Addendum Added June 2019

PCC MACHINE MANUFACTURING TECHNOLOGY

2019 Academic Program/Discipline Review

FT Faculty
Richard Luff
Matthew Graves
Scott Stewart
Alexander Vins

PT Faculty
Donald Birkley
Jesse Moreno
Grant Carsen
Tyler Stahl

Mastercam Tutor
Keri Salim

Academic Advisor
Stedman Bailey

Lab Tech
Rodney Willis

Administrative Liaison
Sarah Tillery Division Dean

Table of Contents

1. Program/Discipline Overview

A. What are the educational goals or objectives of this program/discipline?

The PCC Machine Manufacturing Technology program is one of the oldest original programs at the Sylvania campus. We prepare students for entry into high demand technical manufacturing careers in our surprisingly diverse local ecosystem of employers. Our graduates can be found at Acumed producing surgical hardware, at Boeing machining aerospace parts and A-dec manufacturing everything from furniture for dental offices to tools used in the dental profession.

In addition to these large manufacturers and producers of product, there are many smaller companies and machine shops filling the role of secondary tier suppliers to the larger OEMs (Original Equipment Manufacturers). Smaller shops also employ our graduates and vary in size from a handful of employees to dozens.

These shops can one month be called up to rapidly machine prototype shoe molds for the international athletic brands based in Portland. The next month they find themselves re-tooling to machine chip fab components for Intel. Nearly all durable and non-durable consumer goods are either machined, or machining is required somewhere in their production process supply chain.

All of these diverse manufacturing scenarios require our machinist graduates to be adept at applying foundational ancillary concepts such as Blueprint Reading for Machine Mfg. (MCH 110B) to interpret the part or product geometry and specifications as well as Geometric Dimensioning and Tolerancing (MCH 115) to inspect and verify accuracy of the completed part.

The bulk of our curricula is focused on helping students develop and apply their hands-on material removal skills in the lab on both manually operated lathes (MCH 190B) manual mills (MCH 205) as well as Computer Numerically Controlled versions of these machines (MCH 278, 279).

Excerpts from the PCC Machine Manufacturing website:

> *"In our machine-manufacturing program, we provide the skills you need to begin a career with the fundamental machining skills and concepts proven over time. Our program provides an opportunity to learn with self-paced, modular courses that provide you with necessary fundamental skills, helping you keep pace with the industry and advance your career."*

How do these compare with national or professional program/discipline trends or guidelines?

It is becoming increasingly evident that manufacturing is evolving rapidly and perhaps even more-so than other segments of the employment market. Collegiate manufacturing programs which thrive are not merely meeting the needs of current employers, but are also anticipating and forecasting the future skills needed for graduates to compete in the machine manufacturing marketplace.

The overarching trend in manufacturing is the increasing automation of repetitive manufacturing tasks requiring lower-order skills. If a machining task or operation can be readily programmed and automated, it most assuredly will be.

Increasing automation is creating growing pressure on manufacturing programs to continually re-evaluate discrete aspects of lower-order fundamental manual machining skills and concepts. It is a constant push and pull in weighing the efficacy of including certain basic concepts at the expense of higher-order programming and CNC-related concepts and application skills.

Have they changed since the last review, or are they expected to change in the next five years?

Manual machining is still somewhat prevalent in the manufacturing sphere and continues to be taught in manufacturing programs. The teaching of manual machining has value in introducing basic concepts of material removal and part production as these are essentially the same processes performed by programmable machines. An additional added value is when students engage in turning the handles while hearing and feeling the feedback given by these manual mills and lathes. Programmable CNC machines give little to no tactile feedback, but are nevertheless governed by the same physics and principles of material removal.

The dilemma is where to prioritize instruction as manual machining becomes increasingly overshadowed by CNC machining in the manufacturing industry. In the next five years, MMT will need to expand CNC instruction while at the same time prioritizing and distilling manual machining instruction to the high value skills most likely to inform the thinking of future machinists.

B. Curricular, instructional, or other changes that were made as a result of your SAC's recommendations in the last program review and/or the administrative response.

- ***Continue to review and upgrade course outlines for most courses.***

In 2015 the SAC began a comprehensive review of duplicative course level content and outcomes. With the guidance of Sarah Tillery in 2017-18, the SAC eliminated and consolidated numerous courses within the AAS degree and all certificates. This work is detailed in **Section 2**.

- ***Continue to review and adopt emerging technology.***

The department acquired 3 new CNC machines with advanced features and capabilities which are detailed in **Section 6**.

