FLUID POWER TECHNOLOGY
Needs Assessment

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EXECUTIVE SUMMARY

- This needs assessment was undertaken in order to review the compatibility of fluid power industry needs and Oakland Community College's educational responses to those needs.

- Enrollment and student headcount in Fluid Power Technology (ATF) have declined in the years 1981-1992. IPEDS data indicate that there were no graduates of the ATF degree program from 1987-91, and only one graduate of the certificate program during this time.

- OCC's Fluid Power program has not had an active advisory committee since 1986.

- Nation-wide, student demand for fluid power certificates and degrees is extremely low. Experts theorize that this is due to several reasons including: students not wanting to "get their hands dirty;" public perception of fluid power in relation to other programs such as Robotics and Electronics; elementary, middle and secondary schools hardly ever offering classes in or even discussing concepts of fluid power; and, finally, the lack of information coming from the fluid power industry to let people know that there are job opportunities in this field.

- The majority (82%) of employers surveyed either have no specific educational requirement or require only a high school diploma for entry level positions in fluid power.

- Industry experts stress that there is employment for those who possess fluid power skills. Nearly half (47%) of all local employers surveyed indicated that their need for employees skilled in fluid power is increasing.

- Salaries for employees in fluid power vary by position; full-time engineers earn the highest salaries with an average of $35,289, while technicians, salespeople and maintenance workers earn $20,688, $19,166 and $18,828 respectively. These three positions are the ones most likely to be filled by community college graduates.

- Most of the OCC students who have taken fluid power courses over the past year indicate being "very satisfied" with the quality of the faculty and instruction in the Fluid Power program. Student dissatisfaction was noted primarily in the need for updated equipment, greater frequency of course offerings and a full time faculty person.

- Community colleges throughout the country are going through similar assessments of their Fluid Power programs. Some are eliminating their degree option while maintaining a certificate option, some are experimenting with multiple admission and extended hours programs, others are changing their program's names; still others are becoming more involved with their local K-12 school systems.

- Successful community college Fluid Power programs have at least one full time faculty member who is a champion of the program in the sense that they understand it, believe in its mission and have time and resources to devote to marketing and updating the curriculum.

- Industry experts who have been involved with the program at OCC have suggested changing it to a two track program. One suggested track is engineering technology/sales and the other is maintenance/repair. This second track could be widened and titled "Industrial Technology." This is similar to what some other colleges have done.

- Oakland Community College's Fluid Power program is unique in two ways. It has a fully equipped lab provided by the Rexroth Corporation and it is located in the heart of the automotive world. Experts have repeatedly emphasized that OCC's program could be the most successful in the country.

Oakland Community College
Fluid Power Technology Program
Needs Assessment

INTRODUCTION

Fluid power involves the use of pressurized oil (hydraulics) or compressed air (pneumatics) to do work. Fluid power jacks up automobiles, operates computers, launches spaceships, controls submarines, moves earth, harvests crops, and, in general, makes everyday living easier. Over 90 percent of all machine tools are controlled or operated with fluid power. Hydraulics are used in industrial machines designed for the production of thousands of products from automobiles to children's plastic toys.

The purpose of this report is to review the compatibility of current industry needs and Oakland Community College's (OCC) educational responses related to the field of fluid power. This report is intended to assist the Fluid Power Technology program and the College administration in training students in fluid power in a manner that is consistent with industry needs. The review was initiated by Dr. Bill Rose at OCC's Auburn Hills Campus.

This needs assessment includes a literature review, data supplied by the U.S. Department of Labor and the Michigan Occupational Information System (MOIS), information compiled from phone conversations with industry experts, an examination of related programs in other higher education institutions, and phone interviews with employers of fluid power employees. The employers contacted include automation manufacturers, hydraulics and pneumatics equipment manufacturers and repairers, machine manufacturers and repairers, contractors, sales offices, distributors and general manufacturers. In addition, a survey was conducted of students who had recently enrolled in fluid power technology courses at OCC.

Description of Existing Program

The Fluid Power program was developed in 1980. The impetus for this program was partially based on an employer survey which was mailed to 210 employers with 19 responding. According to the Fluid Power Technology Advisory Committee Meeting Minutes in 1980 (Appendix B), "The results are fair, taking into consideration the current economic conditions. The results are acceptable pending an economic upturn in the near future."

The Fluid Power program prepares students to achieve functional competence at job entry level as a Fluid Power Technician. The program's aim is to produce technicians that are employable in automated machine repair and/or in the many small and large manufacturing companies throughout Southeast Michigan. Fluid power courses cover both the theory and application of many aspects of hydraulics and pneumatics. The student gains a limited amount of work experience in the hydraulics laboratory, using training aids to construct and to operate both hydraulic and pneumatic circuits.

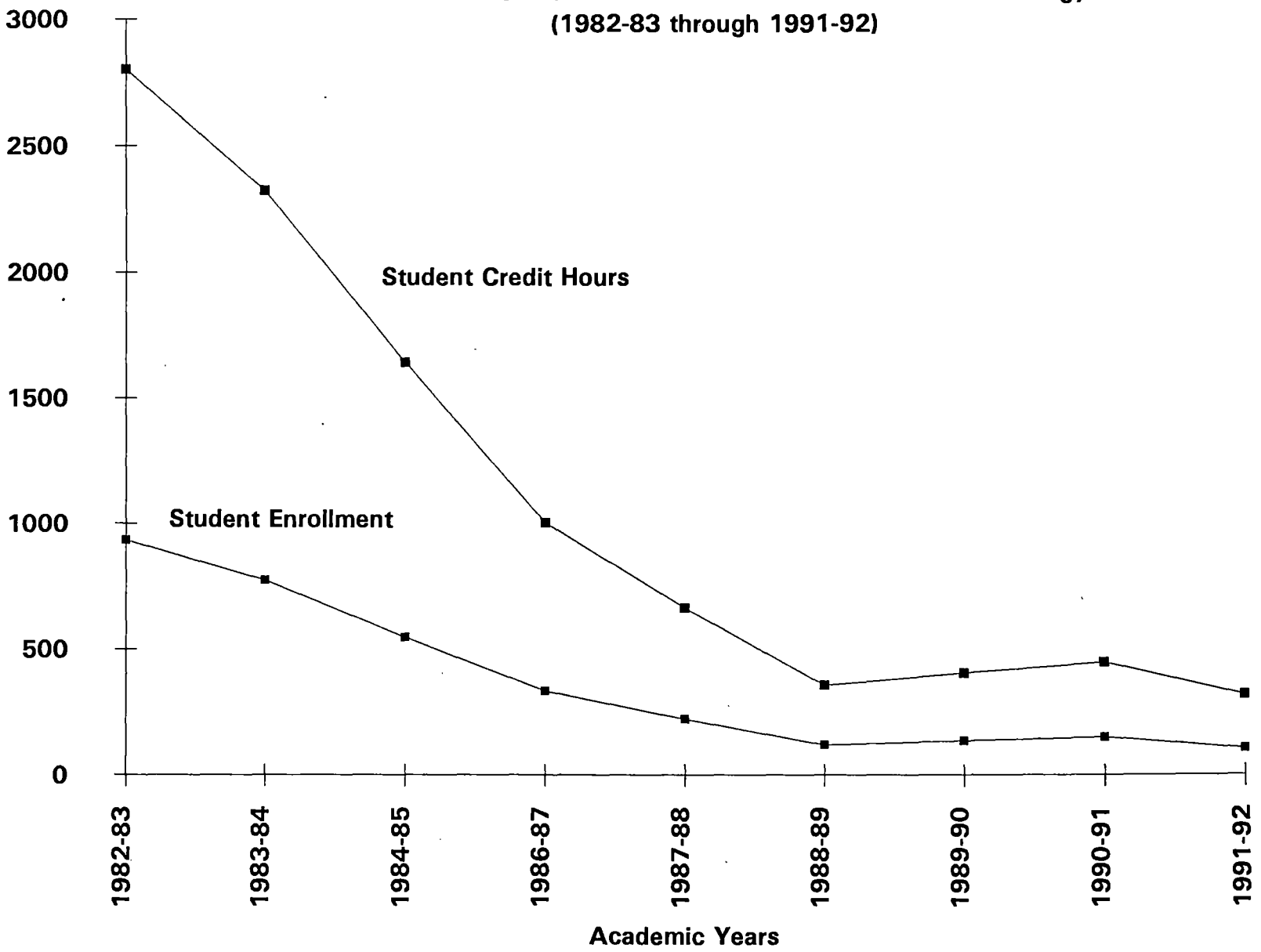
According to Dave Mehrer, former faculty member at OCC, in the early 1980's, "Enrollment in the Fluid Power program was artificially over-inflated due to a big surge in the Robotics program." He maintains that since students majoring in Robotics were required to take fluid power courses,

> The first two classes in the Fluid Power program (ATF 140 and ATF 143) were always full. Some of these students wanted to continue in fluid power, but there were hardly ever fifteen of them which is the minimum number required to hold a class. Therefore, no upper level classes were held for students in the program. This decreased enrollment even further as not many students wanted to enroll in a program with little chance of completing the degree.

Some believe that if the fluid power courses had been better promoted, more students would have enrolled to boost the number to fifteen. However, there was no full time faculty on board to do the promotion and advertising needed.

Dave Doidge, Dean, Academic Services at OCC, completed a "Community College Summary Report for Self-Study Evaluation of Occupational Programs" for Fluid Power Technology on June 13, 1991 (Appendix B). One of the comments read, "The Fluid Power program needs more attention." As indicated in the Ten Year Enrollment Trends Report (January, 1993) prepared by the Office of Institutional Planning & Analysis, there was an 88.7 percent decline in student headcount (duplicated) and student credit hours in Fluid Power Technology (ATF) courses between 1982-83 and 1991-92 (Table 1). Official college records indicate that between 1987 and 1992 there was only one graduate of the ATF certificate program (in 1991-92). Furthermore, there have been no graduates from the degree program over this same period.

Table 1
Student Credit Hours and Enrollment in Fluid Power Technology
(1982-83 through 1991-92)



Source: ACS-6 Enrollment Report

The Fluid Power Technology program has been important to the College for many reasons. Courses within the program are required for apprentice programs, Business and Professional Institute (BPI) programs, and degree programs such as Robotics/Automated Systems Technology, Automobile Servicing, and Climate Control Systems. According to Don Tremper, Apprentice Coordinator for OCC, "there are no apprentice programs at OCC in Fluid Power." However, fluid power courses are required for Machine Repair, Maintenance, and Mill Wright apprenticeships, and occasionally for Electronics. Furthermore, Tremper indicated that, "Without the Fluid Power courses, OCC would be in trouble." He knows the program is weak, and cites the lack of a full time faculty member. He believes the program first needs promotional work and then full time faculty to oversee it.

In March 1993, 47 students who had taken fluid power courses between January 1992 and January 1993 were surveyed as part of this research. The survey revealed that only one quarter (25%) of students taking fluid power courses were actually majoring in fluid power. However, nearly all (94%) of the students who were not majoring in fluid power reported that ATF courses were required for their majors (Table 2).

There were 82 students (77 men and 5 women) enrolled in fluid power courses within the past academic year (1992-1993). The students' ages range from 19 to 55 with a mean of 31 years. Students' reasons for taking fluid power courses vary, (Table 3) but most students are working toward a degree, and none of the students are preparing to transfer. Of all students surveyed, 95% had taken only one course in fluid power; 2.4 percent had taken two or three courses. The majority of the students surveyed (83%) are employed full time. As would be expected, 75% of the students who are majoring in fluid power said the coursework is related to their current employment. However, only 43% of all surveyed students believe the fluid power courses are related to their employment.

Table 2
Majors of Students in
Fluid Power Courses

Student's Major	Percent	Number
Robotics/Automated Systems	40.4	19
Fluid Power Technology	25.5	12
Climate Control Systems	19.1	9
Pre-Engineering	4.3	2
Automobile Servicing	2.1	1
Business Administration	2.1	1
Vehicle Body Technology	2.1	1
Computer Integrated Systems	2.1	1
Undecided	2.1	1
TOTAL	100	47

Table 3
Students' Goals*

Student Goals	Percent	Number
To obtain a degree	70.2	33
For Continuing Education	14.9	7
To obtain a certificate	6.4	3
To complete an apprenticeship	6.4	3
To improve personal skills	6.4	3
To prepare for a new career	4.3	2
To obtain a raise	2.1	1
To prepare to transfer	0	0

**Note: Students gave multiple answers*

Twelve of the students surveyed indicated that fluid power was their major field of study. None of these students indicated that they were seeking a certificate and only six (50%) maintained they were seeking a degree (Table 4). This is low compared with 70% of the total who are working toward a degree, but high, considering no one has graduated from the Fluid Power program in the past five years. Four of the students majoring in fluid power relayed that they were there to comply with an employer's requirement for continuing education. None of the students indicated that they were there for an apprenticeship. All of the surveyed students majoring in fluid power are employed full time, compared with 83% of the total.

Table 4
Goals of Students
Majoring in Fluid Power

Goals of Fluid Power Majors	Number of Fluid Power Majors
To Obtain a Degree	6
For Continuing Education	4
To Increase Chances for a Raise	1
To Improve Knowledge/Skill	1
For an Apprenticeship	0
To Prepare for a New Career	0
To Obtain a Certificate	0
TOTAL	**12**

Although there are usually no problems filling the entry level ATF classes, when these students reach the higher level courses, they have to enroll in self-directed study and independently learn the concepts and skills. Additionally, advanced textbooks are not available, and instructors typically have to write their own instructional material.

In addition to OCC's degree program in fluid power, the College also serves as the Midwest Training Center for the Rexroth Corporation, one of the world's largest and most prestigious international hydraulics companies. According to an agreement between Rexroth and OCC, (Appendix K) Rexroth donated and now maintains the hydraulic equipment used in the program, and therefore, OCC has a fully equipped lab which has been described as one of the top five in the country.

There has not been an active advisory committee for the Fluid Power Technology program since 1986, but ad hoc committees have met as recently as 1991. In 1986, the committee noted that job placement of students was improving,

and that there was a high level of interest in this program from area businesses. Since then, there has been widespread agreement that the curriculum needs to be updated. In 1991, industry leaders stressed that if the fluid power courses are to be continued, the program must be upgraded (Appendix B). Consequently, Edward Konopka, adjunct instructor of Fluid Power Technology, is not teaching within the confines of the "official" curriculum and course descriptions. He maintains that "We are now in a new era of serving automation and space applications" and OCC's curriculum does not reflect these advances. According to Konopka, as of 1993, there has not been financial support for this program nor attention paid to the recommendations made in 1991. However, he is among those who believe there is great potential for the program to succeed.

Description of Occupation

There are 350,000 people working in fluid power nation-wide. Graduates of community colleges who are employed in this field may hold titles such as "fluid power technician," "hydraulics technician," "maintenance technician," "maintenance repair technician" or "machine building technician." Based on the Employer Survey, examples of job titles of people who work locally in fluid power include: pipefitters, engineers, assemblers, designers, machinists, technicians, sellers, maintenance workers, general laborers, and trainees. A complete list of job titles obtained from local employers appears in Appendix E.

Employees with fluid power knowledge and skills can be found in almost any kind of manufacturing organization. Machine Shops, Maintenance Trades, Machine Maintenance Organizations, Sales Offices and Machine Building Organizations need employees skilled in hydraulics and pneumatics. There are four general "types" of organizations which use fluid power; each type of organization was represented in the employer survey.

1) Users: They use hydraulics and pneumatics in their manufacturing.

2) Manufactures: They engineer, design and test hydraulics and pneumatics equipment.

3) Original Equipment Manufactures (OEM): They apply hydraulics and pneumatics components to the equipment they make.

4) Mobile Users: They have equipment on wheels utilizing hydraulics and pneumatics components. Examples of these are utility and construction companies which use cherry pickers and back hoes.

Those who work with fluid power construct, assemble, service, maintain, repair and test fluid power equipment such as power steering units, hydraulic lifts, presses, heavy construction equipment and farm machinery by applying their knowledge of hydraulic, pneumatic and electrical principles. According to the OCC's Fluid Power brochure, a fluid power employee's duties may include:

* Analyzing blueprints, schematics and drawings to determine fabrication specifications.

* Setting up and operating milling machines, lathes, grinders, drill presses and welders to make precision parts

* Verifying conformance of parts to specifications

* Assembling fluid power components, such as pumps, cylinders, and valves

* Connecting fluid power units to test equipment

* Measuring fluid pressure and flow

* Recording data such as fluid pressure, flow and power loss due to friction and parts wear

* Implementing modification in fluid power units and testing procedures based on analysis of results

According to Ted Kokobu of the Fluid Power Society of Detroit (FPS), there are four traditional ways in which people enter the fluid power field. Many employees at the mechanic or maintenance level achieve their positions through formal apprenticeships. However, in general, most people who work with fluid power are engineers who are trained in fluid power once they have their engineering degrees. Others enter the field as technicians who have graduated from a community college. Finally, there are those who enter the occupation after high school and can take community college courses to upgrade their skills.

In 1991, the FPS introduced a certification exam which is becoming widely accepted and even required by some employers. This examination can be taken at any time and lets employers know that potential employees have the knowledge which is "accepted" by the industry as necessary (Appendix C). According to the FPS, the certification process also "elevates the level of professionalism in the fluid power industry." A new Certification Program is in preparation for Fluid Power Engineers, scheduled for release in 1995. There are now three tests available:

1) Mechanic - tests the ability to fabricate, assemble, test, maintain and repair systems and components. Separate Certifications are available for Industrial Hydraulic, Mobile Hydraulic and Pneumatic Mechanics

2) Technician - tests the ability to trouble-shoot systems, test and modify systems, prepare reports, etc. Separate Certifications are available for Hydraulic and Pneumatic Technicians

3) Specialist - tests the ability to analyze and design systems, select components, and instruct others in operations and maintenance

The differentiation among these three tests reflects what experts are saying about the field. They maintain that, when hiring, employers will either look for someone with technician training or someone with mechanical training. Although OCC describes its program as graduating "technicians," a lot of the course work may be similar to that of maintenance or mechanical training. In order to solve this problem, some schools have developed two tracks from which students can choose; this has been proposed for OCC as well and will be discussed further under "Adequacy of Available Training."

METHODOLOGY

Methods of Data Collection

In order to obtain background information on the field of fluid power, a literature search was performed and a variety of professional, industrial, and accreditation organizations were contacted.

A telephone survey of 60 employers was conducted in April 1993. Employers from various employment categories were contacted, including: automation manufacturers, hydraulics and pneumatics equipment manufacturers and repairers, machinery manufacturers and repairers, contractors, sellers and distributors, and general manufacturers (See Table 5 and Appendix H). Employers were asked a series of questions regarding actual and potential employment opportunities (Appendix I). Additionally, detailed information was solicited from these employers regarding desired qualifications and specific skill levels for entry level employees. Employers contacted were selected at random from a variety of sources, and included those employers found in Dun & Bradstreet and those suggested by the Dean of the OCC Fluid Power program and other experts in the field of fluid power. Companies representing a variety of sizes and interests were included in order to provide a comprehensive view of employer needs in the local area.

Table 5
Type of Organization Surveyed*

	Number	Percent
Machinery Manufacturing/Repairing	30	50.0
Sales	12	20.0
Hydraulics/Pneumatics Manufacturing/Repairing	10	16.7
Automation Manufacturing	8	13.3
General Manufacturing	8	13.3
Machine Tool Manufacturing/Repairing	7	11.7
Construction	5	8.3
Distribution	5	8.3
Other**	6	10.0

**Note: Respondents gave multiple answers*

***Others include: CAM Machine Repair, Auto Metal Proto-type Stamping, Sheet Metal Forming and Material Handling*

In March 1993, 51% of all students who had taken at least one Fluid Power Technology course at OCC over the past twelve months (January 1992-January 1993) were contacted by phone. The ages and genders of the students surveyed adequately represent the ages and genders of all students who have recently taken fluid power courses. Students were interviewed (Appendix F) regarding their reasons for taking fluid power courses at OCC, their satisfaction with the program, and their expectations for using their fluid power experience/knowledge in the future.

Finally, a review of fluid power programs in community colleges was conducted. Comparisons of enrollment and graduation information were made, and an examination of program content was conducted.

Methods of Data Analysis

A total of 60 employers responded to the telephone survey. Quantitative analysis of the data was conducted by means of frequency distributions. Verbal responses were analyzed for content, and appear in their entirety in Appendix J. The student survey was similarly analyzed (Appendix F).

ANALYSIS

Fluid Power Industry Outlook

At a 1991 Advisory Committee meeting, the Dean of the program asked, "Should OCC maintain the Fluid Power program?" (Appendix B). Fluid power industry representatives at the meeting stressed that fluid power is not going to go away and is in fact becoming more complex. One of the advisory participants emphasized that, "Hydraulics and pneumatics are important to the future."

Additionally, many experts consulted for this study described fluid power as going through an "identity crisis." In the past five to ten years, robotics and electronics have been explored by the media and these areas have caught the attention of students who grew up watching Star Wars, fascinated by "R2D2." This phenomenon may partially explain the declining enrollment in Fluid Power programs.

A representative from the National Fluid Power Association believes that another reason for low enrollment in programs throughout the country is that students are apprehensive about "getting their hands dirty." At any rate, fluid power has not

received a lot of attention and most high school students do not even know what it is. This is an education problem, not necessarily a demand problem. Industry experts are suggesting reaching out to grade schools and middle schools to introduce students to hydraulics and pneumatics concepts. The toy manufacturer, "Leggo," is now selling toys to school systems that are based on fluid power concepts.

Employment Opportunities

According to employers surveyed, organizations which work with fluid power have anywhere from 1-200 employees working in hydraulics and pneumatics. The majority of the employers surveyed (55%) have from 1-6 employees who work in fluid power. Job titles are not consistent and not all who work with fluid power are constrained to duties involving hydraulics and pneumatics. In the June 1991 OCC assessment of the Fluid Power program done by Dave Doidge, it was noted that "Employment opportunities in the fluid power area are vague." Perhaps this is because people skilled in hydraulics and pneumatics are found holding many different jobs and performing various duties.

Neither the Michigan Employment Securities Commission, the US Department of Labor, the Michigan Occupational Information System nor The Occupational Outlook Handbook track hydraulics, pneumatics, or fluid power employees. Hydraulics and pneumatics are defined as "skills" rather than as occupations. Therefore, it is hard, if not impossible, to find conclusive literature based evidence for employment opportunities. However, there is information on occupations which utilize fluid power skills, such as "maintenance technician" from The Occupational Outlook Handbook. Many maintenance technicians need to possess fluid power skills. Among other duties, they repair and maintain machines and mechanical equipment. Graduation from high school is preferred, but not always required for entry into this occupation. Employment of general maintenance technicians is expected to grow about as fast as the average for all occupations through the year 2005. Employment is related to the amount of equipment needing maintenance and repair.

Both The Occupational Outlook Handbook and surveyed employers described their machinists as using fluid power skills. Machinists plan and carry out the operations needed to make machined products that meet precise specification. Although machinists work in all parts of the country, jobs are most plentiful in areas where manufacturing is concentrated. Machinist training varies from formal apprentice programs to informal on-the-job training. However, most employers consider a formal apprentice program the best way to learn the machinist trade.

