacement of the lab PCs with modern systems and monitors that have a higher specification than a standard PC on this campus. This supersedes an earlier suggestion that the computers be incrementally upgraded. This recommendation is being abandoned as being neither cost effective, nor pedagogically sound.

Software: An additional problem deals with the specific software being used on these PCs. At the time of the evaluation, the lab was still using AutoCAD 2002 even though AutoCAD 2007 was already commercially available and in use in the surrounding CAD community. A 2009 version is also expected. As a general rule, software (and the required hardware) should probably be implemented in our labs within one year of commercial availability.

CNC and Machine Shop Equipment: Equipment ranges in age from 4 to 11 years of age or more (3-10 at the time of initial review). In March of 2008, Ron Smetzer (at the time, chair of the department) anticipated that new equipment would be needed in about 5 years (as of the 2008 review). However, he also acknowledged that some of our existing equipment did not integrate drafting, computing, and manufacturing functions well and may need immediate upgrade or replacement. That lack of integration realistically produces a more immediate need to evaluate the existing CNC and Machining equipment and the creation of recommendations for new (or used) equipment. With HAAS (located in Oxnard) being one of the key manufacturers of this type of equipment, it is hoped that Pierce will develop a strategic relationship with this vendor as a source for expanding our functionality.

Marketing:

The committee would like to recognize the efforts of some of the adjunct faculty who have been involved in ad-hoc tasks to reach out to local high schools students and make them aware of both the job opportunities in industrial technologies and the programs that Pierce offers to help

prepare students for those opportunities. While their efforts are greatly appreciated, they were not supported by a structured, campus-driven plan for reaching out to potential students.

With the removal of many career and technical programs (various “shop” courses, etc) from many of the local high schools in this area, the lack of an integrated marketing and outreach strategy is seen as one of the critical factors that has impacted our program enrollments negatively. Without input from industrial technology teachers in the high school, students are often unaware of our programs. At the same time, private, expensive, career training organizations advertise in a variety of mediums that give them an advantage in student recruitment. Hence, our recommendations section will have several points regarding cost-effective ways to bolster student recruitment.

Curriculum, Degree, and Certificate Programs:

Areas of concerns addressed by the committee included the need to modernize the curriculum, creation of more modular certificate programs, integrating other disciplines with IndTech, Articulation agreements (particularly block articulation agreements) and other factors. This section reviews the current programs in these areas

Degree Programs: The Industrial Tech department (excluding automotive and electronics) offers Associates degrees in the following areas:

- Associate of Arts in Drafting – Mechanical
- Associate of Science in Numeric Control Programming

Certificates (both Pierce Departmental and State Approved): The offerings include:

- Basic Drafting – Mechanical
- Advanced Drafting – Mechanical
- Numeric Control Programming
- Machine Shop Technology
- CNC Operator
- CNC Programming

Some of the issues discovered during the review of these programs include:

- A lack of integration between industrial tech programs, automotive, and pre-engineering programs
- The Associates in Drafting – Mechanical does not accurately reflect, in its name, the fact that computer drafting is the focus of the program. Additionally, there are eight Mechanical Computer-Assisted Drafting courses (I to VIII), and, while these courses can be taken concurrently, if taken consecutively, a minimum of four years would be required to complete them. Additionally course titles should include a more descriptive name that gives indications as to the subjects covered.
- No “Green” or Sustainable Technology courses or certificates are offered.
- There are no courses in Quality Assurance (as recommended by the adjunct faculty)
- There are no courses in robotics or metallurgy

- Industrial Technology does not have a campus departmental webpage for guiding students in degree and certificate programs.
- Outreach and Project Lead the Way programs are not well implemented
- Articulation agreements, and in particular program block articulation agreements need to be either updated or created to generate synergy with 4-year and other institutions.

It is the belief of the committee that the issues above are contributing to the low enrollments documented above. Some of these issues can also be attributed to the fact that during, and prior to this review, the program lacked full-time faculty, and as a result suffered from a lack of maintenance and updating that would be a normal part of AAPP reviews.

Analysis of Employment Trends:

Pierce College is located geographically in an industrial-technology rich environment. As a result, it is ideally situated to service the needs of the manufacturing, aerospace, and small machine shops in the surrounding areas. Educational competition comes mostly from private, expensive career institutes, the West Valley Occupation Center, and from LA Trade Tech (a geographically distant competitor). This section addresses job opportunities that are expected in our community and LA County. Two factors shown below are described; one is a small but steady growth in the total number of jobs in these disciplines, and the other, and more significant, is the total number of expected **job openings** in these disciplines attributable to expected attrition.