- ***Seek financial aid support for one year and EST certificates.***

Over the past five years 20 MCH students have been awarded a total of $17,362 from the OCF Costanzo scholarship.

MCH students also have 2 year scholarships available from the National Science Foundation totaling $11,650 each.

- ***Our SAC needs to review and possibly adjust up the minimum math requirement for our program.***

Adjunct faculty member Donald Birkley worked extensively to revise the MCH 120 Machine Shop Math course as well as the appropriate math requirements for entry into the program.

- ***Expand internship (CO-OP) resources to assure certificate and degree completion.***

Machine Manufacturing Technology students can choose from small local machine shops to world class Manufacturers like Boeing to complete their CO-OPs. Most CO-OPs are paid positions with a hourly wage averaging $18/hr.

- ***Market to engineering and arts programs to inform students of opportunities in our creative trade.***

Several Machine Manufacturing faculty teach the machining lab module of ENGR 262 Manufacturing Processes. Students are introduced to manual lathes and mills as they complete a project assembly developed by Alexander Vins.

- ***Engage in cross departmental coursework for a certificate (EST?) relating to product design and development.***

The SAC is in discussions around expanding curricular opportunities to address the demand for machining skills related to product design and development.

- ***Create EST certificate in Rapid Prototyping.***

When developed, this certificate will likely fold into the curricular initiative mentioned above.

- ***Create metrology lab to support quality, GDT, and inspection topics - Est. $30k/ea.***

The Metrology Lab initiative was spearheaded by Donald Birkley to support the revision of MCH 115a and 115b.

- ***Begin process to replace 12 manual lathes, all approx. 30 years old – Est. $10k/ea.***

6 manual lathes and 9 manual mills have been replaced as detailed in **Section 6.**

- ***Bond related updates:***

The following lab/classroom line item updates were completed.

- *Install larger exhaust vent system on roof for heat treat, compressor room, router room, and RP room.*
- *Paint and upgrade entire department including shop, classrooms, and offices.*
- *Add external air intake, exhaust, and sound dampening to compressor room.*
- *Reorient Mastercam Lab for presentation layout and add podium for projection to side of room.*
- *Remove sheet metal boxes in material room that covered auto hoist hardware.*
- *Noise abatement in router room.*

2. Outcomes and Assessment

A. Course-Level Outcomes:

i. *What is the SAC process for review of course outcomes in your CCOGs to ensure that they are assessable?*

In the late 1990's the Machine Manufacturing program was revised and transitioned to the current modular format. From that point, a variety of content areas and courses were added to the curriculum ad hoc with things remaining otherwise unchanged. Nor was a formal effort mounted to review our curricula as an interrelated whole.

In 2015, the SAC began discussions around overlaps and redundancies in both curriculum and across course level outcomes in numerous 100 level MCH offerings. This process to identify redundant courses and consolidate others began in earnest during the 2017-18 academic year. These changes resulted in a reduction to the Career Pathways Cert. by 6 credits, Manual Machining Cert. by 8.5 credits, CNC Milling Cert. by 4 credits and Turning Cert. by 3. The AAS is being adjusted down to 98 credits. Changes are documented in Appendices 1 through 4.

ii. *Identify and give examples of changes made in instruction, to improve students' attainment of course outcomes or outcomes of requisite course sequences (such as are found in in MTH, WR, ESOL, BI, etc.), that were made based on the results of assessment of student learning.*

As of the 2012 Program Review, the MMT program has experienced a series of major transitions. Most notable is the changeover in our dean leadership. We have had four deans in five years. Additionally, we have had a 50% retirement rate among full-time permanent faculty in the last two years. Due in part to these transitions in both faculty and dean leadership, assessment of student learning has not been a SAC priority. We do not have examples at this time.

Our hope moving forward is that with the addition of two new FT faculty and more steady leadership such as we have had over the last two years, we can continue our curriculum overhaul and incorporate the necessary assessments of student learning.