According to The Occupational Outlook Handbook, employment of machinists is expected to increase more slowly than the average for all occupations through the year 2005. As the economy expands, so will the demand for goods that use machined metal parts. However, the demand for machinists will be constrained by improvements in metalworking technology. Employment opportunities for qualified applicants should continue to be good, but employment of machinists fluctuates with economic conditions.

Despite the lack of conclusive evidence from the literature, experts related to fluid power, including the FPS, maintain that "Industry is concerned that there is and may continue to be a shortage of trained individuals involved in the application and servicing of hydraulic and pneumatic systems and equipment" (Appendix C).

Employment Outlook for Fluid Power Technicians

According to the OCC Fluid Power Technology brochure,

> Employment of fluid power technicians in Michigan is expected to increase through the mid 1990's. Job opportunities should be good in companies that install fluid power systems and components, such as pumps, motors, compressors, valves, cylinders and accessories.

A representative from the National Fluid Power Association concurs that there is a large need for trained technicians whose specialty is fluid power. According to Ted Kokubo of the Fluid Power Society in Detroit, "Fluid power technicians are in demand." Representatives from Spokane Community College in Washington agree. Industry leaders and educators describe Spokane's Fluid Power program as one of the best in the country. Dean Croskey, the Department Chair of the program at Spokane, maintains that there are jobs for graduates of two year Fluid Power programs. He has "four job openings for every student." Some of their graduates complete four year engineering degrees and are not able to find jobs. Typically, these students "come back to Spokane's program and are hired because of their fluid power skills."

Rochley Gross, faculty member in the Fluid Power program at Chippewa Valley Technical College, Wisconsin, says that those in the fluid power industry are "*desperate*" for new employees. He has people calling him, looking to hire graduates from Chippewa's program or any other program in the country! Employers are complaining that they just cannot find people. "When it comes to finding employees

this is a technically starved and deprived industry." He also experiences students returning from four year degree programs who cannot find jobs; they then draw on their fluid power skills and employer contacts.

However, according to the employer survey, only 27% of local employers have difficulty recruiting employees skilled in fluid power. Some of the comments from those who have trouble finding new employees include:

> Hydraulics and Pneumatics seem to be a second choice occupation with Electronics being first.
>
> People know hydraulics, few seem to know about pneumatics, not enough courses offered in pneumatics.
>
> People aren't interested in the Fluid Power programs so there's a shortage of prospective employees.

In November 1990, Edward Konopka, adjunct instructor in OCC's Fluid Power program, visited a "Tech 2000" seminar/exhibit in Washington D.C. He investigated the employability of fluid power technicians with associate degrees and Fluid Power Society Certification (Appendix C). "Many" employers remarked they would hire those graduates immediately. Konopka also believes "Many jobs are available for Fluid Power Technicians in the Aerospace Industries." This could not be confirmed for the Southeast Michigan area due to the lack of aerospace industries, and further research is suggested due to nation-wide layoffs of aerospace personnel.

Currently Konopka contends that anyone who has ever gone through the Fluid Power program "has immediately found a job." Among local employers surveyed, nearly half (47%) said their need for employees skilled in fluid power is increasing. Another 47% maintained that their need is not increasing, and 7% were uncertain. Among those who said that their need is increasing, some stated that they would hire new employees and some said they would retrain current employees to meet their demand (Table 6). In fact, two surveyed employers contacted OCC after the survey seeking qualified fluid power students to interview for jobs.

Table 6
Methods of Satisfying Demand

	Number	Percent
Hiring New Employees	25	89.3
Retraining Current Employees	15	53.6
Other	1	3.6

According to surveyed employers, the main reason for the increasing need for employees skilled in fluid power is the expansion of the organization (75%), followed by new skills needed for new technologies, current employees lacking these skills, and, finally, employee turnover.

This increasing demand was further analyzed by focusing on the type of employer and the individual job title. Eighty-eight percent of surveyed automation manufacturers have a current need for employees skilled in fluid power and 67% of sales organizations indicated a current need. Furthermore, many of the surveyed employers are actively seeking engineers, technicians and salespeople.

Retraining Opportunities

Of the employers surveyed, 59% (35) provide some type of in-house training, exclusive of orientation. Further, 50% (30) of surveyed employers provide their employees with some type of external training. Only 25% of the contacted employers indicated that they would consider OCC for retraining their current employees. Perhaps this number is lower than might be expected because many employers stressed that they offer tuition reimbursement to their employees and it is up to the employee to find the classes; these employers do not *send* their employees to any specific college or training center. However, a few employers indicated that they had specific retraining needs; the names and needs of these employers were forwarded to OCC's Business and Professional Institute for consideration. Some employers asked the interviewers for a copy of OCC's curriculum and some employees were surprised that OCC offered a program and expressed interest in taking classes.

Even though in 1992 Vickers Incorporated (Clawson, Michigan) trained 1,300 customers in hydraulics and electro-hydraulics, they believe the market for retraining is not at all saturated. Similarly, the Rexroth Corporation's lab in Pennsylvania is in

constant use; they charge $800 per person for one week of training and their classes are "always filled." They believe that this is a reflection of the increasing need nationwide for people to be retrained in hydraulics and pneumatics.

Employee Benefits

Wage and Salary

Survey findings indicate that remuneration for fluid power employees varies widely; much is dependent on the level of education and experience. Dependent on job title, mean salaries range from $15,600 to $35,289. Engineers consistently earn the highest salaries. Technicians, those in sales, and maintenance workers earn comparable salaries with means of $20,688, $19,166 and $18,828 respectively. These are the three areas in which community college graduates are most likely to work. Table 7 shows a breakdown by salary and job title.

Table 7
Entry Level Salaries & Job Titles

Job Title	Mean Salary
Engineer	35,289
Technician	20,688
Designer	19,256
Sale	19,166
Machinist	18,972
Assembler	18,868
Maintenance	18,828
General Laborer	16,900
Trainee	16,848
Pipefitter	15,600

Source: OCC Employer Survey

Advancement Opportunities

According to industry experts, students should be learning reading and writing skills if they ever want to be considered for supervisory positions. Surveyed employers indicated that advancement opportunities are available throughout the industry. Some advancements require more knowledge and skill levels, while others require additional education. Top positions are usually in either engineering or management. Some employers stressed that with electrical plus hydraulics and pneumatics skills, employees may go into engineering or become a shop superintendent. Technicians are typically on a path towards engineering, but usually will need a four year degree for advancement to engineer. Maintenance workers may move into service and sales. Assemblers can also move to sales and service positions or to designer and eventually to engineer. One employer remarked that his employees can move to the "Big Three" (General Motors, Ford Motor Company, and Chrysler) after sufficient experience. Two employers stressed that abilities in pneumatics and hydraulics alone are not going to lead to advancement; "employees need to know other skills."

Opportunities for Minorities and Women

Currently, the fluid power field is male dominated. The Fluid Power program at Spokane Community College usually averages one woman per entering class of 30. The chair of the program remarked that the women do quite well, and they are trying to recruit more of them. There were 77 men and 5 women enrolled in fluid power courses at OCC within the past twelve months. In the fall of 1992, Macomb Community College had 29 students, all-male, in their Hydraulics and Pneumatics certificate program.

The Michigan Department of Education reports that minority enrollments in fluid power related fields are below 10% of the total enrollment. One employer complained that there are "not enough minorities (color, ethnicity, gender) who apply; only white males are applying."

Occupation

Level of Training Needed

Employers responding to the OCC survey were asked to indicate the minimum levels of education, experience and other credentials required for entry level employment. Employers were questioned regarding their notions of what components should be part of the ideal two-year fluid power training program.

Employers were asked what non-academic skills they deemed important in an employee. Table 8 depicts a breakdown of skills listed by employers as "very important."

Table 8
Skills Ranked as "Very Important"

	Number	Percent
Teamwork Skills	56	93.3
Problem Solving Skills	52	86.7
Individual Initiative	51	85.0
Organizational Skills	41	68.3
Writing Skills	37	61.7
Speaking Skills	33	55.0

As shown in Table 9, seven employers surveyed require entry level employees to have an associate degree in Fluid Power. The majority of employers (82%) have either no specific educational requirement or require high school completion only. According to the FPS, this phenomenon is likely driven by the fact that most four year schools do not offer programs in fluid power, and there are less students in community college programs than the industry demands.

Table 9
Educational Requirements

	Number	Percent
None	10	16.7
High School Diploma	39	65.0
Apprenticeship	1	1.7
Certificate	3	5.0
Associate Degree	7	11.7
Bachelor	3	5.0
Other*	3	5.0

**Others include: Shop classes in high school; 1-2 years of college or be in college now; Some schooling past high school*

Employers were also asked what academic skills are important when hiring employees. Table 10 gives this breakdown.

When asked what the single most important factor was in hiring decisions regarding fluid power employees, employers were divided between those who most valued technical skills and those who believe personal traits are most important. Comments included:

Technical ability and skills
Good attitude
Computer skills
Basic knowledge of hydraulics and pneumatics
Ambition
Dependable

Table 10
Academic Skills Ranked as "Important" or "Very Important"

	Number	Percent
Industrial Safety	57	95.0
Fundamentals of Pneumatics	55	91.6
Electrical Fundamentals	55	91.6
Relationship of Forces, Motion, Work & Power	54	90.0
Drafting	54	90.0
Business Communication	54	90.0
Fundamentals of Hydraulics	53	88.4
Circuit Design	51	85.0
Geometry & Algebra	50	83.3
Plane Trigonometry	48	80.0
Pipe & Tube Isometric Drawing	46	76.7
Logic Functions & Digital Control Circuits	45	75.0
Working with Metals in Fabrication	44	73.3
Computer Aided Hydraulic Circuit Design	33	55.0
Other	0	00.0

Employers were also asked which skills their employees lack. Although the majority of the employers (76%) asserted that their employees are either qualified or well qualified, there were some concerns expressed. Their comments included:

They do not have knowledge of hydraulics.

Employees do not understand how hydraulics and pneumatics work.

They lack knowledge/understanding of physical properties of compressed air from a mechanical standpoint.

Some community colleges are offering the Fluid Power Certification examination on-site to their students and more employers are at least recognizing and at most requiring the certification. In one industry expert's words, "Certification lends validity to the college programs and to the industry as a whole." (Appendix C)

Adequacy of Currently Available Training

According to Ted Kokubo of the FPS of Detroit, it is an odd reality that four year engineering programs "usually do not incorporate applied hydraulics or pneumatics into their courses, so their graduates are not knowledgeable in these areas." (In the University of Michigan's Mechanical Engineering program, there is one course on fluid mechanics and an optional class on the design of thermal fluid systems.) Kokubo also believes that fluid power education is "going downhill" because there is not enough information from the industry to let people know that there is work in this field. At the high school level there are hardly any programs or classes in either hydraulics or pneumatics. The only institutions offering comprehensive instruction in these areas are the community colleges. Kokubo describes this as "an education problem, not a demand problem." At this point, industries are forced to hire engineers who do not have the hydraulics or pneumatics background, and need extensive training in these areas. Kokubo believes that "industries would rather have community college graduates with the requisite background."

Various community colleges which offer associate degrees and/or certificates in fluid power or hydraulics were contacted. Nation-wide, Spokane Community College in Washington, Chippewa Valley Technical College in Wisconsin, and Milwaukee Institute of Technology have all been described by industry experts and educators as having excellent Fluid Power programs.

Macomb Community College

In 1991, Macomb discontinued their Fluid Power associate degree program. They had graduated nine students from this program since 1987. Now they offer a certificate in hydraulics and pneumatics. The Hydraulics and Pneumatics certificate is one of eight specialty certificates within the Industrial Technology degree program. The Industrial Technology One Year Certificate Programs are:

A. Industrial Laboratory Test Technician
B. Hydraulics and Pneumatics
C. Robotics
D. Mechanical Fabrication
E. Industrial Electrical/Electronic Service
F. Industrial Welding
G. Industrial Sales and Marketing

Students may apply for the specialty certificate after completion of the Industrial Technology core courses and the specialty of their choice. They can go on for a two year Industrial Technology degree by taking the required electives. After completion of the two year associate degree, the student has the additional option of transferring their completed course work to a four year university to begin working toward a bachelor of science Engineering Technology degree.

In fall 1992, Macomb had 29 students in the Hydraulics and Pneumatics certificate program. This certificate is designed to "Prepare technicians, mechanics, diagnosticians and sales personnel in the industries that design, manufacture, service and sell hydraulic and pneumatic components or systems. It is a specialty program that provides training in the transmission and control of power through hydraulics and pneumatics."

According to Al Manore, Professor and Program Advisor for the Industrial Technology Program, not all of industry is cognizant of the term "Fluid Power technology." Macomb did a Needs Study in 1990 to discern the Detroit area Industrial Technology needs. The College learned that industries want employees to be "excellently prepared for one field, yet also have the ability to cross fields as well." Their program works well at preparing multifaceted students, and it is inexpensive to run. They are also working with area high schools in "tech prep" programs in this field.

Mott Community College

Dave Tellahowski, Coordinator of the Fluid Power Technology program at Mott, maintains that although enrollment has declined over the past few years, he still manages to hold about five courses both fall and winter terms. He has made sure that the program keeps up with changing technology by way of computer programs and electro-hydraulics concepts in the courses. Tellahowski believes that it takes so much time to maintain and update a lab, that he does not have time for marketing the program; the updating he does is his form of marketing. He knows his program would fall apart without his willingness to care for it; however, he believes a successful program needs more than one full time person -- one to do marketing and one to do the lab and equipment maintenance.

Washtenaw Community College

Gary Schultz, Advisor and Instructor in the Fluid Power Technology program asserts that they have a "good Fluid Power department and good courses." It is mainly a hydraulics program; they only have one pneumatics class. Although it is not popular as a degree program, the classes are essential because they are required for the Robotics and the Mechanical Engineering Technology programs. Less than six students a year graduate from their Fluid Power program. From 1988-89, 95 students took fluid power courses, and there were three graduates with the Fluid Power associate degree. In 1989-90 there were 112 students and one graduate, in 1990-91 there were 88 students and three graduates, and in 1991-92 there were 105 students and no graduates. From the three programs combined (Robotics, Mechanical Engineering Technology and Fluid Power) there are approximately 15-20 graduates each year. The majority (60-70%) of their students are enrolled for retraining.

When the traditional student graduates from Washtenaw's Fluid Power program, he or she goes to work doing

troubleshooting, maintenance, machine repair, or field service. None of their graduates are going to work for the "Big Three" (General Motors, Ford Motor Company or Chrysler). Most work for a small to medium size company which supports the Big Three in some way.

Spokane Community College

Spokane Community College in Washington has a very successful Fluid Power Technology program. They attribute their success to: 1) Rexroth is advertising for them throughout the country and 2) They received an "outstanding quality program" award from the United States Department of Education. Additionally, each of their instructors does public relations work for the program, and word of mouth is by far their best advertiser.

They have found that the West German Hydraulic and Pneumatic textbooks are the best they could find. They do not have the time to write their own textbooks, so they use the West German ones.

Despite their reputation, they are currently experiencing declining enrollment. In the past they averaged 36 new students each year, of which approximately 30 actually went through the program and graduated. In 1992, they only enrolled 22 students. This is not due to a decreased interest level, but to the quality of high school graduates they have been receiving. For the past three years, their division (The Manufacturing and Engineering Division) has required a competency exam in reading, writing and mathematics, and each year fewer students are passing.

Milwaukee Institute of Technology

The Milwaukee Institute of Technology has one full time faculty member and several instructors from other programs who teach in their Fluid Power Maintenance program. They

recently changed the name of their program from "Hydraulics and Pneumatics" to "Fluid Power Maintenance"--most of their graduates go into maintenance (repair and troubleshooting) although some go into sales. The program is very successful in terms of industry demand for their graduates. Every year the instructor receives more job offers (he had 90 job offers come across his desk last year) than he has graduates. The head of the program attributes their success to the full time faculty member who "strives to have the best program possible."

Currently, Milwaukee is only offering a certificate in Fluid Power, because there is not enough student demand for the degree program. Over half of their students are there for retraining. Their biggest problem (and a problem they perceive as being nation-wide) is marketing to high school students who usually do not know what "hydraulics" and "pneumatics" are, let alone "fluid power." However, the faculty member believes that the demand for graduates of a fluid power program is increasing. They graduate anywhere from 10-20 students each year and unfortunately, this number is decreasing as more and more students are going part time. The College is attempting to offer the FPS Certification examinations at a reduced cost for their graduates.

Chippewa Valley Technical College

Chippewa Valley's Fluid Power program (Wisconsin) has been described as successful since its inception in 1968. Rochley Gross, one of the three full time faculty members in the program, attributes this success to their ability to meet the needs of industries. Their past graduates tell them what their companies are seeking, employers tell them directly what they need, and they also have an advisory committee which meets twice a year. They "make it a point to adapt to industry needs."

Chippewa Valley offers two programs in Fluid Power. One is an associate degree which focuses on technology; the graduates work as engineering technicians or in sales and distribution. The other program is a two year "diploma" program which focuses on maintenance; the graduates work for industries doing maintenance work. This program is more "hands on," and incorporates mobile concepts as well. It does not incorporate the academic and technical skills found in the technician program. They usually have an average of 24 people in the maintenance program and 10 people in the technician program. Some of the technician graduates go on to engineering schools for four year degrees.

They use a simulation or "symbol" software to design and build circuits on a screen to see if they work. They then take the circuit from the screen to the board.

Every year at least one employer interviews on campus and their placement has been 100% to date. Graduates have jobs waiting for them. According to the College, students who have gone on for four year degrees often cannot find jobs and will go back to Chippewa Valley to market their fluid power skills to the employers who are in contact with the program. Demand is equal for each program; however, depending on the nature of the organization, employers usually will only need graduates from one of the two programs. Gross describes the state of the fluid power industry as *"desperate"* for people with necessary skills. He has people calling all the time, looking for graduates from Chippewa Valley or from any other school in the country with a similar program. "Employers cannot find the people they need."

They offer the FPS Certification test on campus to their students. Gross sees more and more companies requiring this certification. Chippewa Valley is considering cutting down the maintenance diploma program to one year (24 credits) and then offering a certificate of accomplishment as well as the opportunity to sit for the certification exam.

Their biggest problem lies in recruiting students. They have sporadically gone into high schools to do recruiting and marketing, but never on an organized basis. They rely a lot on word of mouth and they enroll "a lot of friends and relatives of past students." In 1991 Chippewa Valley incorporated a very proactive marketing effort. They changed their maintenance program to an all year, self paced, student oriented, multiple admission program. Students can enter the program five times each year. Every day from 7:00 am to 10:00 pm there are 1-3 instructors in the lab available for the students who come in and work at their convenience.

The impetus for the multiple entry, self paced program came from the state of Wisconsin. The state issued a grant for redoing labs and curriculums to meet the needs of non-traditional students. As part of the grant, eight people representing the fluid power industry convened and listed the tasks which should be taught in a fluid power program. Twelve instructors, from 10 different schools throughout the state, used this list to design a state coordinated curriculum and this process is still ongoing. Gross is willing to assist OCC any way he can, one of his greatest contributions could be disseminating information from this committee.

The student survey conducted as part of this study reveals that students are relatively pleased with the quality of instruction they have received in the OCC Fluid Power program. Nearly three fourths (74%) of all students taking fluid power courses, and all of the students majoring in Fluid Power feel "very satisfied" or "satisfied" with the quality of faculty and instruction they have received in the program. Similarly, 72% of all students are either "satisfied" or "very satisfied" with the equipment and technology available to students in the program. However, 23% of the students described the equipment as being of poor quality. The paraprofessional who maintains the equipment stressed that not all students are cognizant of the level of equipment and technology being used by industries. Rexroth has installed eight "trainers" which are, for the most part, in excellent shape. However, according to the paraprofessional, there are two units from Sperry Vickers which are very antiquated. A participant at the Advisory Committee meeting on May 30, 1991, emphasized that the Pneumatics area should be upgraded (Appendix B). This was supported by the student survey.

Overall, 85% of the students are satisfied with the content of the courses offered. It is interesting to note that if the student is majoring in fluid power, he or she is more likely to not be satisfied with content of the courses offered. These students are all employed full time and may be more knowledgeable about the skills they need to learn. As one student put it, "The hydraulics used in the factory are at a higher level than the courses offered at OCC." Along with the equipment, many students believe that the curriculum needs updating. The students who are now in the field believe that it would be worthwhile to update the Fluid Power program, "There are good paying jobs available."

Students also expressed concern of having to share facilities with other classes, of the infrequency of courses offered, and that some necessary classes are canceled. One of the comments made at the ad hoc advisory meeting in June 1991 was that advanced courses needed to be offered more frequently (Appendix B). A suggested reason for these problems is the lack of a full time instructor. Because of this, there is limited attention given to the higher level students. Other students complained about the difficulty of the courses and wished that they had taken more math before enrolling in fluid power courses.

According to representatives from both the College and the Rexroth Corporation, the relationship between OCC and Rexroth is often strained. Rexroth is still doing training at the College; both the instructors and the students come from throughout the Midwest to use OCC's lab. The agreement between OCC and Rexroth states that the latter should help with public relations for the program. There are critics who maintain that this is not being done, but Rexroth counters that they advertise OCC in brochures and fliers which are sent to their users nation-wide.

Rexroth and OCC take turns blaming each other for the state of the lab. According to a spokesperson from Rexroth, they not only "gave OCC the equipment, but they are willing to update it and train OCC faculty members to teach their courses using the equipment." However, the paraprofessional who maintains the equipment at OCC perceives Rexroth as abandoning the College; "orders are never filled while the machines are deteriorating." Rexroth maintains that they are "responsive;" that if something is not repaired it is because they are unaware of the problem. Rexroth asserts that whenever they need OCC to inspect or clean or maintain anything in the lab, there is always a "major price tag connected." According to a Rexroth spokesperson, they work with other community colleges which charge "half as much." Rexroth stresses that the labs are never clean; when they have someone coming in to teach a class, he has to come to OCC two days early to clean the equipment. If the paraprofessional does do any cleaning, Rexroth is being charged a

"phenomenal fee." One hour of the paraprofessional's time costs Rexroth 25 dollars. A spokesperson from Rexroth went as far as to say that they wished they had never put the equipment in at OCC.

Both OCC and Rexroth agree that OCC's program has been, "heavily neglected," although they disagree as to whom is at fault. A spokesperson from Rexroth said they "are disappointed in OCC because the College has no full time instructor who cares and is enthusiastic and willing to work hard for the program." He also believes that by being located in the heart of the automotive world, there is "no reason for this program to fail."

Not only does the College not have a full time instructor, but OCC has never focused a marketing plan on the Fluid Power program. The people who are connected to the program in some way have other interests and time consuming activities which have overshadowed fluid power in the past few years. The 1991 "Self-Study Evaluation" commented that "A new director of placement and marketing needs to be sought to ensure complete success of the program."