Expected Job Trends:

The basic trend for employment for our students is positive. The employment projections referenced below are current as of March 2008 and come from Economic Modeling Specialists, Inc (EMSI), which provides integrated economic and labor market data about regional economies for assessment and planning purposes. This enables college, workforce, and economic development professionals to effectively work together for workforce development educational planning. The data below come from an amalgamation of sources: industry projections, state employment development agencies, and federal labor and industry analyses and are intended to maximize educational program impact through labor market responsiveness.

Pierce, as a community college, plays a unique role within regional economies, because we have the challenge and responsibility of meeting a large portion of the San Fernando Valley and Los Angeles County's human capital development demands. In today's fast-paced, competitive, global economy, these advanced skills and training are the fuel that drives a successful economy by preparing students for in-demand jobs. Armed with the right data, Pierce can ensure that its programs are meeting the demands of the ever-changing economy and are placing students in high-wage, high-growth jobs for tomorrow.

We specifically looked for ten year employment projections in three major areas (production, engineering, and installation/maintenance) in Los Angeles County and in Pierce's surrounding zip codes. Information in the EMSI reports shows both projected new jobs and the projected number of jobs that will be open due to current employees leaving the existing workforce (promotion, retirement, changing major employment interest, downsizing, quitting, death, illness, etc.). Each of the three major areas includes numerous specific job titles.

Production Job Trends:

For the ten year period 2008 to 2017, employment projections for Los Angeles County in **production jobs** shows that there will be a **net increase of 7%** or 9,450 jobs in 40 occupations from first line supervisors to aircraft assemblers, structural metal fabricators, team assemblers, CNC machine tool operators, CNC programmers, machine setters, machinists, model makers, welders, metal workers and 28 others.

More importantly, because of people leaving these occupations for a variety of reasons, there is a **need for 41,920 new and replacement employees**. This means that 29% of the workers in these fields in 2017 will be people not in the workforce in 2008. The number of new and replacement jobs in just the Pierce College area is even greater—31%.

Production Salary Ranges:

The 2007 median hourly wage was \$16.31, and ranges from \$8.76 (hand cutters and trimmers) to \$83.11 (timing device assemblers, adjusters, and calibrators).

Engineering Job Trends:

For the ten year period 2008 to 2017, employment projections for Los Angeles County in **engineering jobs** shows that there will be **an increase of 5,556 workers** or 7% over 2008 in 22 occupations including aerospace engineers, industrial engineers, materials engineers, mechanical engineers, architectural and civil drafters, electrical and electronics drafters, mechanical drafters, and technicians in a variety of specific fields. **As with production jobs, there will be a 26% increase in total employment or 19,151 new and replacement workers**, due to retirements and other reasons people leave the field. The increase in the engineering workforce for new and replacement workers in Pierce's service area is 39%.

Engineering Salary Ranges:

These fields had a median hourly wage of \$37.31 in 2007, and range from \$22.12 per hour (mechanical engineering technicians) to \$45.53 (engineers). All the technician fields require an AA degree.

Installation, Maintenance, and Repair Job Trends:

For the ten year period 2008 to 2017, employment projections for Los Angeles County in installation, maintenance, & repair jobs shows an increase from 136,475 workers in 2008 to 151,477 workers projected in 2017. This is an 11% change for 31 occupations that includes first line supervisors, machine repairers, technicians, car and truck mechanics, millwrights, fabric menders, riggers, and 24 others. The number of new and replacement workers for occupations in this field in Pierce's service area is even greater—36%.

Salary Ranges for this Group:

The median hourly earnings for these occupations in 2007 was \$20.11 with a range of \$11.34 for equipment repairers to \$45.33 to power-line installers.

Job Trend Summary:

Quite clearly, in both the greater Los Angeles County area and Pierce's service area, jobs in these three major areas will be plentiful. More significant than the increase in total employment in these areas (about 7% over the 10 year period) is the 30%+ increase in each area for both new

and replacement workers. A large portion of the existing workforce in these three areas will be leaving their jobs and creating tremendous opportunity for employment in jobs that are high-tech, high-growth, and high-wage. It is incumbent upon Pierce to provide effective programs for students and enable them to become successful in these fields.

Recommendations:

General Recommendations:

As discussed earlier, viability review committees tend to produce one of four typical recommendations. The committee is in unanimous agreement that program enhancement is the best, and only, choice. The job trend data, the makeup of the surrounding business community, and the infrastructure that is already in place at Pierce essentially necessitate that our Industrial Technology programs be enhanced and improved to support the needs of our students and the surrounding business environment.