B. Addressing College Core Outcomes: Core Outcomes Mapping Matrix updated Feb 2019.

Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
MCH 100	Machine Tool Basics	2	0	4	0	4	3
MCH 110B	Blueprint Reading II	2	0	4	0	4	3
MCH 115A	Geometric Dimensioning & Tolerancing	2	0	4	0	4	3
MCH 120	Machine Shop Math	2	0	4	0	4	3
MCH 121	Manufacturing Processes I	1	0	3	0	3	3
MCH 130	Trigonometry	3	0	4	0	4	3
MCH 157	Project Machine Technology I	2	0	4	0	4	3
MCH 158	Project Machine Technology II	2	0	4	0	4	3
MCH 159	Project Machine Technology III	2	0	4	0	4	3
MCH 160	Drilling Machines & Operations	2	0	4	0	4	3
MCH 175	Band Saws	2	0	4	0	4	3
MCH 180	Turning Machines & Operations	2	0	4	0	4	3
MCH 190B	Threading and Boring on the Lathe	2	0	4	0	4	3
MCH 205	Vertical Milling Machines & Operations	2	0	4	0	4	3
MCH 210	Project Machine Technology IV	2	0	4	0	4	3
MCH 211	Project Machine Technology V	2	0	4	0	4	3
MCH 212	Project Machine Technology VI	2	0	4	0	4	3
MCH 213	Project Machine Technology VII	2	0	4	0	4	3
MCH 214	Project Machine Technology VIII	2	0	4	0	4	3
MCH 215	Horizontal Milling Machines & Operations	2	0	4	0	4	3
MCH 222	Coordinate Measuring Machine Operation	1	0	4	0	4	3
MCH 225	Surface Grinding Machines & Operations	2	0	4	0	4	3
MCH 259	CNC Lathe Programming	2	0	4	0	4	3
MCH 262	CNC Conversational Programming	1	0	4	0	4	3
MCH 268	CNC Mill Programming	2	0	4	0	4	3
MCH 272	Mastercam Level I	3	0	4	0	4	3
MCH 273	Mastercam Level II	3	0	4	0	4	3
MCH 276	Mastercam Solids	3	0	4	0	4	3
MCH 278	CNC Mill Operation	3	0	4	0	4	3
MCH 279	CNC Lathe Operation	3	0	4	0	4	3
MCH 280A-F	Co-Op Ed Machine Manufacturing Technology (1cr)	3	0	4	0	4	3
MCH 290	Mastercam Fundamentals Orientation	2	0	4	0	3	3
MSD 115	Improving Working Relations (from MSD COM)	3	2	3	3	3	3

C. *Assessment of Degree and Certificate (CTE) Outcomes.*

i. *Reflecting on the last five years of assessment, provide a brief summary of one or two of your best assessment projects, highlighting efforts made to improve students' attainment of Degree and Certificate Outcomes (CTE programs).*

In 2014 the SAC chose an LAC assessment project relating to the setting up or "dialing in" of a manual milling machine. This is a critical set-up procedure which needs to be performed prior to any machining operation. Anecdotally, the faculty observed that although students were initially taught to perform this procedure in the first machining course (MCH 121), they continued to struggle with this in subsequent machining courses (MCH 205, Projects). Students who struggled sometimes took over an hour to complete a procedure which should require minutes to complete.

The SAC decided to implement a pass/fail "dialing in" activity quiz in MCH 121, as well as the same quiz timed at a maximum of 30 minutes in MCH 205. Faculty were also mindful to monitor students who were beginning their daily projects at the mill to ensure the machines were being dialed in. This was implemented because some students would seek out machines previously dialed in to avoid doing so themselves.

After implementing this assessment project, we observed that although some students initially struggled and took considerable time to master this skill in MCH 121, the vast majority of students began to perform it to industry standard.

ii. *Do you have evidence that the changes made were effective by having reassessed the same outcome? If so, please describe briefly.*

We have anecdotal evidence that our students are much more skilled and diligent in performing the set-up operation. This "dialing in" activity quiz has been permanently added to the manual milling related courses.

iii. *Evaluate your SAC's assessment cycle processes. What have you learned to improve your assessment practices and strategies?*

The SAC is currently having ongoing discussions focused on what constitutes best practices instructional delivery and how assessment strategies can inform the process of continual improvement. The goal is to arrive at consensus and implement a best practices model across the entire MMT curriculum which all of the SAC members can embrace.

iv. *Are there any Core Outcomes that are particularly challenging for your (LDC-DE) SAC to assess, or difficult to align and assess within your (CTE) program? If yes, please identify which ones and the challenges that exist.*

It is often a challenge interpret the core outcomes in light of the technical nature within this program of study.

v. ***CTE only: Briefly describe the evidence you have, determined by direct assessment, that students are meeting your Degree and/or Certificate outcomes.***

Among other factors, two major aspects of the MMT curriculum help validate Degree and Certificate outcomes. The first being the actual projects which are completed as part of MCH 121, 180, 190B, 205, and the three TSA courses. The second is consistent Co-op/internship success.