John Nogosian, Director, Fluid Power Educational Foundation, believes that hiring a full time faculty member would not be enough. He emphasized that, "Any technology program needs <u>at least one</u> full time faculty person, and that person has to put extra time into the program." A program "Stands on instructional staff and administrative support for that staff." He also knows people who have taught at OCC part time. According to him, these instructors found the curriculum at OCC to be unrealistic; "the gamut is much too wide to be taught effectively." Konopka is in the process of revamping the curriculum and the Fluid Power Educational Foundation produces a curriculum guide which could be useful to OCC.

Nogosian also recommends changing the title of the program to "Automation Controls." Detroit is strongly unionized and he believes that most people cannot enter fluid power unless they get an apprenticeship. An apprenticeship allows one to work on repairing the machinery, so if one has a degree in "Controls," they can identify the problems and then the unionized workers can fix the problems. The name change would be a method of marketing the program without the apprentice experience. However, neither the employers surveyed, nor the contacted community colleges stressed the importance of an apprenticeship. Perhaps the other colleges throughout the country are not located in an area as heavily unionized as the Detroit-Metro area.

A representative from the FPS stresses that the impact of unionization depends on the organization and the position. If one is trying to work in a heavily unionized

organization such as an automobile plant, they would have to join the union. Smaller companies, engineering laboratories, and sales/distribution offices are usually not unionized. Also, the mechanically related positions are more likely to be union ones, whereas the technician ones are not. However, he does not know of any specific cases where a community college graduate in fluid power was denied a position due to a union policy. According to the Fluid Power Certification Board, "The pace of today's industrial world and its ever-expanding knowledge base precludes the luxury of apprentice training for many industries, including fluid power. Today's fluid power mechanic acquires skills on the run--in short courses and workshops, by reading trade publications and, of course, on-the-job."

Tom Blansett of Vickers Incorporated reviewed OCC's curriculum in 1991 when he participated on the advisory board. Even then he believed that it needed some vast updating. The hydraulics courses were not reflecting what the industry uses, they were "not consistent with the level of expertise needed." Based on his experience in 1991, he maintains that, "not only is the curriculum outdated, but the equipment definitely needed updating. The two go hand in hand; the equipment is adequate for the current curriculum, but both need to be updated." He firmly believes that there is a need for a strong program in the Southeast Michigan area.

Doig Associates distributes industrial pneumatic components for automation, manufactures specialties, and designs and builds air logic control systems. George Doig, President, was also part of the 1991 advisory board. He is "desperate for pneumatics people; there is nobody to hire!" He does not work with hydraulics and believes the two should be separate in a college program. "Electricity, hydraulics and pneumatics are completely separate." He argues that community colleges are good places for pneumatics programs, but "most are in the dark ages regarding compressed air." There is a "crying need for a community college to get a good compressed air program going." The colleges need a pneumatic technologist degree program with fluid power technician rating equivalent (FPS certification, see Appendix C). A few employers backed up Doig with comments that there are "not enough courses offered in pneumatics" in Southeast Michigan, and "People do not have experience with pneumatics." The Fluid Power Society does offer separate certifications for hydraulic and pneumatic technicians. Perhaps OCC could consider either separating the two programs or only offering one of them.

Fluid Power Technology has been described by industry experts as a "low profile" program at OCC and wherever else it exists. Many have commented that programs need to be aggressive in order to survive against "high profile" programs such as Robotics. It has also been suggested that it is important to have an

administrator in charge of the program who understands what fluid power is and what its place is in the industrial technology programs overall. There have been concerns expressed by both internal and external constituents regarding the administrative oversight of the Fluid Power program at OCC. A third suggestion is to have at least one person working full time doing public relations for the program, or else dividing responsibilities for advertising, recruiting and fund raising among the faculty.

In order to attract enough students, colleges are realizing the importance of implementing strong links with local high schools. Representatives from Spokane's program are planning to visit one on one with local high school vocational counsellors. They are concerned with the counsellor's lack of fluid power knowledge, and they are even more concerned about the quality of students who are being channelled into vocational programs from the high schools. In the 1991 "Self-Study Evaluation" of OCC's Fluid Power program, it was recommended that the College develop an effective articulation plan with area high schools.

The Academic Dean at OCC for vocational programs has agreed that the College's marketing of Fluid Power has not been very aggressive. According to the Fluid Power Advisory Committee Meeting on May 30, 1991, "OCC has never focused a marketing plan on the Fluid Power program" (Appendix B). Several of the employers contacted in the survey were unaware of the College's program. In June of 1991, the Advisory Board recommended hiring a new director of placement and marketing. This has not yet been done. The Dean has heard suggestions in the past regarding hiring instructors who would also have the responsibility for marketing, placement, and cooperative programs, and he is willing to consider this plan if the budget allows for the extra costs it would require.

Konopka agrees with many others regarding the issue of full time faculty. He maintains that the College has to both update the program and hire full time faculty to not only teach, but to promote and continuously update the program. According to him, there are no discretionary funds to hire new people. Without adequate enrollment, there will be no discretionary funds for new positions. Without new instructors, there will probably not be increased enrollment. Thus, OCC's program finds itself in a "Catch 22." Some may suggest hiring part time instructors. This has been considered, but, according to Konopka, the pay scale is not enough to attract someone who really knows what and how to teach.

In October of 1990, Konopka proposed updates for the Fluid Power Technology program (Appendix D). Konopka spearheaded the program revision for a year. His proposals included updating the program and course descriptions, and repairing,

replacing and purchasing lab equipment. He also called for an ongoing advisory committee. Other recommendations included:

* Making applications to the FPS, Society of Manufacturing Engineers, Society of Automotive Engineers, National Fluid Power Association, and Manufacturers for grants and/or donations for Lab Equipment

* Seeking a budget for such other equipment as deemed necessary and not available by donation or grant

* Establishing a list of qualified instructor personnel

* Establishing a list of Fluid Power courses which provide the technical and manual skill background toward Certification Tests as Fluid Power Specialist, Fluid Power Technician or Fluid Power Mechanic

In January 1991, Konopka received a Coop Contract from the Department of the Air Force, Tyndall Air Force Base, Florida (Appendix L). The Contract provided Coop Training for Hydraulic and Robotics OCC Students in Tele-Operated Robotized Hydraulic Heavy Construction Equipment; it also provided for permanent employment in that area for successful candidates. The Air Force indicated great interest for college approval. This contract was handed in to the Business and Professional Institute but the program was never implemented.

Konopka also proposed establishing a two track program at OCC:

1) A Fluid Power Maintenance program which would train students in mechanics, repair, maintenance, and trouble shooting.

2) A Fluid Power Engineering Technology program which would graduate students capable of using computer software to help design, analyze, and simulate programs, and capable of working in the laboratory environment to run hydraulic and pneumatic component and systems operational test beds; and be able to enter careers in tech aero space technologies.

A similar expansion suggestion was made by a Rexroth employee. Under his plan, students would start with basic fluid power courses in their first year, and then choose between sales/engineering and maintenance/repair. He maintains that there is a good distinction between these two within the industry. In this scenario, computers become a necessary part of the engineering "track." Care should be taken to ensure that the sales/engineering students could transfer to a four year engineering school. The "maintenance/repair" track could be broadened and titled "Industrial Technology." According to the employers surveyed, there are differences between these two groups. This is also evidenced by the differentiation between a mechanic and a technician by the FPS Certification (Appendix C).

According to Konopka, one of the most important updates needed for the program is computers. Other experts agree that if the program is split into two tracks, the technician track should incorporate computers. In December 1990, Konopka was able to sort out and obtain abstracts for a number of computer programs which would be apropos to the OCC Fluid Power Technology program. In May of 1991, Konopka advised the College to get a site license from "Hydroworks" to establish a course in the design and drawing of hydraulic and pneumatic application circuits. He maintains that if the College offers "Hydroworks," OCC would not even need to sell the program -- there would be immediate enrollment. Konopka believes "There is a need for at least six computers at two thousand dollars each." Installation would be approximately three thousand dollars for a total of fifteen thousand dollars ($15,000). In addition to these costs, there is an approximate cost "of ten thousand dollars ($10,000) for additional equipment to sustain the pneumatics courses." These proposals have not yet been implemented.

In addition to considering implementing computers, the College may want to evaluate the electronics emphasis in the Fluid Power program. According to advisory committee minutes from 1991, "The current curriculum is lacking a focus on electronics" (Appendix B). An industry expert believes that electronics is extremely important for fluid power technicians; "'Electronic Control' is a current buzzword used by employers." A representative from Spokane stressed that students who are proficient in both fluid power and electronics "are sure to find a job." Tellahowski from Mott Community College maintains that colleges need to offer electro-hydraulics in order to keep pace with new technology. Some of the surveyed employers stressed that if their hydraulics and pneumatics employees also possess electrical skills, they can advance to engineering or shop superintendent. Because of this emphasis on electronics, Spokane is concerned about the knowledge level of college instructors. Representatives from the College fear that technology has moved ahead of what most instructors know. Specifically, "Programmable controls and circuitry have become so

important, and people who know fluid power do not necessarily know electronics." Konopka is aware of these issues, and has suggested adding ETT 201 (Electronic Circuits) to the Fluid Power curriculum at OCC.

Konopka may do marketing again in the Spring of 1993. He is concerned that his 1990 plan be continued and fully executed. After this is done, he would have more time to advertise the program.

Konopka has noted that "Even with the low general enrollment in the Fluid Power program it is still one of the profit producing programs in the Tech Area." He also believes that with a promotional update approach especially with computerized analysis and design, the program would become "hot" property.

CONCLUSION

Summary

The Fluid Power program at OCC has experienced great decline in enrollment in the years 1981-1992. This is not unique to OCC; student demand for Fluid Power programs nation-wide is extremely low. This is due partially to student preferences, partially to media emphasis of competing programs, partially to a lack of attention on the part of grade and secondary schools, and partially to the lack of information coming from industry to inform people of potential job opportunities. However, industry experts stress that there is great demand for people with fluid power skills. This was confirmed by the survey of local businesses; nearly half (47%) reported an increasing need for employees skilled in fluid power and 42% of the employers plan to hire new people to meet this need.

Even the most successful Fluid Power programs in the country are going through assessments and restructuring. There is nation-wide concern for and debate over the knowledge level of instructors, the types of students being channelled into vocational programs from the high schools, and the most effective structure for a Fluid Power program. However, all the successful programs have at least one full time faculty member who is willing to devote his time to these concerns. If OCC wants to revive this program, it has been strongly advised that a full time faculty member is hired at some point. Edward Konopka is doing a lot of the necessary work now, but he admittedly does not have the time needed for this program to be successful.

Konopka has suggested offering two tracks within the Fluid Power program, and this has also been suggested by industry experts and faculty members at other colleges. One track could focus on maintenance and repair; the other on sales and engineering technology. In some colleges, the maintenance and repair track culminates only in a certificate; a degree is offered in the sales and engineering technology track with the option of transferring to a four year school. It has also been suggested that computers be integrated into the engineering track. There are curriculum guides available and other colleges going through these same thought processes; there is plenty of accessible information and assistance if OCC wants to further investigate.

Finally, most everyone involved with fluid power thinks the program at OCC has great potential for success. It needs a lot of work, but it has an equipped lab and surrounding employers; many of whom would be willing to be part of an advisory committee. There are fluid power instructors throughout the country who may be willing to act as consultants for OCC, or who will at least supply information to the College. As one instructor said, "We are in this together, this is not competition. I am willing to help you in any way; these programs are necessary, but too often neglected, and the more we help each other, the better off we'll all be."

Issues

- Perhaps OCC can learn from the steps Macomb has taken. By turning their Fluid Power degree into a certificate which could lead to an Industrial Technology degree, they are bridging across traditional lines of demarcation, which is what many experts are saying is happening in the field today.

- The program could be further focused by dividing it into two tracks such as has been done at Chippewa Valley. This has also been recommended by industry experts. One track could be the Industrial Technology degree or certificate; focusing on maintenance and repair. The other track could be engineering technology and sales; this track could make use of computers.

- Some colleges have admitted that they are mainly concentrating on hydraulics. Experts in the pneumatics field have stressed that they would like to see a good compressed air program in the Southeast Michigan area. It may be worthwhile to consider either building up the pneumatics program and separating it from hydraulics, or solely concentrating on hydraulics.

- Along with the need for new employees in fluid power, this assessment also uncovered a need for additional training. Vickers Incorporated trained 1300 customers in hydraulics and electro-hydraulics in 1992 and they had to deny training to some. Similarly, Rexroth's $800 per week training classes are always filled and they see an increasing demand for training nation-wide.

- There is not an active advisory committee for the Fluid Power Technology program. The employers surveyed indicated whether or not they would be willing to participate in the maintenance of the program; perhaps the willing ones could be contacted for the formation of an advisory board.

- The coordinators of tech prep at OCC are willing to look into working with area high schools in fluid power. However, without a full time faculty member here, it would be difficult to run a fluid power tech prep program. Perhaps OCC can team up with Macomb or one of the other local colleges and team teach the courses or share resources in some other way.

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Appendix A
Oakland Community College
Fluid Power Technology
Program Description

Fluid Power Technology

Auburn Hills

Major Requirements			Credits
ATF	140*	Introduction to Hydraulics	3
ATF	143*	Hydraulic Components and Circuits	3
ATF	147*	Fundamentals of Pneumatics	3
ATF	148*	Pneumatic Components and Circuits	3
ATF	250*	Fluid Power Forces and Mechanics	3
ATF	252*	Fluid Power Circuits and Systems	3
ATF	254*	Fluid Power Fabrication Techniques	3
ATF	256*	Fluid Power Logic Systems	3

Required Supportive Courses			
APD	813	Shop Drawing I	3
APD	861	Pipe and Tube Isometrics	3
APM	811*[1]	Geometry-Algebra	3
APM	821*[1]	Plane Trigonometry	3
APP	815	Applied Technology I	2
APP	816	Applied Technology II	2
APT	831	Industrial Safety	2
ENG	135★[2]	Business Communications	3
ETT	101	Electrical Fundamentals I	3
IND	100	Introductory Seminar in Industrial Sciences	2

General Education Requirements

See graduation requirements for an Associate in Applied Science Degree on Pages 33, 35 and 36.

The Fluid Power Technology Program will prepare the student to achieve functional competence at job entry level as a Fluid Power Technician. The specialty courses involved will cover both the theory and application of many aspects of hydraulics and pneumatics.

The student will gain a limited amount of work experience in the hydraulics laboratory, using training aids to construct and to operate both hydraulic and pneumatic circuits. The supportive and related instruction will assist the student in understanding basic principles and will broaden the scope of understanding in the Fluid Power Industry.

[1]The student may substitute MAT 154 and MAT 156 or equivalent.
[2]The student may substitute ENG 131, ENG 151, or an English writing course of a higher level.
★General Education courses listed as Required Supportive may be used to meet requirements of the General Education component.
*When all the courses marked with an asterisk are completed, the student may apply for a Certificate.

in the systems, with an emphasis on safe and proper work habits and procedures. Course fee.

(ATF)
Fluid Power Technology

ATF 140.....3 Credits
Introduction to Hydraulics
This course illustrates the application of physical concepts such as Boyle's Law, Charle's Law, Bernoulli's Theorem, Torrecellie's Law, Pascal's Law, K'Arch's Equation, Reynold's Number, pressure drop, density, specific gravity, efficiency and horse power, through basic hydraulic circuitry. Emphasis is placed on circuit components and how they work. Course fee.

ATF 143.....3 Credits
Hydraulic Components and Circuits
Prerequisite: ATF 140 or equivalent.
This is a laboratory course on the use and limitations of hydraulic circuits and their components. Circuits are designed, built and analyzed. "Trouble shooting" will find instructor-induced errors before proceeding to the next, more complicated circuit. Course fee.

ATF 147.....3 Credits
Fundamentals of Pneumatics
This course is designed to provide the student with the technical knowledge and practical applications for control of valves that operate various air-powered devices. Topics are design, installation and trouble shooting control air circuits; nature of compressed air, compressed air flow, work devices, control devices, circuit diagrams, development of pneumatic control circuits, power source selection and information tables, standard safety procedures, and application of diagramming and blueprint reading. Field trips will be conducted to inspect modern pneumatic equipment, installations and applications. Course fee.

ATF 148.....3 Credits
Pneumatic Components and Circuits
Prerequisite: ATF 147.
The course will provide the student with practical knowledge regarding circuit design, the mechanical principles of pneumatic components, building and maintaining control panels, repair techniques and trouble shooting. Laboratory experiences will supplement classroom lectures and demonstrations. Field trips will be arranged to inspect modern penumatic equipment, installations and applications. Course fee.

ATF 250.....3 Credits
Fluid Power Forces and Mechanics
Prerequisite: ATF 143 or equivalent.
The student will gain an understanding of the relationship of forces, motion, work and power and the resulting effects on machine parts. Reactionary forces involved in component fabrication as well as circuit fabrication will be studied. Fluid power actuated mechanical advantage-type clamping and other work devices will be used to demonstrate amplification during energy transfer. Course fee.

ATF 252.....3 Credits
Fluid Power Circuits and Systems
Prerequisite: ATF 250 or equivalent.
The student will obtain a working knowledge of how fluid power circuits are designed using appropriate symbols and language. Actual hydraulic, pneumatic and/or electrical components are then assembled and the circuit operation is tested. Techniques of circuit calculations, component selection factors and circuit troubleshooting are covered. Applications of fluid power systems to industrial systems are included. Course fee.

ATF 254.....3 Credits
Fluid Power Fabrication Techniques
Prerequisite: ATF 252.
The student will display a working knowledge of various metals and elastomers used in the fabrication of fluid power components. Specific fabrication applications will include: drilling, tapping, milling, grinding, lathe turning, brazing, and welding. The student will be required to layout and fabricate various fluid power components utilizing the previously stated fabrication techniques. Course fee.

ATF 256.....3 Credits
Fluid Power Logic Systems
Prerequisite: ATF 254 or consent of instructor.
The fundamental principles of logic functions, digital control circuits and data organization are presented. Laboratory experience serves to confirm and clarify the student's understanding of these principles. The student sees their applications to several modes of control such as pneumatic, fluidic, electro-mechanical and electronic. Typical applications of fluid power logic systems in industry are represented. Course fee.

Appendix B
Fluid Power Technology
Advisory Committee Minutes
&
Summary Report for Self Study
Evaluation

FLUID POWER TECHNOLOGY

December 4, 1980

Oakland Community College
Auburn Hills Campus
2900 Featherstone Road
Auburn Heights, Michigan 48057

FLUID POWER TECHNOLOGY

Table of Contents

PART I

PROGRAM DESCRIPTION

Mission Statement
Design Criteria
Performance Goals

PROGRAM DESCRIPTION

Mission Statement:

The Fluid Power Technology Program will prepare the student to achieve functional competence, at job entry level as a Fluid Power Technician. The specialty courses involved will cover many aspects of hydraulics, and pneumatics; both the theory and application of these aspects. The student will gain a limited amount of work experience in the hydraulics laboratory, using training aids to construct and operate both hydraulic and pneumatics circuits. The supportive and related instruction will assist the student in understanding basic principles and broaden the scope of understanding in the Fluid Power Industry.

DESIGN CRITERIA I

Program Goals:

P. G. I — The student will gain a basic working knowledge of Fluid ~~Dynamics~~ statics as it relates to automation in industry today.

P. G. II — The student will gain a working knowledge of hydraulic circuit components.

P. G. III — The student will gain a working knowledge of pneumatics circuit components, their functions and applications.

P. G. IV — The student will construct simple, and complex hydraulic circuits, using training aids and modules to demonstrate functional competence as a Fluid Power Technician.

P. G. V — The student will gain specific abilities in mathematics, and applied physics, as well as other related areas to aid in problem solving situations which arise in the Fluid Power Industry today.

P. G. VI — The student will gain a functional knowledge of logic as it relates to the design and operation of various hydraulic and pneumatics circuits and systems, used in industry today.

P. G. VII — The student will perform various objectives in the laboratory; such as the rebuilding of hydraulic and pneumatics components, there by developing and improving manipulative abilities.

Consider the design aspect of the program (courses) Actually do a design before you do Trouble shooting

PART II

CURRICULUM

ASSOCIATE DEGREE AND CERTIFICATE

PROPOSED FLUID POWER
ASSOCIATE DEGREE PROGRAM

REQUIRED SPECIALTY COURSES		CREDITS
*ATF 840	Introduction To Fluid Power (Presently APT 840, Fluid Dynamics).....	3
*ATF 843	Hydraulic Components and Circuits (Presently APT 843, Hydraulics)....	3
*ATF 847	Fundamentals of Pneumatics (Presently APT 847, Pneumatics I).....	3
*ATF 848	Pneumatic Components and Circuits (Presently APT 848, Pneumatics II).	3
*ATF 850	#Fluid Power Forces and Mechanics.....	3
*ATF 852	#Fluid Power Circuits and Systems.....	3
*ATF 854	#Fluid Power Fabrication and Techniques.....	3
*ATF 856	#Fluid Power Logic Systems.....	3
*APM 811[1]	Geo-Algebra.....	3
*APM 821[1]	Plane Trigonometry.....	3

REQUIRED SUPPORTIVE COURSES		
IND 100	Introductory Seminar for Industrial Sciences.....	2
APT 831	Industrial Safety.....	2
APD 813	Shop Drawing I.....	3
ETT 101	Electrical Fundamentals I.....	3
APP 815	Mechanics I.....	2
APP 816	Mechanics II.....	2
APP 817	Mechanics III.....	2
APP 818	Mechanics IV.....	2

GENERAL EDUCATION REQUIREMENTS

The student will select 12-16 credit hours in at least three of the following four general areas:

1. Communications/English
2. Humanities
3. Math/Natural Science
4. Social Science

The student must also complete a State requirement with:

POL 151	American Government	3

ASSOCIATE DEGREE. . . . . 63 - 67

*When all the courses marked with an asterisk are completed, the student may apply for a Certificate of Achievement.

#New Courses to be developed.

[1]The student may substitute MAT 155 and MAT 156 or equivalent.

PART III

COURSE DESCRIPTIONS

FLUID POWER TECHNOLOGY
COURSE DISCRIPTIONS

APT 840 FLUID DYNAMICS (48 hours) 3 Credits

A laboratory course that illustrates the application of physical concepts such as Boyle's Law, Charles' Law, Bernoulli's Theorem, Torrecellie's Law, Pascal's Law, K'Arch's Equation, Reynold's Number, pressure drop, density, specifice gravity, efficiency and horsepower through basic pneumatic and hydraulic circuitry. Emphasis on understanding circuit components and how they work.
Lab fee: $3

APT 843 HYDRAULICS (48 hours) 3 Credits

Prerequisite: APT 840 or equivalent
A laboratory course on the use and limitations of hydraulic circuits and their components. Circuits are designed, built and analyzed. Trouble shooting to find instructor-induced errors before proceeding to the next, more complicated circuit.
Lab fee: $5

APT 847 PNEUMATICS I (48 hours) 3 Credits

Prerequisite: APT 840 or equivalent
This course is designed to provide the student with the technical knowledge and practical applications for control of power valves that operate various air-powered devices. Design, installation and trouble shooting control air circuits. Nature of compressed air, compressed air flow, work devices, control devices, circuit diagrams, development of pneumatic control circuits, power source selection and information tables, standard safety procedures, and application of diagramming and blueprint reading. Field trips will be conducted to inspect modern pneumatic equipment, installations and applications.
Lab fee: $5

APT 848 PNEUMATICS II (48 hours) 3 Credits

Prerequisite: APT 847
The course will provide the student with practical knowledge regarding circuit design, the mechanical principles of pneumatic components, build and maintain control panels, repair techniques and trouble shooting. Laboratory experiences will supplement classroom lectures and demonstrations. Field trips will be arranged to inspect modern pneumatic equipment, installations and applications.
Lab fee: $5

Fluid Circuit Design
Pump pressure off, Circ

FLUID POWER TECHNOLOGY
NEW COURSE DESCRIPTIONS

* ATF 850 FLUID POWER FORCES AND MECHANICS 3 Credits

The student will gain an understanding of the relationship of forces, motion, work and power and the resulting effects on machine parts. Reactionary forces involved in component fabrication as well as circuit fabrication will be studied. Fluid power actuated mechanical advantage-type clamping and other work devices will be used to demonstrate amplification during energy transfer.