The recommendations that this committee makes are driven by the information discovered during the review of our program and the review of the business data from EMSI. These recommendations broadly fall into the following four categories:

- **Academic Recommendations:** This section will address degree, certification, course offerings, and curriculum changes that would be beneficial to the program
- **Recommendations to Support the Program Infrastructure:** This section will address recommendations for equipment upgrades and acquisition, staffing, possible organizational changes on the campus, and suggestions for additional funding sources
- **Marketing Recommendations:** Success of the program will rely on insuring that both potential students and potential employers are familiar with, or are supporting the programs
- **Collaborative Opportunities:** This section will address ways in which Pierce can create synergy between vendors, employers, high schools, grant offerings, and programs like Project Lead the Way.

Academic Recommendations:

Academic recommendations fall into a combination of categories that include integrating our programs with Project Lead the Way, updating courses (including course name changes), adding courses, and modifying certificate and degree programs to reflect current trends in the industry.

Project Lead the Way (PLTW):

Project Lead the Way is a non-profit organization that works extensively with High Schools and Middle Schools to create engaging programs in the fields of Engineering and Bio Sciences. The recommendation of this committee is that Pierce work closely with PLTW and the surrounding schools to create a student base that would grow into Pierce IndTech programs and Pre-Engineering programs. Because many schools have dropped their “shop” programs, Pierce could potentially offer its infrastructure to help support programs for the surrounding schools. This has a couple of key benefits:

- It produces a student base that has had exposure both to engaging learning opportunities via PLTW and to the viability of Pierce College as the next logical pathway for the student to pursue further education, a degree, or a certification
- It gives opportunities to High Schools students, to broaden their learning opportunities in the fields of pre-engineering and industrial technologies such as CAD, CNC, Machining, and other sub-disciplines.

Degree Programs:

The primary recommendations of the committee with regards to degree programs fall into a couple of areas that include:

- Creating articulation, and particularly, block articulation agreements with four-year institutions. Emphasis would be on
 - Pre-engineering
 - Mechanical Engineering
 - Industrial Technologies
 - Sustainable, and or Green Technologies
- Updating Course Outlines of Record (CORs) to reflect new technologies and to change course names (where appropriate) to more accurately (and perhaps enticingly) describe courses. As an example, Mechanical
- Where possible create certificate programs that would act as a springboard towards attaining an Associates degree (or transfer)

Certificate Programs:

The primary recommendation regarding certificate programs was a restructuring that would create a “base” certificate that included, perhaps, four overview courses of sub disciplines within Industrial Technology. These “might” include a basic machine shop course, a beginning CAD course, and introduction to principles of engineering, and a CNC course.

This core, or base Industrial Technology Certificate would then serve as the foundation for advancement to more advanced certificate programs that are sub-discipline specific, and or be used as foundation courses for the Associates Degree program(s).

Additionally, Certificate programs in Sustainable and Green Technologies should be investigated. With more than 400 acres of land, Pierce is one of the few colleges in the state that has the real estate needed to support some of these programs. Options include

- Electric wind generation maintenance and repair certification
- Solar Panel installation and maintenance programs
- Eco-friendly Building Management Systems

- Although discussed outside of the scope of this committee, implementing a program similar to the E7 Studio program that covers cross-discipline internships in that include Industrial technologies, Computer Science, and Pre-engineering options.

Courses and Curriculum:

The following recommendations were made with respect to courses in the Industrial Technologies programs

- Update all out-of-date Course Outlines of Record (CORs)
- Consider course name changes to more accurately reflect course content and provide marketing appeal to the course and insure that catalog and schedule descriptions include up to date technologies.
- Add courses in
 - Metallurgy
 - Quality Assurance and Control (recommended by Adjunct faculty)
 - More robotics offerings
 - Industrial Technology specific Math courses (like those in Auto)
 - Computer Integrated Manufacturing (note that integrating the CAD lab with the CNC lab was an earlier notation in the analysis section)

Program Infrastructure Recommendations:

This section will address equipment and staffing needed to provide appropriate support for these programs.

Faculty and Staff:

The committee is making the following recommendations regarding staffing. Some of the recommendations were provided during a preliminary report to the Faculty Senate and some of those recommendations were addressed by the Faculty Position Prioritization Committee (FPPC) in 2009. As a result, initial interviews were recently conducted for one of the positions.