3. Other Instructional Issues

A. Please review the data for course enrollments in your subject area. Are enrollments similar to college FTE trends in general, or are they increasing or decreasing at a faster rate? What (if any) factors within control of your SAC may be influencing enrollments in your courses? What (if any) factors within control of the college may be influencing enrollments in your courses?

FTE Totals by Subject Area and Percent Difference from Previous Year

	Year									
	2013-14		2014-15		2015-16		2016-17		2017-18	
Campus	FTE	Percent Change	FTE	Percent Change	FTE	Percent Change	FTE	Percent Change	FTE	Percent Change
Collegewide	139.3	-6.5%	154.8	11.2%	142.1	-8.2%	138.9	-2.2%	112.0	-19.3%
Sylvania	139.3	-6.5%	154.8	11.2%	142.1	-8.2%	138.9	-2.2%	112.0	-19.3%

Headcount Totals by Subject Area and Percent Difference from Previous Year

	Year									
	2013-14		2014-15		2015-16		2016-17		2017-18	
Campus	Headcount	Percent Change	Headcount	Percent Change	Headcount	Percent Change	Headcount	Percent Change	Headcount	Percent Change
Collegewide	225.0	7.1%	260.0	15.6%	301.0	15.8%	246.0	-18.3%	178.0	-27.6%
Sylvania	225.0	7.1%	260.0	15.6%	301.0	15.8%	246.0	-18.3%	178.0	-27.6%

There has been a decline in enrollment which the program has experienced over the last several years. There are two major factors playing a role in this. One is general decline in community college enrollment overall due to a robust job market in our region. The other is the machining industry having an especially high demand job market and seeking any and all applicants willing to learn as they work. The downside to this job vs. career path tension is that employers are only training employees for their immediate and urgent needs. Long term prospects for career advancement and wage growth are limited for these lower skilled workers.

B. Please review the grades awarded for the courses in your program. What patterns or trends do you see? Are there any courses with consistently lower pass rates than others? Why do you think this is the case, and how is your SAC addressing this.

The major reason for failure that we as a SAC identified is students we are unable to retain. We try to embrace and welcome all students, but often there is an attrition of people who have decided to move on to something else in life. This happens for a variety of reasons. Potentially with the job market being this strong, some of our students are hired into industry without finishing their degree/certificate thereby effectively disappearing from our program. As the economy declines we would predict the wages of students who did not complete a degree or certificate will top out. Many of them will likely return seeking the next level of employment. We found this to be the case during the last major recession seeing a rapid doubling of our enrollment. Looking to the future we are planning to survey the students and find out what kind of time commitment they expend on

classes. We will be seeking to make adjustments to curriculum while being mindful of possible built-in barriers to completion.

C. ***Which of your courses are offered online and what is the proportion of on-campus and online? For courses offered both via DL and on campus, are there differences in student success? If yes, describe the differences and how your SAC is addressing them.***

All courses are on-campus.

D. Has the SAC made any curricular changes as a result of exploring/adopting educational initiatives (e.g., Community-Based Learning, Internationalization of the Curriculum, Inquiry-Based Learning, etc.)? If so, please describe.

No. Such initiatives are not readily applicable to this CTE program.

E. Are there any courses in the program that are offered as Dual Credit at area high schools? If so, describe how the SAC develops and maintains relationships with the HS faculty in support of quality instruction.

Historically, Machine Manufacturing was one of the three largest CTE dual credit programs at PCC. Almost the entirety of our curricula was available to high school programs. As a SAC we identified the following issues and concerns in maintaining such a wide-ranging program.

- Poor recruitment with less than 2% of our incoming students being from articulating secondary schools.
- Logistical challenges in maintaining relationships with high school instructors and exercising oversight of curricula.
- Financial aid impact on students who went on to pursue other courses of study and could not articulate earned Machine Manufacturing credits.
- The nature of our industry lends itself to practice, so giving high school students credit doesn't do them any favors. They would be better served to have the information repeated and learn new things and have fundamentals emphasized.
- Most newly reconfigured courses do not match with high school programs, their course offerings or equipment capabilities.

To address these issues, our dual credit program was pared down to the six courses offered in the 15.5 credit Career Pathways Certificate. This allows high school students to receive an introduction to this program of study and career option without as much of a financial aid repercussions if they choose a different academic path.