* ATF 853 FLUID POWER CIRCUITS AND SYSTEMS 3 Credits

The student will obtain a working knowledge of how fluid power circuits are designed using appropriate symbols and language. Actual hydraulic, pneumatic and/or electrical components are then assembled and the circuit operation is tested. Techniques of circuit calculations, component selection factors and circuit troubleshooting are covered. Applications of fluid power systems to industrial situations are included.

* ATF 852 FLUID POWER FABRICATION AND TECHNIQUES 3 Credits

This course is designed to provide the student with a working knowledge of metals, elastomers, tools, and other equipment and supplies normally used in the fluid power industry when designing, building or maintaining fluid power equipment. It includes a study of the physical characteristics of both metals and elastomers with respect to their behavior during fabrication and usage. Methods of material removal, elementary aspects of machine tool operation and tooling requirements are studied.

* ATF 856 FLUID POWER LOGIC SYSTEMS 3 Credits

The fundamental principles of logic functions, digital control circuits and data organization are presented. Laboratory experiences serve to confirm and clarify the student's understandings of these principles. The student sees their applications to several modes of control such as pneumatic, fluidic, electro-mechanical and electronic. Typical applications of fluid power logic systems in industry are represented.

* New Courses

FLUID POWER TECHNOLOGY
RELATED SUPPORTIVE COURSES

APD 813 SHOP DRAWING I 3 Credits

This course is the first in a series of drafting classes designed for the apprentice or technical student. It covers basic drawing techniques: linework, geometric construction, orthogonal projection, primary auxiliaries and axonometric projection. Emphasis will be placed upon the relation of reference planes in view solution.
Lab fee.

ETT 101 ELECTRICAL FUNDAMENTALS 3 Credits

Prerequisite: TEM 102 or equivalent
This course introduces the basic theories of electricity as they relate to direct current. Emphasis is placed on safety, tools and materials of the trade, the electron theory, Ohm's Law, conductors and insulators, series circuits, parallel circuits, series-parallel circuits, magnetism, application of magnetism to electromagnetic devices as applied to industrial controls, electrical nomenclature, units of measurement, resistors, and electrical symbols. The correct use of basic measuring instruments (reinforced through laboratory exercises) will include volt-meters, ampere-meters, and ohm-meters. Transparencies, slide films, movies, programmed instruction, and other instructional media is utilized.

APM 811 GEOMETRY-ALGEBRA 3 Credits

Prerequisite: Secondary school algebra or TEM 102
This course will provide the student with the fundamentals of Algebra and Geometry as applied to practical industrial problems that arise in his trade area. Topics include positive and negative numbers, ratio and proportion, simple equations, percentage, taper, square root, formulas and quadratic equations. Geometry principles of axioms, propositions, circle definitions, central angles, and tangents will be applied in the problem solving techniques of actual trade problems.

APM 821 PLANE TRIGONOMETRY 3 Credits

Prerequisite: APM 811 or equivalent
This course provides the student with the basic principles of trigonometry as applied to industrial problems. Topics covered are basic trigonometric functions, functions of angles, relations between trigonometric functions, tables and their uses and solution of right angles. It will also cover the interpolation of angles to the nearest second of a degree, solution of oblique triangles by right triangle methods, Law of Sines and Law of Cosines.

APP 815 MECHANICS I 2 Credits

Prerequisite: APM 811 or equivalent
This course is designed to provide the student or apprentice with the basic fundamentals and applications of physics principles in the field of mechanics as applied to the trade field of his choice. Topics covered are fundamental concepts of matter and energy, measurement and units, simple and compound machines, laws of machines, pulleys, levers and their application, gears, mechanical advantages, work, energy and power, efficiency and friction, and the motion of bodies. Nomenclature, useful formulas, and practical problems are emphasized.

APP 816 MECHANICS II 2 Credits

Prerequisite: APM 811 or equivalent
This course will provide the student or apprentice with the necessary technical knowledge and practical application of static pressure and force in fluids as well as buoyancy (Archimede's Principle), weight and pressure relationship, atmospheric pressure and altitude, barometers and specific weight. The transmission of pressure by fluids (Pascal's Law) as an introduction to fluid dynamics, hydraulics and pneumatics, application of Boyle's Law, production, transmission, reflection and interference effects of sound, dispersion and reflection of color will be studied. Typical problems in each unit of instruction are stressed.

APP 817 MECHANICS III 2 Credits

Prerequisite: APM 811 or equivalent
This course will provide the student or apprentice with the basic technical knowledge and applications of the nature of heat, heat transfer, sources of heat, radiation, and cooling fins. Other topics covered are expansion of solids, liquids and gases, measurement of heat, heat exchangers, change of state, principles of refrigeration and air conditioning,converting heat to work, internal and external combustion engines, diesel engines, and steam engines and turbines.

APP 818 MECHANICS IV 2 Credits

Prerequisite: APM 811 or equivalent
This course will provide the student or apprentice with the technical knowledge and application of magnetism, static electricity, electricity, electric current and circuits, electro-magnetism, electro-magnetic induction, direct current, alternating current, electronics and their application to industrial machines. Material covered is basis for further study in industrial electricity and electronics.

APT 831 INDUSTRIAL SAFETY 2 Credits

The need for safe work habits in related work environment. Guest speakers, lectures and class discussion on safety both on and off the job.

IND 100 INTRODUCTORY SEMINAR IN INDUSTRIAL SCIENCES 2 Credits

The student will elect real or simulated experiences that characterize the functions and operations within the industrial sciences cluster. Further, the student will investigate careers within the industrial cluster such as occupational opportunities, wages, advancement, employee-employer relations and unionism, as well as environmental effect.

PART IV

SURVEY RESULTS

of

NEEDS - STUDY

OCC - AUBURN HILLS CAMPUS

FLUID POWER TECHNOLOGY ADVISORY COMMITTEE MEETING MINUTES

DATE: November 6, 1980
TIME: 2:00 p.m.
PLACE: Auburn Hills Campus, Conference Room B-217

PRESENT: Dolph Wright, G. M. Tech Center
Royce Shari, Sperry Vickers Corp.
Ken Brown, Pontiac Motor Division
Bob Alderman, Ford Motor Co., Tractor Division
Leon Hibbs, Pontiac Motor Division
Gary Fortune, Ingersoll Rand
Bill O'Mahoney, Oakland Community College
Larry Pennefather, Oakland Community College
Harvey Eschenburg, Oakland Community College
Dr. Bill Rose, Oakland Community College
Yvonne Nielsen, Oakland Community College

An introduction of committee members was made. This was the first meeting of the group. Mr. O'Mahoney distributed the advisory committee brochure and explained the committee's general function.

The results of the Fluid Power Employers' Survey was distributed. Mr. O'Mahoney explained that the results were fair, taking into consideration the current economic conditions. The results are acceptable pending an economic upturn in the near future.

Dr. Rose stated that there currently exists a laboratory for this program on campus. It only has minor equipment, however, at the present time. Equipment needs will be the focus of the next meeting. Suggestions submitted by letter or telephone will be appreciated. It was mentioned that Bardsdale (Transamerica Corp.) would be willing to make an equipment contribution if specific needs were identified.

Mr. Brown stated that he is currently assisting with a "trouble-shooting" course at Pontiac Motors for all employees. Cutaways are being used that were assembled from scrap materials. The possibility of using such materials will be further explored.

Mr. Wright extended an invitation for up to five persons to tour the GM Tech Center, the week of November 24th, to view a display of future as well as present equipment and machinery. (Employees of Ford Motor Co. and Chrysler Corp. not included).

Fluid Power Technology Advisory Committee Meeting Minutes Cont.

A complete set of course description will be mailed to all committee members for their input. A need was mentioned for the inclusion of both hydraulic and electrical services.

All members were taken on a tour of the facility.

The next meeting is scheduled for Thursday, December 4, 1980 at 2:00 p.m. to address equipment and laboratory needs.

/saw

EMPLOYERS

19 - RETURNED

At Oakland Community College we are seeking to identify and develop educational programs that meet the needs of the employment community. The program described in this questionnaire is one that has been outlined to us in an area for which we should provide training. In order for us to identify employment needs, training needs, and curriculum components, please answer the following questions to the best of your ability.

1. Are you aware that Oakland Community College offers:

1. Vocational Counseling	17 YES	2 NO
2. Academic, Liberal Arts Curriculum	18 YES	1 NO
3. Health Occupations Training	14 YES	5 NO
4. Technical Training	16 YES	3 NO
5. Job Placement	14 YES	5 NO
6. Continuing Education	18 YES	1 NO

2. Are you familiar with the educational programs offered by Oakland Community College?

13 YES 6 NO

3. Do you employ any persons with educational background from Oakland Community College?

12 YES 6 NO

FLUID POWER TECHNOLOGY

This is an area designed to prepare technicians knowledgeable in the area of transmission and control of power through hydraulics, pneumatics, fluidics, and electro fluid power.

The following is a list of components for curriculum content. Please rate the level of importance of these items as they relate to the training of persons with this job skill. The rating scale is to be interpreted as follows: 1 - no importance; 2 - little importance; 3 - moderate importance; 4 - high importance; 5 - extreme importance.

1. Controls	(14)	3.79	1 2 3 4 5
2. Circuitry	(14)	3.79	1 2 3 4 5
3. Hydraulic Principles	(14)	3.79	1 2 3 4 5
4. Physics Principles	(13)	2.92	1 2 3 4 5
5. Pumps & Operations	(14)	3.14	1 2 3 4 5
6. Compressors & Operations	(14)	2.86	1 2 3 4 5
7. Maintenance Procedures	(14)	3.14	1 2 3 4 5
8. Instrumentation	(14)	3.36	1 2 3 4 5
9. Trouble Shooting Techniques	(14)	3.71	1 2 3 4 5
10. Control Circuits	(14)	3.64	1 2 3 4 5
11. Electro Hydraulic Systems	(14)	3.71	1 2 3 4 5

Continued on back

	Written Communication	(14)	3.5	1	2	3	4
12.	Oral Communication	(14)	3.28	1	2	3	4
14.	Applied Mathematics	(14)	3.43	1	2	3	4
15.	Technical Mathematics	(14)	3.21	1	2	3	4
16.	Safety Practices	(14)	4.21	1	2	3	4
17.	Numerical & Logic Controls	(12)	3.92	1	2	3	4
18.	Microprocessor Principles	(13)	3.61	1	2	3	4
19.	FOLLOW INSTRUCTIONS	(1)	5	1	2	3	4
20.	ATTENDANCE	(1)	5	1	2	3	4

1. Would you be willing to hire persons with job training in this field? ___YES ___
2. What is your current employment capacity for persons with this educational background? _____
3. How many new employees have you hired in this field in the last year? _____
4. What do you estimate your future employment potential in the terms of new positions for
   the next year_____ the next five years_____
5. How many new people will have to be hired as replacements as a result of resignations, terminations, etc.?
   the next year_____ the next five years_____
6. Do you feel the job market and/or future projection indicates a need for this occupatio
   ___YES ___
7. Do you feel there is a need for educational training in this field? ___YES ___
8. Do you feel that two years of education is appropriate training for job skills in this field?
   ___YES ___
9. Would this type of program provide continuing education to upgrade the skills of your current employees?
   ___YES ___
10. Would you recommend this type program to your present employees? ___YES ___
11. How many persons do you presently employee? Less than 25___; 25 to 49___; 50 to 99___; 100 to 499___; 500 to 2000___; more than 2000___.
12. Would you provide a work/training site for students in this program? ___YES ___
13. Please provide the following hourly salary information:
    $_____starting $_____6 month $_____1 year

13.A Are there other salary intervals of note?

_____

Name and address of company completing questionnaire

See Attachment for 1-13

_____

_____

_____

ACCOUNTING — FLUID POWER

QUESTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.	Y	?	Y	N	N	?	Y	N	Y	N	N	Y	Y	N	N	Y	N	Y
2.	OPEN	0	0	0	0	–	2	a	b	0	-2	–	1	0	0	?	0	3
3.	6	0	0	-	0	-	0	0	0	0	0	-	0	0	0	5	0	0
4a.	4	0	?	1	0	?	0	0	2	0	0	-	1	0	0	?	UNK	2
b.	10	1	?	3	0	-	1	1	5	0	2	-	2	0	0	?	UNK	4
5a.	4	0	?	1	0	-	0	0	2	0	-	-	0	0	0	?	UNK	1
b.	20	0	?	3	0	?	1	0	?	0	-	-	0	0	0	?	UNK	-
6.	Y	Y	Y	Y	Y[c]	N	Y	Y	Y	N	Y	Y	Y	?	N	Y	N	Y
7.	Y	Y	Y	Y	Y[c]	N	Y	Y	Y	N	Y	Y	Y	?	N	Y	Y	Y
8.	—	Y	Y	Y	Y[c]	Y	Y	Y	—	—	N	N	Y	?	N	Y	Y	Y
9.	Y	N	Y	N	Y[c]	Y	Y	Y	Y	N	?	Y	Y	?	N	Y	N	Y
10.	Y	N	Y	N	Y[c]	N	Y	N	Y	N	N	Y	Y	?	N	Y	N	Y
11.	500-2000	25-49	<25	<25	—	<25	50-99	<25	50-99	<25	<25	100-499	<25	25-49	100-499	500-2000	2000+	25-49
12.	?	N	N	N	Y[c]	N	N	N	N	N	N	N	Y	N	N	?	Y	N
13. a	$7.21	?	$5.00	$4.50-5.00	–	d.	$9.00	–	–	–	–	–	$6.00	$4.50	–	—	—	—
b.	—	?	$6.00	$5.00-5.50	–	?	$9.50	—	—	—	—	—	$7.00	$5.00	—	—	—	—
c.	$8.07	?	$7.00	$6.00-6.50	–	?	$10.00	—	—	—	—	—	$8.00	—	—	—	—	—
A.	—	—	—	—	—	—	e.	—	f.	—	—	—	g.	—	—	—	—	—

* THIS EMPLOYER FELT HE COULD NOT ANSWER THESE QUESTIONS INTELLIGENTLY.

a. OUTSIDE SERVICE USED.

b. NONE NOW, BUT WITH IMPROVED ECONOMY 2-3

c. "NO KNOWN REQUIREMENT FOR THIS SKILL IN DETROIT AREA OPERATIONS"

d. UNSKILLED – $3.50/hr. SKILLED – $8.00/hr.

e. INTERVALS CONTINUE TWICE A YEAR

f. DEPENDS ON CAPABILITY

g. BASED ON MERIT

PART V

SUPPORT INFORMATION

VICKERS

NORTH AMERICAN GROUP
TROY, MICHIGAN 48084

November 26, 1980

Mr. Bill J. Rose
Dean of Career Education
Oakland Community College
Auburn Hills Campus
2900 Featherstone Road
Auburn Heights, Michigan 48057

Dear Mr. Rose:

Fluid power is an industry that has realized its greatest development in the past two or three decades. Since World War II the industry has grown at a hectic pace.

Today, the National Fluid Power Association estimates that hydraulics and pneumatics shipments will exceed $6 billion in 1981, ranking fluid power sales with those of such large capital goods industries as machine tools, industrial trucks, and construction equipment.

Fluid power education opens a broad spectrum of career opportunities because of the wide diversity of hydraulics applications in industry.

For example, hydraulics are used in industrial machines designed for the production of thousands of products, from the automobiles we drive to the plastic toys our children play with.

Hydraulics can be found on such mobile applications as heavy duty construction vehicles and earthmoving equipment, large trucks used in commerce, and farming equipment.

Even more dramatic are hydraulics at work in commercial air travel. From the up-and-down motion of landing gear to the movement of wing flaps, ailerons, and rudders. Today's big jets depend on hydraulics for smooth, safe operation. Hydraulic components can also be found on missiles, tanks, space craft launch vehicles, on the deck of Navy and commercial sea-going vessels, and on submarines.

Hydraulics continues to be one of the most efficient and versatile means known of putting machines to work--even in a world crowded with electrical and mechanical devices.

MY TELEPHONE NUMBER IS (313) 280-3646

VICKERS

Sperry Vickers has been a leading name in the fluid power field for more than 50 years and has pioneered many basic design developments on which modern fluid power systems are based. A division of the New York-based Sperry Corporation, the company employs some 10,000 people worldwide. We are truly a multi-national company with operations in 32 countries and distributorships in 13 more.

Our need for technically trained personnel is obvious. And our support in helping train hydraulics professionals has been substantial.

Since 1945 Sperry Vickers has operated its own Hydraulics School as part of an intensive customer training program. Regularly scheduled courses cover industrial and mobile product applications and servo maintenance programs. Aerospace, marine, and military programs are held when the need arises and are tailored to meet specific customer needs.

Growing from just 78 students 35 years ago, the school today, located in Clawson, Michigan, annually enrolls some 900. More than 17,000 students representing 3,700 companies have completed courses to date.

Sperry Vickers also began offering scholarships in 1978 to the Purdue University School of Technology and the Milwaukee School of Engineering. A total of 11 students in their junior and senior years have received scholarships and are following a program which will lead to employment in the fluid power field.

At Sperry Vickers, we see a growing need for more fluid power programs in formal education and would welcome this expansion of Oakland Community College's curriculum. In our judgment, there is, and will continue to be, a great demand for highly trained and skilled hydraulic professionals.

Sincerely,

A. O. Roberts
Vice President
Staff Engineering

Ingersoll-Rand Company
AUTOMATIC PRODUCTION SYSTEMS
23400 HALSTEAD ROAD
FARMINGTON HILLS, MICHIGAN 48024

TELEPHONE: 313-477-0800 TELEX: 235623 INRYCO FRTN

November 18, 1980

Mr. William J. Rose
Dean of Career Education
Oakland Community College
Auburn Hills Campus
2900 Featherstone Road
Auburn Heights, MI 48057

Dear Mr. Rose:

As a manufacturer of automatic machinery systems to both assemble and test a multitude of items large and small for both domestic and foreign markets, we have a continuing need for people who posses basic and advanced skills in fluid power systems. The needs of our company in this regard are most certainly duplicated in the many similar and allied organizations in this geographical area.

We are therefore, pleased to know that Oakland Community College is undertaking to train young people in fluid power systems in order to fill these needs. By establishing the proposed program, Oakland Community College will be providing available community service and training that will allow students to select from many attractive career opportunities.

You have both our support and commendation in this endevour.

Very truly yours,

INGERSOLL-RAND COMPANY

Gary T. Fortune

Gary T. Fortune
Assistant Engineering Mngr.

PART VI

ADVISORY COMMITTEE

FLUID POWER ADVISORY COMMITTEE

Dolph Wright
Senior Project Engineer
Manufacturing Development
G.M. Tech Center
Warren, MI 48090
575-0876

John Pippinger, Vice-Chairman
The Fluid Power Education Foundation
124 Florida Street
Laurium, MI 49913
906--337-5167

Steve Coleman
Hydraulics Student
696 W. Baker
Clawson, MI 48017
435-8658

Royce Shari, Manager
Customer Training
Hydraulics Training School
Sperry Vickers Corporation
1401 Crooks Road
Troy, MI 48084
280-3000

Ken Brown
Manufacturing Engineer
Pontiac Motor Division
4097 E. Main
Brown City, MI 48416
346-3068

Armand Johnson
Fluid Power Instructor
S.E.O.V.C.
5055 Delemere
Royal Oak, MI 48073
280-0600

Bob Alderman, Manager
Axle & Hydraulics Dept.
Ford Motor Company
Tractor Division
2500 E. Maple
Troy, MI 48084
643-2263

Leon Hibbs
Manufacturing Engineer
Pontiac Motor Division
General Motors Corporation
One Pontiac Plaza
Pontiac, MI 48053
857-0976

Art Evans, Superintendent
Manufacturing Engineering
Pontiac Motor Division
General Motors Corporation
One Pontiac Plaza
Pontiac, MI 48053
857-0976

Gary Fortune
Assistant Manager
Engineering Department
Ingersol Rand Company
23400 Halstead Road
Farmington Hills, MI 48024
477-0800

Ex Officio Members

Harvey Eschenburg
Hydraulics Instructor
Oakland Community College
Auburn Hills Campus
2900 Featherstone Road
Auburn Heights, MI 48057
852-1000 ext. 212

Bill J. Rose
Dean of Career Education
Oakland Community College
Auburn Hills Campus
2900 Featherstone Road
Auburn Heights, MI 48057
852-1000 ext. 306

OAKLAND COMMUNITY COLLEGE
AUBURN HILLS CAMPUS • 2900 FEATHERSTONE ROAD • AUBURN HILLS, MICHIGAN 48057 • 313-853-4200

May 30, 1986

Dear Fluid Power Advisory Committee Member:

In attendance at the Fluid Power Advisory Committee meeting on May 29, 1986 were the following members:

Ken Brown - CPC Pontiac
George Doig - Doig Associates
Barbara Einhardt - OCC
Harvey Eschenburg - OCC
Steve Goulette - Aeroquip
George Nordenholt - Vickers
Dolph Wright - General Motors

1) Harvey Eschenburg presented an overview of the Fluid Power curriculum. The program includes both hydraulics and pneumatics components. Supportive classes include Geometry-Algebra and Plane Trigonometry which are important basics to understanding the program concepts.

2) Dolph Wright presented the partnership which is being developed with Rexroth Corporation and Oakland Community College. OCC will purchase eight test stands and peripheral equipment and will become the Midwest Training Center for Rexroth.

3) Committee members commented on the lack of good textbooks to teach pneumatics. There does not appear to an up-to-date source for this material. Dolph Wright and George Doig hope to compile materials for instruction.

4) The suggestion was made to develop a course to familiarize students with electrical controls since electronic equipment is being moved into shops with greater emphasis.

5) The goal of the program is to graduate students as engineering technicians who are able to calculate and understand the design of the system. Students need to understand circuitry in order to troubleshoot.

6) Committee members toured the Fluid Power Labs and completed program surveys.