- Two full time faculty positions. One of these positions was awarded a 1st priority position (tie) by the FPPC in 2009. The second position is recommended as the program expands. One of these positions would be tasked heavily with program development and marketing of the new programs
- Adjunct faculty as needed to cover any new specialty courses recommended in the Academic Recommendations section of this report
- Additional Instructional Assistant IT support. Since the CAD/CNC lab incorporates a computer lab, support for this environment is sorely needed. At present there is an Instructional Assistant for 20 hours. We recommend that this become the equivalent of 1 FTE (potentially spread between two part-time assistants). However the IA needs to have the IT designation to support the computer lab.

Equipment:

There are two key areas where the committee is recommending changes or upgrades to the equipment. The first, and most critical is the computer lab used for CAD (Drafting), and the second is enhancements to CNC and Machine Shop equipment.

Computer Lab:

Our review of equipment occurred in April of 2008. At that time, machines were already approximately 5-10 years old (or more), lacked RAM, CPU power, and significant video display technology (old, CRT monitors were in use). The version of the CAD software was a 2002 version and even at that time, a 2007 version was in production, and a 2009 version was anticipated. It is the recommendation of the committee to do the following:

- Replace all lab computers immediately
- Systems should be selected that exceed the default PC configuration in the areas of RAM, Video processing, and CPU power. As a minimum, Core 2 Duo machines with 4GB RAM (expandable to 8 GB without replacing chips), 1GB Video adapters, and large hard drives are recommended. This recommendation should be re-evaluated at the time of purchase to see if newer technologies and specifications are appropriate. Hard drives should be at least 7200 RPM in speed.
- Systems should be converted to flat panel displays, and the option for dual monitor displays should be evaluated as a possible option. Monitor sizes should be increased to at least 19" as a minimum, with consideration for 22" or larger (depending upon pricing) Video components should be HDMI compatible where feasible with a minimum of DVI if HDMI is not feasible.
- CAD software should be upgraded to support the most currently used CAD software found predominantly in the industry. An upgrade or support contract for the software should be investigated to allow us to use current software.

CNC and Machine Shop:

At the time of this writing, the CNC shop equipment ranges in age from 6 to 13 years of ages. While it was described as "isn't the best, but isn't the worst either" at the time of review (April 2008). Since no upgrades or new gear have been added since this assessment, nearly two years of technological advances, and wear and tear should be added to that assessment. Additionally, the equipment needs better integration between the CAD computers and the CNC equipment.

- The CNC machines need to be integrated with PCs. The current lab PCs do not communicate because they are so old that they lack USB ports needed for this process.
- Ron Smetzer anticipates that the Big Bore machines may need replacing within the next 3 to 4 years. These machines have price ranges of \$45,000 to \$85,000 so a search for funding sources should be started immediately.
- One of the academic goals established in this report is to provide better integration between drafting (CAD) and production. At present the PC and CNC labs essentially provide a division between design and manufacturing, and between drafting and

machining. The committee recommends that any and all new acquisitions be reviewed to insure that the goal of integrating these disciplines is facilitated by the infrastructure.

- A Coordinate Measuring Machine is recommended. These machines are more commonly used today than manually measuring with micrometers. Acceptable used machines could be purchase for about \$15,000 according to Ron Smetzer. Again, funding sources need to be reviewed and the total cost of ownership of a new machine versus a used machine should be evaluated.
- Finally, the Industrial Technology buildings are currently not scheduled in bond renovation projects. Pursuing grant or other funding sources to renovate the facilities and equipment is recommended. The National Science Foundation, STEM, and other options should be reviewed.
- It is critical that the administration put fiscal and managerial support into the IndTech programs. It is the belief of this committee that rising employment demand will help increase the FTES count in these programs to help sustain them in the long run.

Haas is a leading manufacturer of CNC equipment and is located in Oxnard. Manufacturers sometimes engage in partnerships with educational sites to provide equipment and support. This may range from donations of equipment, and/or deep discounts. In some cases, creating partnerships would give the vendor opportunities to showcase both their equipment and their dedication to helping people become competent in their systems. These partnerships can often create great synergy for and between the manufacturer and the campus.

Organizational Change:

Pierce may want to consider the creation of a “Center for Engineering Technologies.” Potentially, the current STEM Director could manage this collaboration. The center would serve as an umbrella for a variety of functions that could include:

- The PLTW programs with the local high schools
- Contracted, and/or job-training programs
- Creating pathways for student success in the fields of CAD, Machining, Engineering, and other technologies
- Business/Industry-oriented workshops and seminars,
- Employer-based job exploration seminars for high school and college students,
- Short-term job training programs
- Product demonstrations (see recommendation on partnering with CNC equipment manufacturers
- Student competitions in the fields of Robotics, product design, and prototyping
- Other activities that stimulate student engagement in manufacturing, design, CAD, CNC and engineering.
- The Dean of Career and Technical Education should work with the faculty in the Industrial Technologies department to monitor progress created by the recommendations in this report. This should be supplemented by continued and additional participation of the Advisory Board for the department. Major goals should be reviewed annually, with program changes and enhancements reviewed each semester.