Manufacturing Technician Career Pathway Certificate

CURRENT				NEW		
MCH 100	Machine Tool Basics	1		MCH 100	Machine Tool Basics	1
MCH 105	Blueprint Reading I	1.5		MCH 110B	Blueprint Reading	3
MCH 110	Blueprint Reading II	1.5				
MCH 115	Geometric Dimensioning and Tolerancing	3.5		MCH 115A	Geometric Dimensioning and Tolerancing I	2
MCH 120	Machine Shop Math	2		MCH 120	Machine Shop Math	2
MCH 121	Manufacturing Processes I	4		MCH 121	Manufacturing Processes I	5
MCH 125	Speeds and Feeds	1				
MCH 130	Machine Shop Trigonometry	2.5		MCH 130	Machine Shop Trigonometry	2.5
MCH 135	Basic Measuring Tools	1.5				
MCH 145	Layout Tools	1.5				
MCH 150	Precision Measuring Tools	1.5				
Total Credits		**22**		**Total Credits**		**15.5**

F. Please describe the use of Course Evaluations by your SAC. Have you created SAC-specific questions? Do you have a mechanism for sharing results of the SAC-specific questions among the members of your SAC? Has the information you have received been of use at the course/program/discipline level?

Course Evaluation response rate is typically low with rates hovering between 20-40%. Our format has students interacting with all faculty making it a challenge to tie responses back to the instructor of record.

We would like to add some survey questions to determine much time was spent on all respective coursework. This information would be quite valuable when adding or subtracting content according to credits assigned.

4. Needs of Students and the Community

A. Have there been any changes in the demographics of the student populations you serve? If there have been changes, how have they impacted curriculum, instruction, or professional development, and, if so, in what way?

The demographics of our student population have remained relatively stable and unchanged between the 2012 Program Review and the most recent 2017-18 statistics. Roughly 60% of our students are white, 10% are unreported, and the remaining 30% comprise other ethnic and racial groups. 83% of our student population are male. The age distribution is almost evenly split between under 20, 20 to 24, and 25 to 49. Under 20 enrollment gained roughly 8% and was the largest category change. Enrollment for 50 and older has remained consistently in the single digits.

B. What strategies are used within the program/discipline to facilitate success for students with disabilities? If known, to what extent are your students utilizing the resources offered by Disability Services? What does the SAC see as particularly challenging in serving these students?

Machine manufacturing is a field which places physical demands on machinists to stand and move around frequently while performing physical tasks including frequent lifting of heavier objects, deburring parts, tightening vises and adjusting fixtures.

From time to time we see students with hearing impairment. These students have had sign language translators assist during their lab work and interactions with faculty.
The self-directed, self-paced and individualized set-up of the program fits within the Universal Design for Learning framework. Students with Disabilities are free to focus on one course at a time, complete that course, and add a new course in the same term if time permits. Students may also spend as much time as they need (within the confines of the term) to master each skill set before moving on to the next.

When a student does self-identify, the student is referred to Disability Services for any additional support. As there are few written exams or lectures, and because most of the work is hands-on and untimed; there are few additional accommodations that are necessary.

One of the problems with our Open Enrollment format is that the instructor of record gets the notification of a student that needs commendation. We have as a SAC made a point to address this by meeting privately to exchange this information, because of the safety for the students the instructor on the floor needs to be able to address the needs of the students.

C. What strategies are used within the program/discipline to facilitate success for online students? What does the SAC see as particularly challenging in serving online students?

While none of our courses are truly online or exclusively for online students, MCH 120 (Machine Shop Math, 2 credits), MCH 130 (Machine Shop Trig, 2.5 credits), MCH 115a (Geometric Differences and Tolerance pt. 1, 2 credits), and MCH 115b (GDT pt. 2, 2 credits) could be considered hybrid in form.

These courses have been set up to help the student progress through the 10 week term with suggested progress benchmarks for each week. As with the other MMT courses, all materials are due at the end of the term, so while recommendations are made for progress and completion, the student may still individualize the learning timeline to the student's own personal needs, within the confines of the term. Additionally, all faculty members including the instructor of record are available throughout the week for additional clarification as the students self-pace through the curriculum.

Additionally, we are migrating most of our content and some of our testing to D2L for easier access by students studying remotely.

D. Has feedback from students, community groups, transfer institutions, business, industry or government been used to make curriculum or instructional changes (if this has not been addressed elsewhere in this document)? If so, describe.

The advisory committee had requested an emphasis on GD&T with options for both introductory and advanced study. We broke the class into two making MCH 115a a more streamlined introductory course while permitting experienced machinists to take MCH 115b.