Sincerely,

Barbara Einhardt

Barbara Einhardt
Admin. Assistant:
Dean of Career Education

c: Dr. Gram
Dr. Rose

3. a. Summary of Evaluation Perceptions by Administrators and Faculty

Number of Administrators and Faculty Participating 3

Comments:

- Goals and objectives for individual courses need to be improved and expanded
- Good use of small group instruction
- Supportive courses are relevant to needs of the students
- Adequate coordination with business and industry
- Plans to update the lab/equipment for Sept, 86 are excellent
- Job placement of students is improving
- There is a high level of interest in this program from area industries
- The Advisory Committee is actively involved with this program
- This program functions effectively in supporting the curriculum needs of the apprentice programs
- Part-time instructors are adequate to outstanding
- Advanced courses need to be offered and staffed
- The program needs to be updated to include electro-mechanical curriculum with lab experiences
- The program needs a dedicated faculty person who would be responsible for teaching the courses and overseeing the curriculum and lab

Recommendations:

- Develop improved goals and objectives for courses in the program
- Implement more follow-up on graduates
- Continue good coordination with business and industry
- Continue developing Co-op sites
- Marketing of this program needs to receive more emphasis
- Update the lab with current equipment in electro-mechanical units
- Designate a full-time instructor to teach and oversee the curriculum and lab
- New curriculum and lab exercises need to be developed and integrated within the program
- Advisory Committee meetings need to be held on a regular basis

3. b. Summary of Evaluation Perceptions by Students

Number of Students Participating: 48

Comments:

- Quality of instructors is not always good
- More hands-on time is needed in labs

Recommendations:

- Offer more courses through-out the year, they seem to be primarily run in fall semesters
- Provide more work experience with employer supervision
- Provide more career planning information and job success information of former students
- Provide more assistance in lab
- Increase number of work stations
- Update training equipment
- Update instructional materials (Pneumatics book is very poor, was not even used by instructor)

3. c. Summary of Evaluation Perceptions by Advisory Committee Members

Number of Advisory Committee Members Participating 6

Comments:

Major strengths of the Fluid Power Program include the following:

- Good quality instruction
- Good input from industry
- Program draws on experienced professionals in the field for part-time instructional staff
- Students learn a good basic knowledge of hydraulics and trouble shooting
- Good "hands-on" experience
- Exceptional key faculty
- Good access to needs of local automotive facilities
- Strong support of local industry
- Waiting job market exists for qualified students
- Good training given in performing engineering tests, including set-ups and reports
- Excellent addition to the program to include Rexroth in the instruction
- Program is doing a good job servicing both students and the community

Recommendations:

- Update the instructional equipment
- Place greater emphasis on relationship of electrical control to fluid power
- Continue teaching trouble shooting
- Give more focus to specific occupational fields
- Committee needs to meet regularly to review progress and utilize committee's influence in updating the curriculum and equipment

4. Summary of Community College Action Plan – (Include comments on goals and objectives, processes and resources. Use additional sheets if necessary.)

- Goals and objectives will be reviewed and improved.
- The college will place added emphasis on marketing this program.
- The lab will be reviewed for updating the equipment.
- Proposal will be made for a full-time instructor to teach and oversee the program.
- The Advisory Committee will meet on a regular basis.
-

FLUID POWER ADVISORY COMMITTEE MEETING

May 30, 1991

Present: Andy Binversie, Rexroth Corporation
Tom Blansett, Vickers Incorporated
Dorothy Buchan, OCC
George Doig, President, Doig Associates
Jim Hanneman, Oakland Schools
Janet Harp, OCC
Ed Konopka, OCC
Larry Pennefather OCC
Bill Rose, OCC

Dr. Rose welcomed the group and gave a history of the Fluid Power program at OCC. He mentioned that the OCC Foundation has a scholarship available for Fluid Power students. There are good lab and classroom facilities. Mr. Konopka noted that, through the auspices of the Rexroth Corporation, OCC has a fully equipped lab. The Pneumatics area must be upgraded.

Fluid Power is a two-year associate degree program. There is no full-time instructor, but we do have qualified adjuncts.

Computers and software must be incorporated into the program. Mr. Pennefather mentioned a recent conversation he had with Chancellor Fulton regarding the need for a computer center for the Technology Department. She told him to get the necessary information together, so he is forming a committee to explore the possibility of developing such a computer center. Both Vickers and Rexroth are using computers and software for designing circuitry. Pneumatic control software is used only in sizing valves and conductors. Andy Binversie indicated that a person still needs to have a basic understanding of mechanics in order to interpret what the computer is being asked to do.

Dr. Rose asked the committee if they thought OCC should maintain the Fluid Power program. Mr. Binversie stated that everything we use, sit on, even the cars in the parking lot, use hydraulics. Fluid power is not going to go away. Mr. Blansett agreed and said that it is here to stay and is becoming more complex. All areas of technology must be addressed. Mr. Doig asked if OCC is going to continue to offer Fluid Power courses. He stated that if these courses are to be continued, the program must be upgraded.

Dr. Rose would like to use the committee to analyze the curriculum and market the program. OCC has never focused a marketing plan on the Fluid Power program.

In regard to the curriculum, Mr. Pennefather noted that Pneumatics is a requirement in the Climate Control program, and that the Robotics program has Fluid Power courses in its curriculum as well. He also suggested integrating

Microprocessor classes with the Fluid Power program. The current curriculum is lacking a focus on electronics.

Dr. Rose asked the committee if the handout on the description of the Fluid Power Technician was accurate. He stated that the Dean at Spokane would probably send a list of job titles if contacted.

Mr. Konopka stated that two Fluid Power students are going to Tampa, Florida, to work with the space program.

The evaluation required by the Michigan Department of Education was distributed. Some of the committee members indicated that they were not familiar enough with the program to accurately complete the evaluation.

The next committee meeting was scheduled for Tuesday, September 17, 1991. The agenda will include a review of the evaluations, a review of the present core and required supportive classes (page 103 in the catalog), and a discussion of job classifications and job titles.

Submitted Janet A. Harp
Janet A. Harp

rs

HE-4185-I-B-FR 3/90

AUTHORITY: PL 98-524
COMPLETION: Voluntary (Consideration for funding will be possible only if form is returned.)

Michigan Department of Education
Higher Education Management Services
COMMUNITY COLLEGE SERVICES UNIT
Box 30008, Lansing, Michigan 48909

Direct questions regarding this form t. the Community College Services Unit at (517) 373-3360.

COMMUNITY COLLEGE SUMMARY REPORT FOR SELF-STUDY EVALUATION OF OCCUPATIONAL PROGRAMS July 1, 1990 to June 30, 1991

SUBMITTING EDUCATIONAL AGENCY	Name of College: Oakland Community College	College Code: 23A/2804
	Project Contact Person: Dr. David A. Doidge	
	Title: Dean, Academic Services	Telephone: (313) 471-7707
	Program Title: Fluid Power Technology	
	CIP Code: 15.9999	PIN: 0090

GENERAL INSTRUCTIONS:

Complete this Summary Report for each occupational program according to the college evaluation schedule. Submit it as the Program Evaluation is completed, but no later than June 30, 1991. This will allow the college to continue uninterrupted through the Program Planning Process.

A complete copy of the total evaluation document for each program must be kept on file at the college. This document may be requested at a later date for state or federal audit purposes. Specific definitions, guidelines, program components, and reporting requirements related to this Summary Report are found in Section 5 of the "Dean's Guide to Federally Reimbursed Community College Occupational Programs."

PART I. SUMMARY REPORT FORMAT

The following data and comments are recorded to summarize the results of the college Self-Study Evaluation:

1. PROGRAM ENROLLMENT (Previous Three-Year Figures)

Year	Unduplicated Headcount	Student Credit Hours for Specialty Courses	Student Contact Hours
1987-88	214		642
1988-89	118		354
1989-90	135		405

2. PROGRAM GRADUATES (Previous Three-Year Figures)

Year	Unduplicated Headcount
1987-88	0
1988-89	0
1989-90	0

3. a. **Summary of Evaluation Perceptions by Administrators and Faculty**

Number of Administrators and Faculty Participating 3

Comments:

1. The Fluid Power program is a viable program which should produce technicians that are employable in automated machine repair and/or installation in the many small and large manufacturing companies throughout the Oakland County area.
2. Business, manufacturing, and training partnerships should be explored that will enhance curriculum development, equipment improvement, development of faculty, and marketing opportunities. For the last four years, OCC has been in partnership with Rexroth, a hydraulics components and manifold manufacturer. This partnership is now being reviewed for renewal.
3. A new director of placement and marketing needs to be sought to ensure complete success of the program.
4. An active advisory committee needs to be established and maintained.
5. Presently, this program satisfies the requirements for the OCC Apprentice program but produces very low enrollment in the high level courses.
6. The Hydraulics lab equipment is excellent, and some course improvement and development has occurred.
7. Workshops and short courses have been provided to area industries by Rexroth Corporation. More emphasis needs to be placed on how this partnership benefits the Fluid Power program, i.e. curriculum, equipment, placement, and overall development.

Recommendations:

1. Continue to develop effective business and training partnerships that will enhance all aspects of the Fluid Power program.
2. Monitor the progress of existing students to permit the proper scheduling required of Fluid Power courses.
3. Cultivate the interest and commitment of full-time and adjunct faculty to support and participate in the overall development and teaching of the Fluid Power program.
4. Formulate a new and active advisory committee that will lend guidance and support for curriculum and placement opportunities.
5. Continue to update and develop curriculum that will maintain the Fluid Power program as viable, current, and futuristic.
6. Develop an effective articulation plan with area high schools (Tech Prep 2+2).
7. Develop an effective marketing plan to properly advertise the employment benefits and worth of the Fluid Power program.

3. b. **Summary of Evaluation Perceptions by Students**

Number of Students Participating 36

Comments:

1. The Fluid Power program needs more attention.
2. Advanced courses need to be offered on a more regular basis.
3. The employment opportunities in the Fluid Power area are vague.
4. Placement needs to be made available to students in this program.
5. Co-op opportunities would help the students in this program.
6. Students should have the opportunity for field trips.

Recommendations:

1. Administration should seek ways to improve the enrollment in this program.
2. Advanced courses should be offered more frequently.
3. Placement and co-op should be an integral part of this program.
4. Identify the businesses/industries and job classifications for graduates of this program.

3. c. Summary of Evaluation Perceptions by Advisory Committee Members

Number of Advisory Committee Members Participating 6

Comments:

1. The Fluid Power program is a very important program to the college and the community.
2. Graduates from this program will have excellent opportunity for employment.
3. The existing Fluid Power program's curriculum needs to be reviewed and possibly improved.
4. A strong targeted marketing program needs to be developed to improve the enrollment in this program.
5. Partnerships should be explored that will benefit the program and the student.

Recommendations:

1. Maintain an active advisory committee.
2. Review the curriculum and the appropriate scheduling of classes.
3. Develop a sound marketing plan.
4. Formulate viable partnerships with business and industry.
5. Continue to improve the lab facility.

4. SUMMARY OF COMMUNITY COLLEGE ACTION PLAN

(Include comments on goals and objectives, processes and resources. Use additional sheets if necessary.)

1. The Fluid Power curriculum will be reviewed and improved.
2. The job market for the graduates of this program will be identified.
3. The laboratory will be maintained and improved.
4. A market plan will be developed.
5. Partnerships will be arranged to provide technical assistance, curriculum guidance, staff development, and placement.

PART II. SIGNATURES

I certify that the information submitted on this report is true and correct to the best of my knowledge.

DATE 6/13/91 PROGRAM EVALUATOR _____ (SIGNATURE)

DATE _____ OCCUPATIONAL EDUCATION CONTACT PERSON _____ (SIGNATURE)

Appendix C
Fluid Power Society Certification

Fluid Power Certification: Questions and Answers

What's involved in certification?

Fluid power certification consists primarily of an optional educational review session followed by testing and recognition. A typical certification unit will include two or more days of review and a 3-hour written test. There is an additional 3-hour hands-on test for mechanic certification.

How many kinds of tests are offered?

Review sessions and tests are available for each of the three certification skill levels:

- SPECIALIST — analyses and designs systems, selects components, instructs others in operations and maintenance, etc.
- TECHNICIAN — trouble-shoots systems, tests and modifies systems, prepares reports, etc. Separate certifications for hydraulic and pneumatic technicians are available.
- MECHANIC — fabricates, assembles, tests, maintains and repairs systems and components, etc. Separate certifications are available for industrial hydraulic, mobile hydraulic and pneumatic mechanics.

New certification programs are in preparation for electronic control specialists and fluid power engineers.

What technologies are covered by these tests?

Fluid power and motion control technologies include questions on hydraulics, pneumatics, electronic control and vacuum.

Who does the training for the review sessions?

The Fluid Power Certification Board accredits both the instructors who conduct the review sessions, and the educational institutions that train the instructors.

Who organizes these review sessions?

Review sessions can be organized by educational institutions, end-user companies, fluid power distributors, fluid power component manufacturers, for-profit educational organizations and the Fluid Power Society — both chapters and national headquarters.

Who administers the tests?

All testing is conducted under the direct supervision of proctors retained by the Fluid Power Certification Board.

How will my accomplishments be recognized?

Certified fluid power professionals are encouraged to include their certification on their business cards and letterhead — even on the signage used on their work vehicles. Certification patches are also available for use on work clothes and uniforms. All certified professionals are listed in the international directory and receive a certificate suitable for framing.

Is my certification good for a lifetime?

No. It's good for five years and then you'll have to apply for re-certification based on career proficiency. On your re-certification form you'll be asked about your job responsibilities, additional educational courses you've taken, or taught, and your professional involvement in any of the many fluid power organizations.

What will all this cost me?

As little as possible. All efforts have been made to keep costs low to make certification available to as many fluid power professionals as possible.

Fee schedules for seminars, manuals, and testing are regularly published in the Fluid Power Society Professional Report and are available from FPS headquarters.

Many manufacturers and distributors subsidize this program because it's a great way to multiply their investment. A contribution to the Fluid Power Certification Program helps upgrade the skills of those professionals committed to the industry and thereby elevates the level of professionalism in the fluid power industry.

When's the next test and where can I get more information?

Tests are scheduled throughout the year. You'll receive sample test questions and an application form.

Contact:

Fluid Power Certification Board
FPS — THE INTERNATIONAL ORGANIZATION FOR FLUID POWER AND MOTION CONTROL PROFESSIONALS
2900 North 117th Street, Milwaukee, WI 53222
Phone: 414/257-0910 FAX: 414/257-4092

The Fluid Power Society is the international organization for fluid power and motion control professionals. It has chapters in major U.S. and Canadian cities and has student chapters in leading fluid power educational institutions. The society's services include education, certification and professionalism for fluid power and motion control professionals.

Printed in U.S.A.

Form 109

Fluid Power Technician Certification

Introduction

The Technician is the mainstay of any industrial support group.

Working with direction from the engineering and scientific staffs, the fluid power technician reviews project instructions and circuits to determine test specifications, procedures, objectives, technical problems and possible solutions.

Using ISO standard graphic symbols, the technician prepares and revises fluid power circuits. By setting up and testing fluid power systems and components under operating conditions, the technician obtains data for development, standardization and quality control. The technician may recommend modifications to existing systems and components to improve performance.

The fluid power technician is responsible for writing technical reports and preparing graphs and schematics to describe the operation and performance of developmental or operational fluid power systems.

With all of the special skills and knowledge required to be an effective technician, today's technicians need to demonstrate their capabilities to remain competitive in the marketplace. In response to this need, FPS, through the Fluid Power Certification Board (FPCB), offers Certification for both Hydraulic Technicians and Pneumatic Technicians. FPS Certification parallels the fluid power guidelines accepted by the U.S. Department of labor as listed in the Dictionary of Occupational Titles.

How You Can Benefit From Certification

Certification as a Fluid Power Technician identifies you as a professionals, a person who has demonstrated extensive knowledge and talent as a Fluid Power Technician. This certification:

- gives you a credential that may open career doors,
- provides your employer with another measure of your value as an employee
- recognizes your skills with a numbered certificate and a certification patch which can be worn on your work clothes, and
- demonstrates your efforts to achieve and maintain the highest professional proficiency available to fluid power technicians.

Preparing for Technician Certification

Upon Application, each candidate will receive a review manual to help prepare for the test. The review manual lists the areas to be tested, provides sample questions, and lists additional references.

In addition to the review manual, candidates are urged to attend a review session held prior to each test if one is available. These review training sessions can be sponsored by educational institutions, end-user companies, fluid power distributors, fluid power manufacturers, for-profit educational organizations, and by FPS - both local chapters and national headquarters.

Applying for the Certification Test

Complete the application form on page 15 of this booklet and send it to FPCB Secretariat with your application fee. Fee information for the exam and the review training can be found on a separate sheet included in this booklet.

Contact the FPCB Secretariat for the dates and locations of upcoming review training and tests. This list is regularly published in the FPS newsletter, the PROFESSIONAL REPORT.

Upon application, you will receive the review manual and an admission slip to the test. If you are unable to take the test on the scheduled date, contact the FPCB Secretariat for a new date.

Refund Policy

If you cancel your review session/test registration, you will be charged a $50.00 administrative fee. To cancel, you must call the Fluid Power Certification Board Secretariat at 414/257-0910 AT LEAST SEVEN (7) WORKING DAYS prior to the scheduled review session/test to obtain a cancellation number. If you cancel less than seven days prior or you do not follow this procedure, you will be liable for the full fee. With the Fluid Power Certification Board Secretariat's approval, however, a portion of the charge may be applied to a future review session/test, and enrollment substitutions may be made at any time.

Taking the Certification Test

The Technician Certification Test is a written, three hour test which includes no more than 100 Multiple choice items. A hand-held calculator and two reference books may be used during the written test. You will not be permitted to refer to the review manual or to notes from the review training during the test. To pass the test, you must correctly answer 70% of the questions.

Sample questions found on pages 5 to 12 of this booklet will give you an overview of the topics covered on the written tests.

Following the Test

Approximately one month after the test, you'll receive your score report directly from the FPCB Secretariat. No one else will know your test score unless you tell them.

As a Certified Fluid Power Technician, you'll received a numbered certificate suitable for framing. You can also show off your accomplishment with certification patches on your uniform or work clothing. And, your name will be added to the international directory of fluid power professionals.

However, fluid power certification is not forever. To maintain your certification, you'll need to re-apply in five years. No test is necessary, but you'll be asked about your job responsibilities, additional courses you've taken, or perhaps taught, and your professional involvement in any of the many fluid power organizations.

About FPS

FPS is the international organization for fluid power and motion control professionals. It has chapters in major U.S. and Canadian cities and has student chapters in leading fluid power educational institutions. FPS services include education, certification and professionalism for fluid power and motion control professionals.

Fluid Power Mechanic Certification

Introduction

In the early days of American industry, the apprentice mechanic learned his craft under the watchful eye of a master. After considerable on-the-job experience, he sought to demonstrate his capabilities through the creation of a masterpiece. Having satisfied his master, he too became one.

The pace of today's industrial world and its ever-expanding knowledge base precludes the luxury of apprentice training for many industries, including fluid power. Today's fluid power mechanic acquires skills on the run - in short courses and workshops, by reading trade publications and, of course, on-the-job.

Yet, today's mechanics still need to demonstrate their capabilities and their competitiveness in the marketplace. In response to this need, the Fluid Power Society developed a certification program for mechanics, and recently introduced three separate certifications for mechanics working in industrial hydraulics, mobile hydraulics, and pneumatics.

How You Can Benefit From Certification

For you, the fluid power mechanic, this is your opportunity to demonstrate your extraordinary effort to develop your know-how and skills in the practice of fabricating, assembling, testing, maintaining and repairing fluid power systems and components.

In addition, your certification:

- gives you a credential that may open career doors,
- provides your employer with another measure of your value as an employee,
- recognizes your skills with a numbered certificate and a certification patch which can be worn on your work clothes, and
- demonstrates your efforts to achieve and maintain the highest professional proficiency available to fluid power mechanics.

Preparing for Mechanic Certification

Upon Application, each candidate will receive a review manual to help prepare for the test. The review manual lists the areas to be tested, provides sample questions, and lists additional references.

In addition to the review manual, candidates may benefit from the review session held prior to each test. These review sessions can be sponsored by educational institutions, end-user companies, fluid power distributors, fluid power manufacturers, for-profit educational organizations, and by the Fluid Power Society - both local chapters and national headquarters. All instructors who conduct FPS-sponsored review sessions are accredited by the Fluid Power Certification Board.

Applying for the Certification Test

Complete the application form on page 15 of this booklet and send it to FPS headquarters with your application fee. Fee information for the exam and the review session can be found on a separate sheet included in this booklet.

Contact FPS headquarters for the dates and locations of upcoming review sessions and tests. This list is regularly published in the FPS newsletter, the PROFESSIONAL REPORT.

Upon application, you will receive the review manual and an admission slip to the test. If you are unable to take the test on the scheduled date, contact FPS headquarters for a new date.

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Taking the Certification Test

The Mechanic Certification Test consists of a written test and a hands-on test. The two and a half hour written test includes no more than 100 multiple choice items. A hand-held calculator and two copyrighted reference books may be used during the written test. You will not be permitted to refer to the review manual or to notes from the review session during the written test. To pass the written test, you must correctly answer 70% of the questions.

During the hands-on portion you'll be required to complete six work job performance tests in three hours. Typical tasks include identification of fittings, fasteners and fluid power symbols, bending and flaring tubing, making hose connections, setting pressure relief and pressure reducing valves, and drawing fluid power circuits. To pass the hands-on test, you must earn at least 70 out of the 100 available points for each of the six tasks.

An unsuccessful candidate is required to retake either the written test or the hands-on test — only that test which was failed. Sample questions found on pages 4 to 12 of this booklet will give you an overview of the topics covered on the written tests.

Following the Test

Approximately one month after the test, FPS headquarters notifies each candidate of his/her score. You'll receive your score report directly from headquarters. No one else will know your test score unless you tell them.

As a Certified Fluid Power Mechanic, you'll received a numbered certificate suitable for framing. You can also show off your accomplishment with certification patches on your uniform or work clothing. And, your name will be added to the international directory of fluid power professionals.

However, fluid power certification is not forever. To maintain your certification, you'll need to re-apply in five years. No test is necessary, but you'll be asked about your job responsibilities, additional courses you've taken, or perhaps taught, and your professional involvement in any of the many fluid power organizations.

About FPS

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Fluid Power

The Source For Fluid Power Professionals

The Fluid Power Society (FPS) is a non-profit organization chartered in 1960 to further the growing technology of fluid power (hydraulics and pneumatics); to foster activities aiding its development and application; to meet the needs of those working in this technology; and to exchange information, ideas and techniques.

The Society's objectives are accomplished through local chapter meetings that help expand educational programs, services, new ideas and exchange information about the technology of fluid power. Those goals are achieved through a national organization that encourages research and supports the chapters in all their endeavors.

Certification: A Professional Investment

The Fluid Power Society has established a certification program to distinguish those who have reached an established level and scope of knowledge in the field of fluid power. Leaders in the fluid power industry want those working in fluid power to have the same degree of credibility and professionalism as found in industries where certification programs already exist.

The Fluid Power Society's Certification Program has been in existence for many years and is now being expanded. The overall program covers six levels of certification.