Funding Opportunities:

Obviously, this is a challenging time to recommend investing money in staffing, infrastructure, and program development. However, the research from EMSI that indicates significant job opportunities during the next several years warrants a serious and dedicated campus effort to fund IndTech programs. The initial development of funding sources for enhancing our IndTech programs should be a collaborative effort between the IndTech faculty, department chair, CATE Dean, and the campus Grant Writer/Director/Administrator. In addition to the campus general funding for operating costs and staffing, Pierce should pursue a variety of Grant possibilities to help fund new infrastructure, staff, faculty, and program marketing. Some possibilities may include:

- Work with the mayor's office to develop job training programs for their initiatives in clean and green technologies
- Develop business collaborations leading to CCC Industry-Driven Regional Collaborative grants (California Education Code Part 52, Section 88500)
- Develop partnerships with local high schools and apply for California Partnership Academy funding
- Apply for US Department of Education Title 5 and CCRAA (focus on Hispanic Serving Institutions [HIS] <http://www2.ed.gov/programs/hsiccraa/index.html>) - funding
- Develop partnerships to obtain funds from the US Department of Labor Community Based Job Training Program
- Apply for any HSI-STEM grant opportunities
- Apply to foundations and corporations that support engineering and IndTech programs
- Research and apply for opportunities under ARRA (American Recovery and Reinvestment Act)
- Work with CNC, machine shop equipment manufactures, and local industries to create collaborative programs where some infrastructure and program costs are offset by contributions from these entities

Allocating Instructional Hours:

As indicated previously in this report, we are recommending that new curriculum, courses, certificates, and programs be developed. All of this will require that some additional instructional hours be allocated to the IndTech programs. These allocations should be phased-in as the program develops and grows. Programs can be added incrementally based upon enrollment growth and this should be re-evaluated annually in the department's AAPP.

Marketing Recommendations:

Throughout this report we have alluded to the issue of marketing and the competition for Industrial Technology programs. For-profit organizations like ITT and Devry charge tens of thousands of dollars for degree programs in Industrial Technologies. They market extensively and expensively. Pierce has a unique advantage that its programs fall in the pricing range of all community college programs. Students complete these programs with little or no student loan expenses for tuition and the focus of the campus is student success, not recruitment. But it is the belief of the committee that a part of our enrollment problems can be attributed to the lack of a

coordinated, grass-roots marketing and recruitment problem. This was exacerbated by the fact that students touring our CAD lab would be horribly unimpressed by its out of date computers and aging software. Recommendations for marketing include:

- The department MUST develop and maintain an appealing and up to date web site that fully describes its programs. Options should include some fast-paced, visually appealing videos of our new (if you follow our recommendations) lab, the CNC gear in production, interviews with students, our successes in the Westec competitions, and more.
- We must develop a strong outreach program to the local high schools, most of whom have lost their “shop” courses. Creating some classes for high school students, an Industrial Tech Day, an interactive competition for students, etc are all options. In this regard, further development of the PLTW (Project Lead the Way) programs should be pursued.
- Build relationships with local employers at many levels
 - Create internship opportunities
 - Involvement in advisory roles
 - Support for our programs
 - Possible collaborations for new CNC and CAD equipment
- Develop marketing collateral (brochures, open-house events, job fairs) for distribution to high school students, government agencies, and engineering and machine oriented businesses
- Provide training to the counseling department so that they can accurately and enthusiastically guide students towards the proper program and course selections in the Industrial Technologies. At present, there have been many reports that some counselors are not fully aware of IndTech options, pre-engineering programs, transfer options, etc. However, the adjunct faculty specifically noted that Alyce Miller has done an excellent job of guiding Industrial Technology students. Perhaps the department and Alyce could work together to provide training to the other members of the Counseling Department.

Summary:

With the statistical data regarding job opportunities, the foundation of faculty and existing infrastructure, and the implementation of the enhancements recommended by this committee, it is the absolute belief of this committee that Pierce College has a unique opportunity to serve the community, its students, and local commerce by enhancing its Industrial Technology programs. While the state’s economic crisis might superficially suggest that this is not the time to spend money, wise investors know the simple adage of “buy low, and sell high.” Investing in programs during the downturns in the economy is perhaps one of the keys to creating the types of people who will become the producers of the future. We look forward to a great future for many Industrial Technology students.