The frequently recurring feedback we receive from students relates to how the Machine Manufacturing open lab concept is a highly effective and convenient method of instructional delivery for lab based courses. Students reflect positively to having the option to work at their own pace while fitting lab and study time around their schedules. Students can either finish a course early in the term or have the option to take extra time in order to practice a concept or technique.

5. Faculty Composition, Qualifications & Development

A. Strategic intentions for diversity, equity and inclusion in PCC's Strategic Plan, Theme 5.

Awareness of and sensitivity to both our diverse individual backgrounds yet common humanity is an evolving process. Though this institution undoubtedly champions a policy and procedural framework of equity, inclusion and diversity; ultimately it is up to the individual members of our college community to evolve and embrace a more enlightened perspective. Theme 5 is a laudable strategic initiative. In-person sessions and mandatory trainings are necessary to show good faith institutional sensitivity. We are working on this as a team and will be focusing on this with our dean moving into the next five years.

The faculty of Machine Manufacturing Technology are a cross section of the community the program serves with unique perspectives and experiences as machinists, business owners and educators. The Division Dean has worked with individual faculty to address issues around diversity, equity, and inclusion. Several FT faculty have been through bias workshops as part of search committee training.

One way we have tried to be more inclusive it to consider socioeconomic factors. We were using multiple textbooks which were rapidly going up in price. Recently, we have switched to a more affordable textbook suggestion. We have also rewritten some course material to reflect a broader range of study habits (i.e. video examples to augment written and verbal information).

B. SAC changes to instructor qualifications.

The primary change was made in 2017 and comprised the rewording of *formal training by completing a Journeyman Apprenticeship or Technical Trade School graduation*.

> Education: Associates of Applied Science or equivalent degree in Machine Manufacturing Technology or a related field. Degree must be from an accredited institution. Or Completion of a formal training program in machining such as 4-year Journeyman Apprenticeship or 2 or more-year Technical Trade School in machining.
>
> AND
>
> Experience: Five years' relevant industry experience using any four (4) of the following basic machine tools: 1) sawing machines, 2) turning machines, 3) milling machines, 4) drilling machines, 5) grinding machines, and/or 6) Computer Numerical Control (CNC) machines (turning center machines and machining center machines) required. Applicants who have taught in secondary or postsecondary assignments may substitute teaching experience for recent industry experience (1.5 years teaching for 1 year of industry experience).
>
> Approved: August 2017

C. Professional development of faculty.

There is no nationally or regionally recognized certification or credential in Machine Manufacturing. It is nevertheless very important to keep up with industry trends. Several of our instructors have had or still own machining businesses of their own and interact with both suppliers and clients for their work.

Additionally, the SAC would like to take up the conversation around NIMS (National Industry Machining Standards) to see if the training and certification for NIMS would be useful as a professional development standard for the SAC. No decision on this has been made to date.

6. Facilities, Instructional, and Student Support

A. Laboratory and classroom space.

The AM 113 main lab area is a trifurcated yet open concept with manual hand-operated lathes situated near the main west entrance, manual milling machines in the middle of the laboratory and Computer Numerically Controlled (CNC) programmable lathes and mills at the far east end. Student safety is a major priority for the faculty and this open concept lends itself well to direct line of sight to practically all machines and students in the shop. The CAD/CNC design lab and resource room are directly adjacent to the main lab area and accessible to students and faculty who float between the classroom and lab area as needed.

Laboratory equipment.

As of the 2012 program review, students had been learning on manual lathes and mills dating back to the early 1980s. In 2014-15, six of the original manual lathes were replaced along with nine of the old manual mills. This has enabled students to interface with newer and more precise machines which has lowered the frustration level. The focus is now on techniques of proper machine operation and accurate part production as opposed to work-arounds required to coax industry level accuracy from old machines. That said, we still have ten old machines in need of replacement.

On the CNC side, a lathe, mill and cutting laser were decommissioned and replaced with a Haas brand lathe with live tooling, Okuma machining center and Okuma lathe. This avails students a total of six modern machines and seven legacy machines.

Though the legacy machines still operate on the same basic programming principle, their capabilities are rudimentary and rarely will graduates encounter such machines in a fast paced, modern machine shop environment. Maintaining and repairing these machines is becoming an increasing drain on the departmental operating budget.

Many machining programs procure and teach a single brand of machine and control. While this makes for easier teaching, acquiring the two Okuma machines has allowed us to expose students to a variety of control interfaces which they are quite likely to encounter out in industry.