Mechanic (Basic Hydraulics & Pneumatics)
September, 1990

Technician (Hydraulic) In Prep. Est. Release
December, 1991

Technician (Pneumatic) In Prep. Est. Release
December, 1991

Fluid Power Specialist (Selects components and designs systems) (Existing)

Fluid Power Electronics - In Prep. Est. Release
1992

Engineer (Design and Development of Products, R & D Systems) (Proposed)

Certification by the Fluid Power Society gives you an opportunity to demonstrate to yourself and others that you have acquired a comprehensive level of knowledge and understanding about fluid power.

The Certification program has the following prime objectives:

1. To challenge and strengthen an individual's knowledge of fluid power.
2. To recognize individuals who have demonstrated a thorough understanding of fluid power principles.
3. To raise the professional standing of those working in fluid power.

Preparation For Specialist Certification

To help those interested in becoming certified, the Fluid Power Society Certification Committee has developed a *Specialist* Certification Study Course. This 83 page manual is available with each exam application.

The intent of this study guide is to assist individuals to prepare for the examination, not to simply help them pass it. The guide contains definitions of test topics, sample questions, and a list of study references.

Review seminars are available nationwide on (1) a scheduled basis, (2) by special arrangement, (3) through local Fluid Power Society Chapters, or (4) through the Fluid Power Society Educational Foundation's network of schools. Contact the Society Headquarters for your particular requirements. Review sites and test sites are scheduled by the Society.

Application For The Test

An examination application form can be found on page 19 of this booklet. FPS headquarters will provide you with a schedule to test dates and sites. Should you not receive this notification, please be sure to contact FPS headquarters at 2433 North Mayfair Road, Milwaukee, WI 53226; Telephone: (414) 257-0910; Fax: (414) 257-4092.

Taking The Test

The Fluid Power Examination for Fluid Power Specialists consists of a number of questions relating to hydraulics and pneumatics, fluid power fundamentals, specialized fluid power topics, relay logic, systems, electrical control, and the use of English grammar. To pass, you must score at least 129 points out of 185. The test booklet provides space for one answer per question.

On The Date Of The Test

To make it possible for all candidates to be tested under equally favorable conditions, the following standard procedures and regulations will be observed at each test center:

1. No candidate will be permitted to continue beyond the allotted time.
2. Candidates will be allowed to bring with them *only* fluid power reference technical materials. Review manuals will *not* be permitted.
3. No other books or notes will be permitted.
4. Silent calculators will be allowed.
5. Permission to leave the examination room during the test will have to be obtained from the proctor.
6. Misconduct of any kind during the test will disqualify a candidate.

Fees

The appropriate test fee must be paid in U.S. Dollars when the candidate registers for the examination. Checks or money orders should be made payable to the Fluid Power Society. **Please, do not send stamps or cash.** The following schedule of fees applies.

FPS members	$95.00
Non-members	$135.00
Student members (full time)	$45.00
All exam retakes	$35.00

The Review Guide will be mailed promptly after the appropriate registration fee is received. The candidate will receive an admission slip. If the candidate is unable to take the examination on the scheduled day, it will be his or her responsibility to contact the Fluid Power Society for a re-schedule date.

Location Of Test Sites

Contact Fluid Power Society Headquarters for the current schedule of review seminars and exam dates and locations. Fluid Power Society can normally arrange an exam in an area where there is sufficient interest. A current schedule of exam sites and dates is listed in the F.P.S. Newsletter.

A minimum of five or more industry individuals are required to arrange exams.

Re-Certification

All successful candidates must be re-certified every *five* years to maintain their certified status. For additional information, contact the Fluid Power Society Headquarters.

Score Reports

Each candidate will be notified of his or her test score about one month after the test date. The Fluid Power Society will send this report directly to each candidate.

Appendix D
Proposed Updates for Fluid Power Program
-Edward Konopka

FROM: Edward J. Konopka

TO: Dr. Bill Rose, Dean; Donald Tremper, Apprentice Coordinator: and Larry Pennefather, Department Chairman

DATE: 12/10/90

SUBJECT: Progress Report #1 on Phase I of Fluid Power Technology Update per Special Assignment PAF Dated 11/13-21/90

Persuant to the implementation of the Special Assignment PAF Dated 11/13-21/90 for the Update of the Fluid Power Technology Program, I am pleased to make this Progress Report #1 on Phase I of the Work Plan. (Preliminary Draft Dated 10/21/90)

Phase I, Sec.1.,Par. C-Texts/Manuals/Computer Software
At the TECH 2000 EXHIBITS and SEMINARS at Washington, D.C., visited the 17 NASA established Tech Transfer Centers for Technology Transfer to the Private and Educational Sector; checked on any employability surveys and on access to Public Domain Software for Fluid Power Computerized System Design and Analysis. I was directed to the COSMIC Center at the University of Georgia.
ACTION TAKEN; Visited the COSMIC CENTER Display at Washington, D.C. and followed up for additional clarificati0on by phone Dec. 5th
RESULTANT; Using the COSMIC CENTER CATALOGUE on the FLOPPY DISK on my 386 Computer, I was able to sort out and obtain Abstracts for a number of computer programs which would be apropos to the OCC updated Fluid Power Tech Program. **(Software Abstracts Attached Hereto)**

Phase I, Sec. 1., Par. D-Employability
Contacted Mr. James P. Mockler, Vice-President of Parker Hannifin Corporation and President Fluid Power Group on Employability Survey by the NFPA (National Fluid Power Association-The Fluid Power Manufacturers Group) and also on the "Fluid Power Megatrends 2000" Paper presented at the 1990 NCFP (National Conference on Fluid Power)
ACTION TAKEN; Phone call to Mockler's office
RESULTANT; Promised to sent information and to cooperate with OCC effort.
Visited the Tech 2000 Seminar and Exhibits in Washington D.C. Nov. 26-28/90 talked about the employability of Fluid Power Technicians with Associate Degrees and FPS (Fluid Power Society) Specialist Certification. Many would hire immediately. This also supported by advertisements In JOBS PUBLICATION for Technicians in the NASA and other Aero-Space Companies Jobs in the G-11 and G-12 Categories paying $20K to $30K to start.
ACTION TAKEN; Attended the TECH 2000 Seminars Washington D.C. Nov. 26-28-90
RESULTANT; Many jobs available for FLUID Power Techs in the AERO-SPACE Industries.
U.S. Academy Summer Scholarships for Cooperative Trainig for Fluid Power Students available for students with 16 CRHR and 3.5 GPA

PROGRESS REPORT #1 con't

Talked to Paul Hozian; presently teaching Fluid Power to employees at Down-River Ford Rouge and Inland Steel; Paul reported many apprentice opening for skill trades Fluid Power available; it is also reported that GM has opened 299 apprenticeships for various trades.

Phase I., Sec. 1., Par., E Program and Course Recommendations
Talked to John Nogosian, FPS (Fluid Power Society) , National Education and Grants Chairman, about the OCC Fluid Power Technology effort. He reported that the FPS was just completing a restudy of the courses and curriculum requirements for the Fluid Power Technician. The FPS was cooperating with American Association for Instructional Materials
ACTION TAKEN, Met with John Nagosian at the FPS meeting regarding grants and curriculum in Fluid Power Technology
RESULTANT; Nagosian promised to send the New Curriculum FPS recommendatioons to OCC attention as soon as available.
Talked to Steve Atma about the possibility of using the IBM XT's for Fluid Power Students implementing the COSMIC software.
He responded cooperatively.
Talked to Doug St.Clair about the Robotics and TeleRobotics innovations and their relations to Fluid Power.
He responded Cooperatively.
Talked with Dave Mehre about the effort for Fluid Power Update.
He responded enthusiastically.

This concludes Progress Report #1. I am continuing toward further action on the Fluid Power Technology Update. Plan to fly to Golden, Colorado for a two day visit to Martin Merriette to visit their labs for hydraulic telerobots and Space Station Liberty and talk about Fluid Power Technician qualifications.

DONATION TO OCC; Expenses incurred in the discharge of the PAF Contract resposibilities and the above Travel, Living, and Registration in the **TOTAL OF** ; **$681.21** are herein DONATED TO OAKLAND COMMUNITY COLLEGE, AUBURN CAMPUS; AUBURN, MICHIGAN.

Respectfully Submitted
Edward J. Konopka

COPIES TO:
Dean. Bill Rose
App.Coor. Don Tremper
Dept. Chair Larry Pennefather
App. Tech. Harvey Eschenburg

MSC-16795

ITLE: ROHDA- ROCKWELL HYDRAULIC DYNAMIC ANALYSIS

EQUIREMENTS: IBM 360 Series
ANGUAGE: FORTRAN IV
EDIA: 9 Track 1600 BPI IBM IEHMOVE Format Magnetic Tape
IZE: Approximately 5,830 source statements
rice: Program $800.00/Documentation $21.00

**** A B S T R A C T ****

This program, called ROHDA - Rockwell Hydraulic Dynamic Analysis, was developed to mathematically describe complete hydraulic systems in order to study their dynamic performance. Previous simulations of hydraulic systems employed computer models of individual system elements which used the method of characteristics to simulate the connecting lines. ROHDA can be used to conduct dynamic simulations of an entire hydraulic system (or individual segments), providing physical insight into problems which are obscured by previous approaches. The program will calculate the values of pressures, flows, and component variables througnout a hydraulic system. This allows the designer to study the dynamic response of any system parameter, such as actuator piston velocity, pump output pressure, or line pressures. ROHDA should prove a valuable tool to engineers with detailed performance results of aircraft, spacecraft, or similar hydraulic systems. ROHDA is a general purpose hydraulic simulation program which employs a building block approach in the form of subroutines which simulate the various components of a hydraulic system. These subroutines are then controlled by a main program. Component modules available include pumps, pressure lines, flow lines, flow reversing and pressure reversing lines, orifices, sinks and sources, regulators, fittings, reservoirs, accumulators, filters, valves, and actuators. The program is structured so that the user can include additional component modules as they are developed. The hydraulic system functional arrangement is defined by input data. The order of the elements in the data deck determines the order of system evaluation. The input to the hydraulic system is normally an actuator demand which causes a disturbance to propagate through the model. The output of the program consists of time histories of pressure and flows at any point in the system and component variables of interest, such as actuator velocity, position, and load. This program is written in FORTRAN IV for batch execution and has been implemented an IBM 360 series computer with a central memory requirement of approximately 280K of 8 bit bytes. ROHDA was developed in 1977.

EYWORDS:
HYDRAULIC CONTROL
HYDRAULIC EQUIPMENT
FLUID MECHANICS
AUTOMATIC CONTROL VALVES
SERVOMECHANISMS

C O S M I C Program Abstract

MSC-19753

TLE: SPACE SHUTTLE HYDRAULIC SYSTEM POWER ANALYSIS

QUIREMENTS: IBM 370 Series
NGUAGE: FORTRAN IV
DIA: 9 Track 1600 BPI EBCDIC Card Image Format Magnetic Tape
ZE: Approximately 760 source statements
ice: Program $500.00/Documentation $14.00

**** A B S T R A C T ****

This is a fluid mechanics package containing five subroutines to determine required hydraulic fluid flow rates, hydraulic system power requirements, and heat input. The program is designed to contribute time savings in the determination of required system flow rates, horsepower, and heat inputs for hydraulic actuation devices. In the design of hydraulic control systems, it is necessary to determine the amount of power required to operate the hydraulic actuation devices. This program provides this capability when given the actuator design and performance requirements. The output of the program can then be used to determine the necessary transmission line sizes for providing power and fluid to the actuators. The program calculates actuator no-load flow rate from the flow limiting factor, actuator no-load design rate, and actuator flow gradient. Actuator servo valve leakage is determined from the number of servo channels and a function of the no-load flow rate. The actuator power spool leakage is also determined as a percentage of the no-load flow rate. The program also calculates actuator demand flow, actuator total flow rate, system flow rate, pump horsepower, and heat input to the system. The program is of a general purpose nature and can be used to determine system power requirements and transmission line sizes based on actuation device design and performance inputs. The program operates in interactive mode, requires a minimum of 184K bytes of storage, and has been implemented on the IBM 370/168. User supplied routines are required for CRT output.

YWORDS:
SPACE SHUTTLES
HYDRAULIC EQUIPMENT
FLUID POWER
FLOW VELOCITY

C O S M I C Program Abstract

MFS-23295

ITLE: DYNAPS- DYNAMIC ANALYSIS OF PNEUMATIC SERVOMECHANISMS

EQUIREMENTS: UNIVAC 1100 Series
ANGUAGE: FORTRAN IV
EDIA: 9 Track 1600 BPI EBCDIC Card Image Format Magnetic Tape
IZE: Approximately 1,030 source statements
rice: Program $500.00/Documentation $19.00

**** A B S T R A C T ****

DYNAPS is a generalized computer program which can perform a dynamic analysis of almost any kind of pneumatic servomechanism and the system which it is controlling. The system and device to be modeled can contain up to 20 ullage chambers, 20 moving parts (pistons, poppets, etc.), and 40 flow lines. The program can be easily modified to model larger systems. DYNAPS calculates, as a function of time, the position of all moving parts within the system and servomechanism, pressures within the internal chambers of the servomechanism and in any ullage chambers in the complete system, and flowrates in each line of the system, including sensing lines and main flow passages. DYNAPS has been used in the Space Shuttle Program to make analytical assessments of the dynamic behavior of a regulator controlling the pressure in a tank which has liquid flowing in or out of it. DYNAPS should prove useful in the analysis of any kind of pneumatic servomechanism system, including pressure regulators, relief valves, pneumatic actuators or positioning devices, shock absorber systems, and surge chambers. The DYNAPS computer program is comprised of five major parts. The first part is the main routine, which handles all input-output functions and has the 'logic' to model the system from the input data. Moving parts, such as pistons, are assumed to be subjected to pressure area forces, spring forces, breakout friction, dynamic friction, viscous damping, flow drag, and vibration. Every volume is assumed to be comprised of a multispecies gas and to be connected to other volumes by one or more lines. Each volume may do work on a piston, the piston being either the surface of a moving part or moving liquid surface. The second and third components of the program set up the necessary rate and position equations and perform the time integration using a Runge Kutta integration algorithm. A fourth component of DYNAPS solves the flowrate, mass, and energy equations to determine the rate of change of the pressures, temperatures, and gas composition within each chamber and the flowrate in connecting lines. The fifth component solves the force balance equations and determines the acceleration history on all moving parts in the system. The DYNAPS program is written in FORTRAN V for batch execution and has been implemented on a UNIVAC 1108, under control of EXEC 8, with a central memory requirement of approximately 27K decimal of 36 bit words. DYNAPS can produce plots of the line histories of the system variables being studied. Plotting is accomplished on a SC-4020 plotter.

FROM: Edward J. Konopka

TO: Dr. Bill Rose, Dean; Donald Tremper. Apprentice Coordinator; and Larry Pennefather, Department Chairman

DATE: 1/31/91

SUBJECT: Progress Report #2 on Fluid Power Technology Update per Special Assignment PAF Dated 11/13-21/91

Persuant to the implementation of the Special Assignment PAF Dated 11/13-21/91 for the Update of the Fluid Power Technology Program, I am pleased to present this Progress Report #2 on the Work Plan Draft Dated 10/21/90.

Phase I, Sec.1., Par. C-Texts/Manuals/ Computer Software:
I have acquired the documentation for the computer software for the following Hydraulic/Pneumatic design, analysis and symulation programs: "Rockwell Hydraulic Dynamic Analysis Program"(ROHDA); "Space Shuttle Hydraulic System Power Analysis Computer Program"; and "Dynamic Analysis of Pneumatic Servo Mechanisms" I am making contact with IBM Ms. Susan Workman to explore the possibility of translating the above programs originally designed for the IMB 3600 series computer hardware, into, programs geared for the IMB PC Dos 4.0 Version or PS2 Systems.
In addition, through the services of Dr. Rose's Office I am in process contacting Delta Eagle Enterprises on acquiring software for "Hydraulics for WordPerfect 5.1" a symbol library for design of hydraulic powewr circuitry and contacting Tech Team Inc. on further information on their software "Hydroworks".
This Phase I, Sec.1 Par. C effort would be the basis for Upgrading The ATF 200 Courses to a level for employability of OCC Fluid Power Technology Graduates as Engineering Technicians. It is also anticipated that these computerized ATF 200 Courses would be attractive to industrial up-grade trainingas proposed in the cover page of Update of the Fluid Power Technology Program Proposal.

Phase I, Sec. 1., Par. D-Employability:
I am happy to report receipt of a Coop Contract from Depaartment of the Air Force, Tyndall AFB, FL:(Copy of which is attached hereto); such Contract to provide Coop Training for Hydraulic and Robotic OCC Students in Tele-Operated Robotized Hydraulic Heavy Construction Equipment; it also provides permanent employment in that area for successful candidates. After my contact with Prof. Sinclair, there are presently two (2) students who are interested and eligible to enter such a Coop.
HOWEVER; the COLLEGE must first consider the Contract and APPROVE the ATTACHED CONTRACT before implementation of same.
I ask for expeditious action to this end. The Air Force has indicated great interest for the College Approval.(They have asked for proposed student candidates Resumes)

Phase II, Sec. 2 Tech Department Approval for Proposed Program;
I have met with Prof. Sinclair to inform him of the Air Force Coop; he has announced same to his students;
RESULTANT: two student have indicated interest; they informed the College has to first sign the Contract.
I have met with Prof. Powell regarding suggested Electronic Courses

for students regarding tele-operated hydraulic systems and regarding software for Electronic Design and Analysis.

RESULTANT: Prof. Powell recommended ETT 201 as a possible course to included in the Upgraded Fluid Power Curriculum.

I have met briefly with Dave Mehre regarding regarding his suggestions for the renewal of the Fluid Power Curriculum.

RESULTANT: It was agreed that there might be a two track program; First, a Fluid Power mechanics, repair, miantenance, and trouble shooting Program; Second, a Fluid Power Engineering Technician capable of using computer software to help design, analyze, and simulate programs; and capable of working in the laboratory environment to run hydraulic and pneumatic component and systems operational test beds;also to be able to enter careers in the aero space technologies.

This concludes Progress Report #2. I understand that the PAF Dated 11/13/90 has expired. I would like to continue my work in implementing the Fluid Power Upgrade Proposal if it so please the College. I, therefore ask, for a PAF renewal so I may proceed.

DONATION TO OCC: Cost of software documentation; travel; long distance phone; Martin Merriette contact and Tyndall; AFB contact; **TOTAL;$703.47 are herein DONATED TO OAKLAND COMMUNITY COLLEGE, AUBURN HILLS CAMPUS, AUBURN HILLS, MICHIGAN.**

Respectfully Submitted
Edward J. Konopka

COPIES TO:
Dean, Bill Rose
App.Coor. Don Tremper
Dept. Chair Larry Pennefather
App. Tech. Prof. Harvey Eschenburg

FROM: Edward J. Konopka

TO: Dr. Bill Rose, Dean; Donald Tremper. Apprentice Coordinator; and Larry Pennefather, Department Chairman

DATE: 5/6/91

SUBJECT: Progress Report #3 on Fluid Power Technology Update per Special Assignment PAF Winter Semester '91

Persuant to the implementation of the Special Assignment PAF Dated 11/13-21/91 for the Update of the Fluid Power Technology Program, I am pleased to present this Progress Report #3 on the Work Plan Draft Dated 10/21/90.

I am pleased to present the following summary of activity during the past two semesters persuant to the above:

1. The completion of the coop training contract for training of two OCC students at Tyndall AFB for hydraulic robotized construction equipment for use on road and runway building and for use in the projected mining activities on the Moon.
2. The completion of the classroom testing for the viability of the "HYDRO WORKS" computer software program for the design and drawing of hydraulic and pneumatic application circuits. The IBM PS-2's in the CIM computer room are powerful enough to utilize the software. Such software to be used as an introductory phase for the ATF 143 course and as a full semester training course for a revised ATF 252 course to be designed under future PAF authorizations.
   The college would have to get a site license from Hydro Works to establish such a course.
3. A completed Teacher's Manual for ATF 140, Basic Hydraulics was presented to Dr. Rose, Professor Eschenberg and Mr. Kalera for evaluation. The teacher's Manual contained;
   Lesson Plans; Student Hand-Outs; Lab Experiments; Self-Evaluations; and Suggested Quizz and Exams.
4. A suggested list of Advisory Committee members was presented to Dr. Rose's Office March 21, 1991.

Attached hereto is a Teacher's Manual for ATF 147 Basic Pneumatics for evaluation and consideration. I am also presenting a copy to Professor Eschenberg for his comment and evaluation. The Manual has complete Lesson P{lans; Student Hand-Outs; Lab Experiments; Self-Evaluations; and suggested Quizzes and Exams.

This concludes Progress Report #3. I donnot anticipate working on this renovation project during the Spring or Summer Semesters. I would anticipate resumming the work on the Fluid Power Upgrade Proposal if it so please the College next Fall Semester. I would ask, for a PAF renewal at that time.

Respectfully Submitted
Edward J. Konopka

COPIES TO:
Dean, Bill Rose
App.Coor. Don Tremper
Dept. Chair Larry Pennefather

Appendix E
Job Titles
-Reported by Local Employers

Fluid Power Job Titles

Assembler
Assembly Technician
Assistant Engineer
CAD Person
Civil Engineer
Designer
Detailer
Engineer
Engineering Draftsman
Engineering Technician
Fabricator
Field Service
Field Technician
General Laborer
Helper
Hydraulic Repairman
Hydraulic Sales
Hydraulics Engineer
Hydraulics Technician
Installation Services Mechanic
Installers
Junior Engineer
Lab Technician
Laborer-electrical
Layout
Machine Apprentices
Machine Builder
Machine Operator
Machine Repairer
Machine Tool Helpers
Machinist
Maintenance Person
Mechanical Engineer
Mechanics
Pipe Fitter
Pipe Fitter Trainee
Pneumatic Tool Repairer
Pneumatics Employee
Power Unit Builder
Press Operator
Production Person
Purchaser
Sales
Saw Operator
Service Technician
Service Worker
Sheet Metal Model Maker
Shop Assembly
Shop Personnel
Sketcher of Product Drawings
Systems Engineer
Technical Sales Rep
Technician
Tool Maker
Tool Repairman
Trainees
Upgrader

Appendix F
Fluid Power Technology
Student Survey

Survey Number_____ Name_____

SSN#_____

1. What was your primary reason for taking fluid power courses at OCC? *(Let the respondent answer and then check all that apply.)*

_____ To obtain a degree.
_____ To obtain a certificate.
_____ To complete courses necessary for transfer to another college.
_____ To prepare for a new career.
_____ To improve your knowledge, technical skill or competency for your job.
_____ To comply with your employer's requirements for continuing education.
_____ To comply with the requirements of an apprenticeship program.
_____ To increase your chances for a raise and/or promotion.
_____ For personal development.
_____ Other:_____

2. What is your current employment situation?

1 _____ Employed full-time.
2 _____ Employed part-time.
3 _____ Unemployed. *Not employed but actively seeking employment (Go to question 5)*
4 _____ Not employed and not seeking employment, (because of choice). *(Go to question 5)*

3. What is your current occupation/job title?

_____

4. Is your current employment related to the coursework you have taken at OCC in fluid power?

1 _____ Yes
0 _____ No

5. How do you plan to use the knowledge and skills gained in your fluid power courses at OCC, in the future?

_____

_____

6. Is/was fluid power your major field of study at OCC?

1 _____ Yes. (Skip to Question 9)
0 _____ No.

7. What is/was your major field of study? _____

8. Are the classes you took in Fluid Power required for your program?

0 _____ No
1 _____ Yes, Which classes? _____

_____

_____

9. Please rate your level of satisfaction with the following aspects of the fluid power program at OCC using the scale, 5=Very satisfied, 4=Satisfied, 3=Neutral, 2=Dissatisfied, 1=Very Dissatisfied.

	Very Satisfied	*Satisfied*	*Neutral*	*Dissatisfied*	*Very Dissatisfied*
a) The variety of fluid power courses offered . . .	5	4	3	2	1
b) The content of fluid power courses taken	5	4	3	2	1
c) The scheduling of fluid power courses	5	4	3	2	1
d) The quality of faculty/instruction in fluid power	5	4	3	2	1
e) The equipment/technology available	5	4	3	2	1

10. What do you or did you most like about the fluid power course/program? *(Probe for information about specific courses)*

_____

_____

11. What do you or did you most dislike about the fluid power course/program? *(Probe for information about specific courses)*

_____

_____

12. What could OCC do to improve the Fluid Power program?_____

_____

_____

13. Is there any other comment you would like to make about the Fluid Power program at OCC?

_____

_____

"Thank you for taking the time to speak with me about your experience with OCC's Fluid Power program. The information you have provided will be useful to us as we complete our review of the program."

Appendix G
Fluid Power Technology
Narratives from Student Survey

FLUID POWER TECHNOLOGY
NEEDS ASSESSMENT
STUDENT RESPONSES

3. What is your current employment situation?

01: Maintenance
02: Business Machines
03: Metallurgy/Engineering Technician (Powdered Metals)
04: Oakland University (Maintenance)
05: Engineering
06: House painter
07: Engineering
08: Numerical Hydraulics (drill machines)
09: Research & development in fluid Power
10: Engineering
11: Electronics
12: Machinist
13: Assembler
14: Computer Technician
15: Stock keeper
16: Machine repairman
17: Pipe fitter
18: Chrysler Corp.
19: Die design apprentice (General Motors)
21: Warehouse personnel
22: Factory
23: CNC machinist
24: Assembler
25: Assembler
26: General Motors (Truck and Body)
27: Automotive seating
28: Pontiac schools (Heating & cooling)
29: Supervisor -small company
30: Hydraulics
31: Body Shop
32: Industrial Electrical Automation
33: Mechanical
34: Driver - warehouse
35: Pool Director (City of Ferndale); Clinical assistant (OCC)
36: Fork lift truck driver
37: Driver
38: Machinery salesman
39: Job setter
40: Helper for a beer distributer

41: Self-employed - Contract electrical and remodelling work
42: Stocker, Arbor Drug
43: Assembler, General Motors Truck & Bus
44: Clerk, United Parcel Service
45: Grocery store clerk
47: Final Inspector - General Motors
48: Fuel Injection Company

5. How do you plan to use the knowledge and skills gained in your fluid power courses at OCC, in the future?

01: Climate control
02: Climate control field
03: As an electrical trades person
04: Heating and cooling field
05: In my current job
06: Get a job with a big company
07: Robotics - own my own business in the future
08: Not sure
09: In my current job
10: Using it in my current job
11: Electronics &/Fluid Power in my job (have a double major)
12: Not sure - maybe management and supervising
13: To get a better job position at GM or a better paying job elsewhere
14: When degree is received, plan to transfer to Sanuc Corp to build computers
15: May take skilled trades test at GM or may not use at all (currently attending University of Michigan majoring in history)
17: Not really - CAD design (in the future)
18: Own a business
19: Die Design Apprentice - doing this right now, make $22/hour & have reached my goal.
20: Obtain a better job in fluid power OR heating & cooling
21: Robotics
22: Already graduated
24: Work for General Motors OR own my own business
25: Robotics or engineering
26: No - not going into this field
27: Management
28: Continue courses and help my current job
29: Do not plan on using it; at Management level right now
30: Hydraulics
31: Do not really plan on using it anymore
32: For robotics
33: General mechanic
34: Electrical engineer
35: Needed for robotics work dealing with pneumatic & hydraulic operations

36: Use hydraulics knowledge to repair fork lift
37: Use it in the robotics field
38: Use it with any engineering background
40: Don't know
41: Use it in the robotics industry
42: Will need it when I start working in climate control
43: Plan to use it in climate control work
44: Don't plan to - changed major from Robotics to Business Administration
45: When I get a job in robotics, will need knowledge to diagnose problems
46: Plan to use it when I get a job in robotics
47: For self-improvement
48: Promotion

7. What was your major field of study?

02: Climate Control
03: Electrical Trades
04: Heating & Cooling
05: Robotics
06: CIM (Computer Integrated Manufacturing)
07: Robotics
10: Engineering
15: Applied Science
14: Robotics
15: Robotics
16: Robotics
18: Heating & Cooling
19: Pneumatics
20: Heating & Cooling (Climate Control)
21: Robotics
23: Robotics
24: Climate Control
25: Robotics
26: Robotics
27: Robotics
28: Climate Control
32: Robotics
33: Mechanics/Automotive
34: Robotics & Electronics
35: Robotics
36: Robotics
37: Robotics
38: Robotics
39: Undecided, either Machinery & Tooling or Electrical
40: Climate Control

41: Robotics
42: Climate Control
43: Climate Control
44: Business Administration
45: Robotics
47: Robotics
47: Vehicle Body Technology

8. Are the classes you took in Fluid Power required for your program? Which classes?

01: Hydraulics & Pneumatics
02: Intro. Hydraulics
03: Intro. Hydraulics
04: Intro. Pneumatics
05: Pneumatics & Hydraulics
06: Intro. Hydraulics & Intro. Pneumatics
07: Intro. Hydraulics
08: Intro. Hydraulics
09: Intro. Hydraulics
10: Industrial Hydraulics
11: First 5 courses; up to #253
12: Intro. Hydraulics & Intro. Pneumatics
13: Intro Hydraulics; Can't remember the rest
14: ATF 140; (147 plan to take in future)
15: Intro to Hydraulics
16: ATF 140
18: Pneumatics
19: Pneumatics
20: Pneumatics
22: Pneumatics & Hydraulics
23: Hydraulics & Pneumatics
24: Too numerous to name
25: 143 & 147 (Pneumatics & Hydraulics)
26: Hydraulics & Pneumatics
27: Hydraulics
28: Pneumatics
29: Intro. Hydraulics & Intro. Pneumatics
30: Hydraulics
31: Intro. Hydraulics & Pneumatics
32: Intro to Hydraulics
33: Intro. Hydraulics
34: Hydraulics
35: Intro. Pneumatics; Into. Hydraulics; Hydraulic components/circuitry
36: Hydraulics
37: ATF 140

38: ATF 140
39: No - took it for personal satisfaction
40: Hydraulics/Pneumatics
41: ATF 140 & Pneumatics 147
42: ATF 140
43: Pneumatics
44: ATF 140
45: Hydraulics
46: Hydraulics 105; Pneumatics
47: Intro to hydraulics
48: Hydraulics

10: What do you or did you like most about the fluid power/course program?

01: Learned a lot - good content
02: Instructor good (enthusiastic)
03: Likes course
04: Liked course!
05: Instructor good
06: Enjoyed both courses except for instructor
07: Very informative
08: Instructor good
10: Likes the course - satisfactory
12: Instructor OK; Courses good; learned a lot
13: No comment
14: The organization that the instructor gave the class made it very interesting.
15: Instructor made it an interesting class. His presentations explained the subject very well.
16: Liked the technology/theory offered in the class
19: Had only 1 course and liked it
20: Like hands on experience
21: Higher level courses hard to get, Need full time instructor, Some equipment is hard to obtain (pipe fittings & nuts & bolts)
22: Nothing
23: Hydraulics - liked
24: Nothing
26: Liked the courses (introductory courses)
28: Liked instructor & course!
29: Hydraulics course very good
30: Liked everything about the course!
31: Liked the course
32: Liked course & instructor
33: No
35: The hands on approach
36: The hydraulics (can't remember name of 1 course taken)
37: Hands on experience

38: The instructor
39: The Labs - the hands on
40: Gave me knowledge to work on equipment that I use currently.
41: That it falls in line with electrical work/formulas, Shows how the electrical process is developed
42: Liked the hands on work
43: Got a clear understanding of the subject with the option of having hands on experience; we were taught what is involved in working with that type of experience.
44: The knowledge of the instructor - His ability to apply hydraulics/use of to every day life
45: Working on the wicker benches
46: Nothing - disliked being required to take class for robotics degree- robotics do not use FP technology any longer
47: Don't like it
48: Liked course - everything

11. What do you or did you dislike about the fluid power course/program?

01: Lab - equipment bad
02: Lab - equipment very poor
03: Nothing wrong with the course so far
04: Scheduling - only offered 1 time a year
05: Equipment could be better - felt I wasted time trying to find parts or fix them
06: Instructor was poor - didn't like
07: PLC - could have more emphasis on this in the course
08: Needed more information -(better introduction) over my head (math & hydraulics)
10: Nothing
11: Equipment terrible; Hydraulics components were terrible (hydraulic hardware)
12: Equipment in pneumatics lab needs improving
13: Instructor was old, senile; He bounced around to different subjects and he was hard to follow.
14: The scheduling of the class (in the evening)
15: Not enough equipment or training modules
16: The oil was messy
17: Architecture 102 - disappointed w/ instructor
18: Pneumatics equipment poor
19: Nothing
20: Nothing
21: Nothing
22: Instructor for hydraulics was poor
23: Pneumatics - disliked - labs terrible & equipment terrible-gauges not working properly
24: Heating courses - more duct work
25: Pneumatics lab -very poor (equipment)
26: Nothing
27: Hydraulics - not very explanatory
29: Pneumatics labs terrible - equipment very poor

30: Nothing
32: Nothing
33: Teacher too old - couldn't understand or explain
34: Oil was dirty
35: The instructor - He knew the subject but he went off on tangents that did not apply to the class.
36: They were messy
37: Equations are difficult
38: Labs not properly equipped - When there was a need to do an electrical test, there were no multimeters.
39: No
40: Little of the information (knowledge) actually applied to my degree program.
41: Nothing
42: Nothing - a good class
43: Nothing
44: Length of class - 3 or 4 hours long
45: Nothing - good class
46: It was outdated
47: The instructor applied most of the classes to robotics.
48: Nothing

12. What could OCC do to improve the Fluid Power program?

03: Nothing
06: Nothing
07: More CAD use computer integrated manufacturing hydraulic diagrams (CIM)
09: Instructor kind of old - would like someone younger
10: Nothing
11: Equipment bad & instructor didn't spend much time with the student; Not enough attention for the high level students
13: Need to update instructor
14: Have the class in the daytime or midday
15: Robotics needed higher technology robots - the ones used presently are "antiques"
16: Should raise the technology level of the class. The hydraulics used in factories are at a higher level than the OCC classes offered.
19: Nothing
20: Equipment could be updated
21: See Question 10
22: One instructor very poor
23: Pneumatics & Hydraulics need to be improved (put more money into it). Labs not set up -equipment poor in pneumatics
25: Need a full time instructor in Fluid Power
26: Nothing
27: Better instructor for Intro. Hydraulics
28: Nothing

29: Scheduling of courses - cancelled because of lack of enrollment so couldn't take any more courses at OCC
31: Nothing
32: Nothing
34: Movies need to be updated (1960's)
35: Get some better equipment, get more work boards
36: No comment
37: Nothing
38: Get a larger facility (Auburn Hills). Other students used the room/faculty and FP students could not hear the instructor.
39: Nothing
40: Get better equipment. When time for lab, half the equipment was broken (Auburn Hills).
41: It was a very good class
42: Some people have trouble getting into classes or the classes were cancelled.
43: Scheduling of lab time hours
44: No comments
45: Don't know - nothing to compare it to.
46: Update the program.
47: Combine hydraulics into the back and front end alignment classes for vehicle body technology.
48: Nothing

13: Is there any comment you would like to make about the Fluid Power program at OCC?

11: Instructor spent most of his time with the beginning students in a combined class.
13: Need to have a pre requisite of math - algebra before admitting a student into FP classes. Need more types of FP classes.
14: No, great class
23: Need to update it to attract more people. Good paying jobs available; advertise it.
25: Enjoyed course - learned a lot
27: Teacher expected too much for a beginning course.
41: FP is a necessary class; it should be on the program. FP is a necessary part of automation.
44: It is helpful that OCC has experienced teachers such as Mr Konopka.
45: Mr. Konopka is an excellent teacher.

Appendix H
Fluid Power Technology
Employers Surveyed

Cheryl Davis
Supervisor of Employment
Giddings & Lewis Integrated Automation
17801 East 14 Mile Rd
Fraser, MI 48026
(313) 293-3000
ID# 23

Jaye Saarinen *(D)*
Manufacturing Manager
Raycon Corp
2850 Industrial Hwy
Ann Arbor, MI 48104
(313) 677-2614
ID# 58

George Nordstrom
Sales Manager
American Heller Corp
33632 Doreka Drive
Fraser, MI 48026
(313) 294-6066
ID# 22

Darin O'Riley
Vice President
MCSS Limited
24260 Indoplex Circle
Farmington Hills, MI 48333
(313) 471-4121
ID# 16

Brian McCallum
Plant Superintendent
Hewitt Tool Co
120-124 East Hudson Ave
Royal Oak, MI 48068
(313) 399-6180
ID# 19

Philip Serra
Plant Superintendent
Fab-All Prototype
645 Executive Drive
Troy, MI 48083
(313) 585-6700
ID# 18

Mark Pritchard
Production Scheduler
Miller Fluid Power
33067 Industrial Road
Livonia, MI 48150
(313) 522-1902
ID# 49

Jan Meyers
Sales
Parker-Hannifin
651 Robbins Drive
Troy, MI 48007-3500
(313) 589-2400
ID# 50

Michael Detz *(D)*
Service Manager
Pneumatics & Hydraulics
21251 Ryan
Warren, MI 48091
(313) 758-0108
ID# 53

Charles Hodder
Shop Foreman
La Valla Prototype
Madison Heights, MI 48071
(313) 583-3410
ID# 20

Michael DeRush *(D)*
President
Hydramet Amer Inc.
Royal Oak, MI 48073
(313) 547-7600
ID# 21

John Noble *(D)*
Director of Materials
Theilhaus Microfinish Corporation
Novi, MI 48375
(313) 349-9450
ID# 24

Tom Paulin
Senior Fluid Power Engineer
Krueger H R Machine Tool Inc.
Farmington, MI 48336
(313) 477-8400
ID# 25

Kathy Smith *(D, P)*
Purchasing Agent
Overhead Conveyor Co.
Ferndale, MI 48220
(313) 547-3800
ID# 26

Don Smith *(D, P)*
General Manager
Cannon Engineering & Equipment Co.
Troy, MI 48084
(313) 362-0560
ID# 28

Brad Peake *(P)*
Sales Manager
QED Environmental Systems, Inc
Ann Arbor, MI 48103
(313) 995-2547
ID# 38

John Kasperan *(P)*
Process Engineer
TI Coating Inc.
Utica, MI 48315
(313) 726-1900
ID# 40

Dennis Marshall *(D)*
Engineer
Peaker Services Inc.
Brighton, MI 48116
(313) 437-4174
ID# 44

Bruce Steagell
President
Billow Co.
Detroit, MI
(313) 255-4446
ID# 57

Jerry Childers *(D, P, U)*
Manufacturing Manager
Novi Precision Products, Inc
Brighton, MI 48116
(313) 227-1024
ID# 59

Larry Donovan
Training & Documentation Manager
Behr Sys Inc
1911 Northfield Drive
Rochester Hills, MI 48309
(313) 853-2400
ID# 39

Kirk Bolton
Controls Engineer
Bond Robotics Inc
6750 19 Mile Road
Sterling Heights, MI 48314
(313) 254-7600
ID# 42

Dave Ebbler
Plant Electrician
General Bearing Corp
30156 W Eight Mile Rd
Farmington Hills, MI 48336
(313) 478-1745
ID# 37

Craig Ford *(P)*
Plant Manager
Monnier Inc
2034 Fruit Street
Algonac, MI 48001
(313) 794-4935
ID# 36

Carl Redner
Engineering Manager
General Filters Inc
43800 Grand River Avenue
Novi, MI 48375
(313) 476-5100
ID# 30

Charles Pate *(D)*
General Manager
Carden Metal Fabricators Inc
981 East Saratoga Ave
Ferndale, MI 48220
(313) 547-6310
ID# 45

Don Ericson
Purchasing Manager
Firwood Mfg Co
23915 Kean Avenue
Dearborn, MI 48124
(313) 274-5100
ID# 43

Ray Patil
Manager Manufacturing Services
Core Indus Inc
500 N Woodward Avenue
Bloomfield Hills, MI 48304
(313) 642-3400
ID# 46

Don Purdy
Vice President
Detroit Elev Co
1938 Franklin Street
Detroit, MI 48207
(313) 259-3710
ID# 27

Chuck Rivers
Electrical Engineer
Fabricating Engineers Inc.
27170 Dequinder
Warren, MI 48092
(313) 575-9520
ID# 29

Larry Marsh
Owner
Jayco
555 South Court Street
Lapeer, MI 48446
(313) 664-3900
ID# 54

John Lee ***(D, P, U)***
Vice President of Michigan Operations
Kundinger Fluid Power
PO Box 71590
Madison Heights, MI 48071-0590
(313) 589-1885
ID# 55

Joe Wager ***(D, P, U)***
Accounting & Personnel
Master Pneumatic-Detroit Inc
6701 18 Mile Road
Sterling Heights, MI 48314
(313) 254-1000
ID# 01

Kim Watsky ***(P, U)***
Programming Engineer
Eonic Inc
464 East Hollywood
Detroit, MI 48203
(313) 893-8100
ID# 11

Tom Hull
Owner
Service Diamond Tool Co.
6169 Lakeshore Road
Port Huron, MI 48059
(313) 385-4436
ID# 12

Mike Bittle
Owner
P C S Co
34488 Doreka Drive
Fraser, MI 48026
(313) 294-7780
ID# 14

Hugh McLean
Design Engineer
Air Gage Co.
12170 Globe
Livonia, MI 48150
(313) 591-9220
ID# 13

Greg O'Bloy
President
Special Drill & Reamer Corp
408 East Fourteen Mile Rd
Madison Heights, MI 48071
(313) 588-5333
ID# 15

Robin Royer
Fluid Power Engineer
Fischer George Foundry Sys
407 Hadley Street
Holly, MI 48442
(313) 634-8251
ID# 41

Tony Hall
Manager of Engineering
Durr Indus Inc.
40600 Plymouth
Plymouth, MI 48170
(313) 459-6800
ID# 17

Cynthia Rucker
Administrative Assistant
City Wide Tool Service Co
18539 W Eight Mile Rd
Detroit, MI 48219
(313) 538-7040
ID# 04

Scott Miles *(D)*
Vice President
J. E. Miles Company
310 Executive Drive
Troy, MI 48083
(313) 583-1020
ID# 31

Ty Wells
Plant Foreman
Detroit Jack & Tool Service
2287 Indiandale
Detroit, MI 48238
(313) 867-2100
ID# 05

Mr. Drake
President
Drake Hydraulic Systems Inc.
22626 Dequindre
Warren, MI 48091
(313) 758-2266
ID# 32

Dan Linstrom *(D, P)*
Specialist in Hydraulics
J N Fauver Company
1500 East Avis Drive
Madison Heights, MI 48071
(313) 585-5252
ID# 03

Bill Hallock *(D, P, U)*
President
Hallock Hydraulic
837 Airport Boulevard
Ann Arbor, MI 48108
(313) 663-5100
ID# 34

Larry Hawes
Owner
Hawes Hydraulic Repair
31700 Eight Mile Road
Farmington Hills, MI 48336
(313) 476-2400
ID# 35

John Hollis
Owner
Hollis Hydraulic Supply
11677 South Wayne Road, Suite 100
Romulus, MI 48174
941-9900
ID# 33

Ed Riddle
Sales Manager
J. H. Bennett
41369 Vincenti Court
Novi, MI 48376-8028
(313) 476-8700
ID# 52

Jim Kowalsky *(D)*
Manager
Industrial Air & Hydraulic Equipment
20430 Sherwood Ave
Detroit, MI 48234
(313) 366-8134
ID# 56

EMPLOYERS SURVEYED

D = Willing to help in the development of a program
P = Willing to offer a paid internship
U = Willing to offer an unpaid internship

Jerry Schulte
Civil Engineer
WW Engineering & Science
39209 W Six Mile Rd
Livonia, MI 48152
(313) 591-0522
ID# 06

Norman Hughes
Owner
N R Hughes & Assoc
3875 High Pointe
Metamora, MI 48455
(313) 678-3678
ID# 07

Jim Rybicki ***(D)***
Owner
Creative Automation Sales & Engineering
29261 Wall
Wixom, MI 48393
(313) 349-3877
ID# 08

Tom Paquette
Vice President of Operations
Cargill Detroit Corp.
4475 Purks Drive
Auburn Hills, MI 48326
(313) 377-0300 x303
ID# 48

Iris Rust
Office Manager
Action Automation
33910 James J. Pompo Dr.
Fraser, MI 48026
(313) 294-1740
ID# 60

Scott Klein
Chief Engineer
Automated Systems Inc
2400 Commercial Drive
Auburn Hills, MI 48326
(313) 373-5600
ID# 47

Kevin McDonald
Senior Engineer
Ergomatic Systems
10388 Enterprise Drive
Davisburg, MI 48350
(313) 620-1830
ID# 51

Bob McConnell
Engineering
J I C Electric
6900 Chase Road
Dearborn, MI 48126
(313) 582-4700
ID# 10

Tim Donovan ***(D, P, U)***
Production Manager
Robotic Production Technology Inc
30545 Stephenson Hwy
Madison Heights, MI 48071
(313) 583-2185
ID# 09

Zolton Nemeth ***(P, U)***
Plant Manager
C R S Service
1986 Rochester Industrial Dr.
Rochester Hills, MI 48309
(313) 652-9940
ID# 02

Appendix I
Fluid Power Technology
Employer Survey

6. Do you plan to meet that need by

	Yes	*No*
a) Hiring new employees?	1	0
b) Retraining current employees?	1	0

c) Other, Please specify: _____

7. What are the reasons for the growing need for hydraulics and pneumatics skills? *(Please circle all that apply)*

	Yes	*No*
a) Employees are lacking these skills	1	0
b) Employees with these skills are leaving the company	1	0
c) New skills needed to meet new technology	1	0
d) Organization is expanding	1	0

e) Other reasons. Please specify:_____

8. What is the minimum **educational** qualification required by your organization for entry-level personnel in hydraulics and pneumatics?

	Yes	*No*
a) No specific educational requirement	0	1
b) High School diploma or equivalent	1	0
c) Completion of Apprenticeship	1	0
d) Certificate	1	0
e) Associate degree	1	0
f) Bachelor degree	1	0

g) Other education or degree, not listed *(Please specify)*_____

9. Please consider the following list of skills and qualifications you as an employer would value when hiring hydraulics and pneumatics technicians. Rate each on the scale 3=Very Important, 2=Somewhat Important, and 1=Not Important.