The new Haas SL10 lathe has a feature called live tooling. Live tooling is an advanced capability which permits a cutting tool to not only move in the X and Z axis, but to also spin and articulate in additional axes of motion. This enables highly complex parts to be designed, programmed and produced. Many local employers have migrated to this advanced style of machine with live tooling.

As mentioned previously, machining is a rapidly evolving industry always seeking greater capabilities and production efficiencies. The next level beyond live tooling for lathes is the twin spindle style machine which essentially re-positions parts to allow all surfaces to be machined. On the machining center side, 5 axis articulation capabilities are now more the norm than the exception. We currently do not have such capabilities and need to invest in this next level of machine to keep pace with skills being demanded by employers. The cost factor can be an additional 30 to 50 percent above the base price of a typical machine.

B. Describe how students are using the library or other outside-the-classroom information resources (e.g., computer labs, tutoring, Student Learning Center). If courses are offered online, do students have online access to the same resources?

Students typically use resources which are available in the lab (i.e. computer labs located within the machine shop, a learning skills specialist who works with students as a tutor in Mastercam, and even at times academic advising happens in the shop.

C. Does the SAC have any insights on how students are using Academic Advising, Counseling, Student Leadership, and Student Resource Centers (e.g., the Veterans, Women's, Multicultural, and Queer Centers)? What opportunities do you see to promote student success by collaborating with these services?

Students have an assigned Perkins advisor who supports this program with advising being done in-house. The Perkins Advisor provides enrollment support, academic advising and planning, strategies for success in the program, and helps students navigate catalog and scheduling options to achieve their personal program goals. The next most commonly used student resource is the Veterans Resource Center.

7. Career and Technical Education (CTE) Programs

A. Evaluate the impact of your program's advisory committee on curriculum and instructional content methods, and/or outcomes. Please include the minutes from the last three advisory committee meetings in the appendix.

All curriculum changes are brought before the MMT advisory board for recommendations and approval when needed.

The recurring challenge is to recruit and maintain a diverse cohort of advisory members representing the full cross-section of local employers. Our advisory committee has been continually attended by industry leaders from the greater Portland area including Boeing, Ascentec, Freightliner and Leupold and Stevens to name a few. Minutes are located in Appendices 5 through 7.

B. Describe current and projected demand and enrollment patterns for your program. Include discussion of any impact this will have.

Contact with Program Support Staff from Employers indicate there is a high need for skilled machinists in the greater Portland Metro area. At this time, we are seeing an uptick in students coming to us from the manufacturing industry. These students are already working in the industry and seek further training to support the work they already do. This could be a great opportunity to partner with industry to grow enrollment and meet the specific needs of industry.

C. How are students selected and/or prepared (e.g., prerequisites) for program entry?

This is a closed program with limited entry. Students must first enroll in PCC and complete the placement test or prior credit evaluation to determine that the program perquisites are met. Due to the self-directed nature of the program, prerequisites are set at readiness for RD/WR 115 or higher and readiness for MTH 65 or higher, to ensure students have sufficient academic skills to be able to access technical manuals and texts written at the college level, and be prepared for the mathematical skills required for precise work.

Once a student can demonstrate the prerequisite is met, the student must submit a program application. This is reviewed by the program advisor to ensure the student meets the minimum requirements. The student also self-identifies what shift they would like to attend (day or evening) and how many credit hours they are prepared to complete. Applications are processed on a first come, first served basis. The enrollment for a term would close once each shift has the equivalent of about 12-13 full-time students have been enrolled on each shift. This means we admit somewhere between 18-25 new students every fall, winter and spring.

Continuing students also submit a request each term for the shift they would like to attend and the number of classes they need to take, and overrides are prepared for students based on that information, as well as what classes the student has completed and the student's intended educational goal. Effort is made to distribute continuing students between the two shifts and evenly through the courses to avoid bottlenecks on machines and to avoid crowding on each shift that could lead to either too many people to supervise or instruct on the shop floor.

D. Review job placement data for students over the last five years, including salary information where available. Forecast future employment opportunities for students, including national or state forecasts if appropriate.

Per Institutional Effectiveness, the most recent Employment Outcomes stats are dated 2010-11.

E. Present data on the number of students completing degree(s) and/or certificate(s) in your program. Analyze any barriers to degree or certificate completion that your students face, and identify common reasons why students may leave before completion. If the program is available 100% online, please include relevant completion data and analysis.