	Very Important	*Somewhat Important*	*Not Important*
a) Ability to work as a team member	3	2	1
b) Organizational skills	3	2	1
c) Ability to use individual initiative	3	2	1
d) Writing skills	3	2	1
e) Good speaking skills	3	2	1
f) Problem solving skills	3	2	1

10. What is the single most important quality or characteristic you look for when hiring hydraulics and pneumatics employees?

_____

_____

_____

11. As part of our assessment we are interested in understanding potential career paths for entry level technicians. Could you explain what advancement opportunities are available, with examples of typical job titles?

_____

_____

_____

12. Do you experience any difficulties finding entry level employees who work in hydraulics and pneumatics?

1 _____ Yes

0 _____ No *(Skip to 14)*

13. What problems do you encounter? _____

_____

_____

14. Please rate, on an average, how well qualified your entry level hydraulics and pneumatics employees are, using the scale: 1=Extremely Unqualified, 2=Not Qualified, 3=Qualified, 4=Well Qualified and 5=Extremely Well Qualified.

Please circle:

1 2 3 4 5 ***If 3, 4 or 5 skip to 16***

15. What specific skills do your entry level employees lack?

_____

_____

_____

16. The following list of knowledges and skills is quite long; however, we believe that it is important to consult with you on all the skills we now teach or are contemplating teaching. Please rate how important it is for entry level technicians to have a strong knowledge base in the following applications using the scale: 3=Very Important, 2=Somewhat Important, 1=Not Important.

		Very Important	*Somewhat Important*	*Not Important*	*Unaware of*
a.	Fundamentals of Hydraulics	3	2	1	8
b.	Fundamentals of Pneumatics	3	2	1	8
c.	Relationship of Forces, Motion, Work and Power	3	2	1	8
d.	Design of Circuits with Hydraulic, Pneumatic and Electrical Components	3	2	1	8
e.	Computer Aided Hydraulic Circuit Design	3	2	1	8
f.	Working with Metals and Elastomers in the Fabrication of Hydraulics and Pneumatics Components	3	2	1	8
g.	Logic Functions, Digital Control Circuits, and Data Organization	3	2	1	8
h.	Fundamentals of Drafting	3	2	1	8
i.	Pipe and Tube Isometric Drawing	3	2	1	8
j.	Geometry and Algebra	3	2	1	8
k.	Plane Trigonometry	3	2	1	8
l.	Industrial Safety	3	2	1	8
m.	Business Communications	3	2	1	8
n.	Electrical Fundamentals	3	2	1	8
o.	Other: _____				

17. Would your organization consider sending current employees to OCC for retraining in a hydraulics or pneumatics program?

1 _____ Yes
0 _____ No
7 _____ Uncertain, please explain: _____

18. Does your organization provide any formal <u>in-house</u> or <u>external</u> hydraulics or pneumatics training for employees (not including orientation programs)?

a) In-house training:

1 _____ Yes

0 _____ No

b) External training:

1 _____ Yes

0 _____ No *(<u>If response to BOTH a and b are "NO", skip to 20</u>)*

19. Can you describe the nature of the training? _____

_____

_____

20. Is there any customized training that OCC can provide for your company? *(Information can be sent, if they wish)*

0 _____ No
7 _____ Uncertain
1 _____ Yes, please explain: _____

_____

_____

21. Would your organization consider offering internships (either paid or non-paid) for students in a Hydraulics and Pneumatics program?

PAID?
1 _____ Yes
0 _____ No
7 _____ Uncertain, please explain: _____

UNPAID?
1 _____ Yes
0 _____ No
7 _____ Uncertain, please explain: _____

22. Would you be willing to help in the review of our Hydraulics and Pneumatics Technology Program? *(This could include activities such as focus groups, advisory committee)*

1 _____ Yes

0 _____ No

7 _____ Uncertain, please explain: _____

Thank you for your time and assistance. We appreciate your help and believe that your responses will help to influence what happens in our community colleges in the future. If you have any further questions please contact OCC's Office of Planning and Analysis at (313) 471-7746.

Interviewer: _____

Date: _____

Time interview finished: _____

Appendix J
Fluid Power Technology
Narratives from Employer Survey

FLUID POWER TECHNOLOGY
NEEDS ASSESSMENT
EMPLOYER RESPONSES

1. Which of the following categories best describes the nature of your organization? Other:

11: CAM Machine Repair
18: Auto Metal Proto-type Stamping
20: Sheet Metal Forming; Sheet Metal Proto-types
29: Material Handling
38: Assembly Facility
51: Material Handling

2. What are the main duties of your employees who work in either hydraulics or pneumatics?

Hydraulics:

06: Design process systems
12: Assemble presses and testing machines
27: Manufacture, install, and service elevators
28: Install and repair hydraulics on trucks
31: Work with hydraulic systems (pumps, valves, cylinders)
32: Build hydraulics systems for auto companies, analyze and repair systems, put components together, and do sales
33: Assemble and rebuild
34: Design and build systems, repair and rebuild valves
35: Repair and rebuilding of machinery
37: General repair
40: Use hydraulics components in manufacturing process
43: Build machinery, put units in working order
58: Hydraulic tooling design

Pneumatics:

01: Assemble
36: Assembly work
38: Employees assemble and test equipment - make pneumatic pumps with pneumatic controls
42: Pipe fitting and designing
44: Installation, rebuild valves, troubleshooting
47: Piping
51: Designing, engineering, building and manufacturing
54: Assembly
56: Component sales, some designing and building

Didn't Specify:

02: Rebuilding and Assembling
03: Manufacture and repair tools
04: Repairs and sales
05: Operate lathe, drill press, honing applications
07: Systems design
08: Design automation systems for auto companies, make special machines
09: Sell robotics for various applications, material handling, programming, assembly, designing, fabrication
10: Design electrical circuits for machines
11: Machine repair
13: Make gauging equipment, design into machinery and put together equipment
14: Plastics assembly and repair
15: Machining
16: Machine repair
17: Sizing systems; defining content of systems
18: Operate presses
19: Operate machines
20: Operate air grinders, presses, spot welders, sheet metal formers
21: Assemble, start up of project
22: Assembling
23: Design and testing
24: Install components in machinery
25: Detailing and designing
26: Manufacturing duties; welding and fitting
29: Installation, troubleshooting; employees using hydraulics and pneumatics usually are electricians and or have a mechanical background
30: Maintenance
39: Assemble and design
41; Design start-up
45: Designers and detailers
48: Pipe making, drawing
49: Assemble cylinders - quoting, order processing, manufacturing, follow-up, inventory control, shipping and receiving
50: Sales
52: Customer service, engineering, fabrication
53: Repairing and sales
55: Sales and customer service of components (pumps, motors, cylinders)
57: Disassemble and repair tools
59: Build the print

5. Is your need for employees skilled in hydraulics or pneumatics increasing?

01: In pneumatics
10: Need for computer skills increasing

05: Must be able to read micrometers, telescope gages, check for flatness, square, & parallel
07: Knowledgeable, adaptable, flexible
08: Autocad applications, mechanical design
09: Past work experience
10: Past work experience
11: Technical skills
12: Self motivated
14: Flexibility, need to wear many hats, willingness to learn
15: Good attitude
16: Ability to work with others
17: Technical competence
18: Desire to perform
19: Dependability
20: Previous experience & good attendance
21: Attitude
22: Problem solving skills
23: Electrical/mechanical background with hands on experience
24: Organization skills
26: Skills & background
27: Team effort
28: Ability to follow directions
29: Knowledge of systems
30: Problem solving skills
31: Experienced & educated
32: Reliable, experienced
33: Dependable, mechanical ability
34: Trainable, quick to learn, conscientious, mechanical ability
35: Mechanical ability and skills
36: Safety minded individual
39: Attitude
40: Team player
42: Reliability
44: Attitude
45: Team skills
46: Basic knowledge of hydraulics and pneumatics
47: Past experience
48: Experienced, team member, able to communicate
49: Attention to detail
50: Communication skills
51: Dependable
52: Computer skills and team player
53: Work experience and attitude
54: Overall aptitude & knowledge
55: Well rounded experience
56: Sales ability

27: In hydraulics
28: In hydraulics
36: In pneumatics
38: In pneumatics
42: In pneumatics
51: In pneumatics
55: Need for people skilled in pneumatics and electrical is increasing

Uncertain, please explain:

04: Hard to say
12: Robotics area expanding
14: In the electrical end
32: Lost art; not much use for hydraulics anymore
39: Need more computer skilled people

7. What are the reasons for the growing need for hydraulics and pneumatics skills?
Other reasons:

17: Clients' needs are expanding
36: There are not enough people trained in pneumatics
40: Increasing demand for the use of hydraulics
25: More employers need detailers and designers with CAD

8. What is the minimum educational qualification required by your organization for entry- level personnel in hydraulics and pneumatics?
Other education or degree:

01: Require a two year degree for an engineering technician
18: Need shop classes in high school
21: They must have 1-2 years of experience plus some college or 1-2 years of college or be in college now
25: They must be in college, but they don't need to have the degree yet.
52: Like them to have schooling past high school
55: Would really prefer a 2 year associates degree

10. What is the single most important quality or characteristic you look for when hiring hydraulics and pneumatics employees?

01: Technical ability & attitude
02: Past experience
03: Ambition
04: Mechanical skills

to installing the product, to troubleshooting the product, to repairing the product.

39: From entry level to field & service technician; to management position; to project manager; to design management.

41: Employees have the option of going from designer, to engineer, to sales, to sales marketing, to components repair technician, to systems trouble shooter, to service manager

42: From pipefitter trainee to pipefitter leader can move to designing or engineering if qualified.

43: From helper/mill hand to shop foreman

45: Hydraulics and pneumatics are needed as a side skill to other specific skills in this company, so I have no answer.

46: From maintenance, to journeyman, to group leader, to maintenance supervisor, to plant engineer

47: We offer tuition reimbursement so that employees can get higher positions in engineering and welding

48: With good education could go to controls engineering or to managerial positions

49: Plant or shop manager

50: Sales to management levels

51: Possibly to managerial positions

52: Employees can move to management

53: Employees can move to engineering, management, and sales

54: Company is too small for advancement

55: Sales people can move to manager levels

56: Employees can move to different levels of sales

57: They move to the Big 3 after experience

58: Abilities in pneumatics and hydraulics isn't going to get them any higher - they need to know other skills

59: Our pipe fitters don't move up to different job titles. When they become highly skilled, they move to bigger companies.

60: To supervisor positions or field service (troubleshooting)

13. What problems do you encounter in finding entry level employees who work in hydraulics and pneumatics?

17: Overinflated salary expectations

19: Some cannot read or write

21: Lack of basic understanding & bad attitudes

25: Hydraulics and pneumatics seems to be a second choice occupation with electrical being first.

28: People are not willing to work

29: Applicants do not know or understand material handling business

33: It's hard to find people who aren't on drugs

34: Can't find a good inside salesperson

36: People know hydraulics, few seem to know about pneumatics, not enough courses offered in pneumatics

57: Pleasant & hard working
58: Need other experiences with machine tools
59: Good hard worker
60: Read prints (schematics & blueprints)

11. As part of our assessment we are interested in understanding potential career paths for entry level technicians. Could you explain what advancement opportunities are available, with examples of typical job titles?

03: Technicians can move up to application engineers
05: Hydraulics repairmen can move into service and sales
06: Engineers can move to senior levels
07: Engineers can move to head of engineering
08: Can move up with more skills and obtain a higher salary
10: Can move up to head of a department
11: Possibly to management
12: Possible raise in salary
13: Can advance to machine builder
14: Advance to supervisor
15: Maybe management
16: To plant superintendent
17: Up to supervisor level which pays $55-65,000/year
18: Advancement comes as one gains knowledge
19: Up to plant superintendent
20: Leader to upgrader
21: Full machine builder to master builder
22: From assembler, to sales tech., to service tech., up to chief engineer
23: Detailer, to layout, to designer
24: Depends on education. Can go into controls applications. With electrical plus hydraulics and pneumatics skills may go into engineering or become a shop superintendent.
25: Detailer to designer to project engineer
26: From manufacturing could move into electrical or mechanical engineering
28: From trainee to hydraulics technician, supervisor of installation & maintenance, to design work.
29: From fabrication go into field service, then to installation, to engineering, to project management (with proper education).
30: From maintenance tech., to area supervisor, to engineering technician
31: Possibly to engineers or managerial positions
32: Very limited; maybe supervisory level
33: Mechanics can advance to shop foreman
34: Can advance to service and then to sales
35: Very limited because of size
36: From assembler, to machine work, to design process, to engineering process
37: Can move to electrician or supervisor to manager
38: Customer service, to repairing and troubleshooting of equipment, to servicing the field,

38: No experience with pneumatics
41: People don't have practical experience
42: The people are not out there
44: Not enough minority (color, ethnic, gender) people apply; only white males seem to apply
46: We don't have any problems in Detroit or New York, in other parts of the country where our plants are located, we have more problems finding people.
48: No, there is an overabundance of people
52: People aren't interested in the fluid power programs - shortage of prospective employees
53: Hard to find people with experience & skills
57: Difficult to find anyone who has skills
59: Applicants need better basic skills

15. What skills do your entry level employees lack?

17: They don't expect to work as hard as they must to do the job
21: They lack circuitry knowledge
25: They do not learn, know, understand machine tool business
28: They do not have knowledge of hydraulics
29: Employees do not understand how hydraulics and pneumatics work
36: Knowing safety factors when working with compressed air
38: They lack knowledge/understanding of physical properties of compressed air from a mechanical standpoint. Need understanding of how air is calculated, what its capacities are, pressure limits, how to use it.
40: This is a specialized company (manufacture chemical vapor deposition equipment) few people have had any experience with this type of work.
42: Reliability
43: Common sense
44: Business is very specialized - no way to get skills that apply to this business
45: Need skills in communicating (writing, speaking, and understanding)
46: Do not have knowledge of basic skills of hydraulics & pneumatics
57: Basic knowledge of how a tool operates

17. Would your organization consider sending current employees to OCC for retraining in a hydraulics or pneumatics program?
Uncertain, please explain:

03: Possibly, it depends on the program
05: We use Macomb Community College
09: Possibly, it depends on the course
14: It depends on the course offered, we really need a class on how to read an electrical machine control diagram
17: We offer reimbursement
20: We have tuition reimbursement, but employees seek out classes

21: Presently send to Macomb Community College; we have employee reimbursement
27: Company has tuition reimbursement, but employee must seek own classes.
29: We offer tuition reimbursement, but employees have to seek their own classes
44: We do send to OCC
45: We're currently sending our employees to Macomb Community College
46: None of our plants are located in Oakland County
48: We offer tuition reimbursement, but the employees choose their own schools
53: Possibly, depends on what's offered
54: Possibly, depends on program
58: Vendors offer the retraining we need
59: I'd have to look at the program first

19. Can you describe the nature of the training?

01: Workshops, seminars, and on the job training
04: Workshops and on the job training
05: Use Macomb Community College
06: Seminars and workshops
10: Seminars & workshops
11: Seminars
12: On the job training
27: Vendor classes; International Elevator Constructors Union provides good classes & instruction
28: Instruction on basic hydraulics and use vendor seminars
31: Seminars & workshops
32: Workshops
33: Tuition reimbursement
34: Tuition reimbursement
36: OSHA, understanding specific aspects of working with compressed air; staying within specific guidelines of working with compressed air.
39: Employee self initiative - employee seeks out what he wants/needs - have tuition reimbursement; vendors supply training
40: On the job training
41: Vendor & Rexroth training
42: Classes offered by vendors
44: Company pays the employee to go to school; subject is the employee's choice
47: Employees go on their own for additional training; company doesn't provide any training
49: Seminars & workshops
50: Seminars
52: External training provided by other companies; have on the job and seminars
53: Tuition reimbursement, on the job, and workshops
55: On the job
56: Seminars & on the job
58: One person is well versed in hydraulics and he will train others. Vendors and local community colleges offer courses

59: The people we buy our materials from will offer classes to train our employees on those materials.
60: Seminars

20. Is there any customized training that OCC can provide for your company?

20: Possibly in drafting or shop math
21: Need to put on classes for our clients, balanced out over a 1-2 week period. Provide hands-on experience on theory, testing, trouble shooting. Formerly used Vickers School of Hydraulics but that is no longer an option. Need to use OCC's training center to bring in our clients.
24: Please send me information on BPI.
25: Maybe some interest; would have to contact Larry Swan Jr.
28: Need a well-designed seminar on basic hydraulics
38: We have a diverse group; where training most needed - where most interest is -- could be design for manufacturing people or pneumatics fundamentals for sales people.
40: Quality control training; SPC training. Could use a seminar or one day workshop on quality control or something in electrical field for electricians.
44: Would consider it; classes in math skills (trig, geometry, algebra)
57: Hands on pneumatic/hydraulic classes
59: Can't think of any off the top of my head.

Appendix K
Agreement Between the Rexroth Corporation & Oakland Community College

AGREEMENT

THIS AGREEMENT is made this __1st__ day of May, 1992, between OAKLAND COMMUNITY COLLEGE (OCC) and THE REXROTH CORPORATION (REXROTH).

RECITALS:

A. OCC and REXROTH have entered into a letter of agreement dated June 5, 1986; revised July 3, 1986 and May 1, 1992.

B. The parties wish to make more definite some of their duties and obligations and provide for a mechanism for terminating the relationship between OCC and REXROTH;

NOW THEREFORE, in consideration of the mutual promises and undertakings set forth below, the parties agree as follows:

1. REXROTH shall:

a) Assist OCC in pursuing Tech Prep opportunities with secondary school districts;

b) Assist OCC in developing an electro-mechanical fluid power curriculum;

c) Provide training and education to OCC faculty who utilize the electro-mechanical teststands/equipment, provided by REXROTH, in teaching courses;

d) Keep the teststands updated with improvements during the life of this agreement;

e) Cooperate with OCC in offering fluid power training courses to members of the business and industrial community when such courses do not conflict with other OCC courses in the fluid power laboratory.

e) Abide by the spirit and intent of the letter agreement dated June 5, 1986 and revised July 3, 1986 and May 1, 1992;

f) Use tuition and course fees received by OCC from each enrollee to cover the cost of each course. Courses that do not generate adequate enrollment to cover course and program cost will be cancelled or at REXROTH'S option conducted at REXROTH'S expense.

There shall be agreement between REXROTH and OCC to a mutually established course charge and tuition rate that is cost effective.

2. OCC shall:

a) Abide by the spirit and intent of the letter agreement dated June 5, 1986 and revised July 3, 1986 and May 1, 1992;

b) Provide a laboratory with REXROTH equipment that can be used as part of the fluid power program at OCC;

c) Offer fluid power courses in cooperation with REXROTH to area businesses and industries at times not in conflict with on-going OCC courses;

d) Set a cost effective course charge for courses offered in cooperation with REXROTH;

e) Communicate to REXROTH the total charge for a course in which REXROTH cooperates in the form of an itemized invoice;

f) Receive tuition for such courses from enrollees, credit tuition received to the total charge for the course and inform REXROTH if the total tuition received is more or less than the total charge of the course.

3. The relationship between OCC and REXROTH, and all agreements between OCC and REXROTH, may be terminated as follows:

a) This agreement and the letter agreement and the relationship between OCC and REXROTH may be terminated by either party at any time without cause, or for any cause, and without further obligation, upon 30 days written notice to the other party;

b) There shall be no liability to either party for damages, either direct, indirect or consequential, as a result of any such termination;

c) Any termination agreement will consider the needs of students presently enrolled in the program.

OAKLAND COMMUNITY COLLEGE

BY:_____

BY:_____

THE REXROTH CORPORATION

BY:_____

BY:_____

Appendix L
Letter from Tyndall Air Force Base

DEPARTMENT OF THE AIR FORCE
325TH MISSION SUPPORT SQUADRON (TAC)
TYNDALL AIR FORCE BASE FL 32403-5000

15 Jan 91

Professor Edward Konopka
Oakland Community College, Auburn Hills Campus
5900 Featherstone Road
Auburn Hills, MI 48059

Dear Professor Konopka

Enclosed please find a Cooperative Education Program Working Agreement to establish a program between Tyndall Air Force Base, Florida and Oakland Community College. Please obtain the appropriate signature and complete the signature element for the educational institution on the lower left of page 1. Please return the executed agreement to this office for our records. Also enclosed is a copy of the Federal Personnel Manual governing co-op positions.

The SF 171, Application for Federal Employment, and SF 181, Race and National Origin, are for your use when and if we do get a co-op position established and begin recruitment.

Should you have any questions or wish to discuss this information, you may contact me at (904) 283-4531/4532. Our mailing address is: 325 MSSQ/MSCS, Stop 29, Tyndall AFB, Florida 32403-5705.

We look forward to providing a rewarding and profitable work experience to your students.

Vera R. Heath

VERA R. HEATH
EEO & Staffing Specialist

4 Atch
1. Agreement
2. Federal Personnel Manual
3. SF 171
4. SF 181

1. Which of the following categories best describes the nature of your organization?
(Please circle all which apply)

	Yes	*No*
a) Machinery/Automation Manufacturing	1	0
b) Machine/Hydraulics Equipment Repair	1	0
c) Machine Tool Accessories	1	0
d) Construction/Contracting	1	0
e) Sales	1	0
f) General Manufacturing, Production and Processing	1	0

g) Other: _____

2. What are the main duties of your employees who work in either hydraulics or pneumatics?

(Hydraulics) _____

_____

(Pneumatics) _____

_____

3. How many hydraulics and pneumatics employees do you have working in your organization?

_____*(actual number)*

4. Among your hydraulics and pneumatics employees, what are examples of job titles and salary ranges for **entry** level positions?

	Entry Level Job Titles	Entry Level Salary Range
a)	_____	_____ to _____ per hour
b)	_____	_____ to _____ per hour
c)	_____	_____ to _____ per hour

5. Is your need for employees skilled in hydraulics or pneumatics increasing?

1 _____ Yes *(Please circle hydraulics or pneumatics if they specify)*

0 _____ No *(If "No", skip to 8)*

7 _____ Uncertain, please explain: _____

Survey Number_____

FLUID POWER TECHNOLOGY
NEEDS ASSESSMENT
EMPLOYER TELEPHONE SURVEY

Name of Business:_____

Type of Business:_____

City and Zip Code:_____

Telephone: _____

A. Once you reach the Director of Training, Personnel, Human Resources or other appropriate supervisor, be sure to record:

Name: _____

Title:_____

Phone:_____

Time Interview Begins:_____

B. Begin survey here:

SURVEY

We are in the process of reviewing our hydraulics and pneumatics program. I'd like to talk to someone who works with hydraulics and pneumatics and who would be able to comment on our curriculum and tell us what skills they need in employees who work in hydraulics and pneumatics.

(The Fluid Power Technology program at OCC is designed to prepare students to achieve functional competence as a Fluid Power Technician. The courses cover both the theory and application of many aspects of hydraulics and pneumatics.)