			Year				
Major	Description	Degree	2013-14	2014-15	2015-16	2016-17	2017-18
CNC	MCH: CNC Turning	ACERT1	7	5	3	4	5
MANT	MCH: Manufacturing Technician	ACERTP	14	19	21	62	29
MCH	Machine Manufacturing Techno	AAS	13	9	12	19	11
MILL	MCH:CNC Milling	ACERT1	6	6	2	6	6
Grand Total			40	39	38	91	51

One of our barriers to completion is that there is a market for partially educated Machinist. In this job market there is such a deficit in workforce many of our students are lured into working with the promise of a paycheck. They sacrifice is wages in the future for a paycheck today.

F. Is the program Perkins-eligible? If so, answer the questions below. If not, put N/A for F.

i. With which secondary school(s) does the program have aligned Programs of Study? Do PCC faculty meet with these HS program faculty on a regular basis?

As previously mentioned in **Section 3E** of this document, the SAC continues to maintain connections with HS programs which have historically taught our dual credit courses. HS teachers have been assessed over the last five years and with the scale down in dual credit, the program is considering other options to connect and support high school programs and teachers. Connections we are considering are serving on the respective HS advisory boards, providing teach in training opportunities for HS faculty at our campus facility, as well as a variation of the summer robotics camps taught by Machine Manufacturing faculty.

ii. Please describe the Technical Skill Assessments (TSAs) that are reported annually. Include information about the nature of the assessment, content covered, alignment of degree and certificate outcomes, when the assessment is taken by students, the number of completers, and the percentage of students meeting the identified benchmark(s) for the last 5 years.

MCH has three TSA classes. TSA CNC Lathe (MCH 287A), TSA CNC Mill (MCH 288A), and TSA Manual Machining (MCH 286A). In the last five years, a total of 70 students have gone through the TSA Courses. 67 students passed and 3 students have failed.

We plan on identifying gaps in learning and closing the loop on improving our curricula.

iii. What does the SAC consider to be the most impactful use of Perkins funding for your program?

Our advising is funded by Perkins. The students have a clear understanding of what is expected of them and what order to take our classes. It has removed a large amount of confusion by our students on the academic process, and let the instructors focus on teaching as opposed to the course path to get there.

G. Describe opportunities that exist or are in development for graduates of this program to continue their education in this career area or profession.

While this is not a transfer program, there are opportunities for students to take portions of the program and apply the courses to Manufacturing Engineering or Technology Management degrees. Some students continue on to Oregon Tech.

8. Recommendations

A. What is the SAC planning to do to improve teaching and learning, student success, and degree or certificate completion, for on-campus and online students as appropriate?

- Time study all course offerings through student survey or other means to confirm direct relationship between time required to complete/master respective courses and credit offered. Doing so will enable the SAC to determine whether courses are right-sized and which need adjusting. This data will also help "free up" redundant credit if such instances exist.
- Continue to move towards a more project based curriculum. It has been clearly evidenced that assigning engaging and challenging projects leads to a more intrinsically motivated model of learning.
- Develop additional content and possibly new courses bridging identified learning gaps between CNC programming, Mastercam CAD/CAM and CNC machine operations.
- Add a course specifically focused on fixturing and work-holding.
- Add content in production efficiency and tool life.
- Develop a comprehensive and streamlined, evidence based approach to the evaluation of student learning and pedagogical improvement.
- Explore more intuitive connections to MakerLab and new curriculum for Advanced Manufacturing and Design. Anecdotally, there is considerable community interest in the tools, techniques and capabilities of the machining trade. In accordance with Theme 3, we plan to explore the development of a comprehensive introductory survey class for non-majors such as ENGR, ART, as well as members of the community at large. This course would be designed to formalize augment the Digital Design and Fabrication Certificate currently on hold.

B. Support needed from the administration.

Our industry is very dependent on technology. The successful graduates in our program are expected to program and run machines that we do not have. To be a more competitive program we would like to upgrade and modernize some of the machinery on the floor. Some attention needs to be given to our tooling as there is a fair amount of wear and tear that happens to old tooling. There is also new technology constantly being implemented in industry. Our students need to be aware of best practices that have changed with new technology.

There is also considerable room for filling gaps in learning and building out curriculum focused on smaller and more economical CNC machinery. Some examples are the CNC router, Tormach mini machining centers, and other similar equipment. This equipment could also easily dovetail with Design related instruction in the MakerLab while greatly enhancing the learning experience in that space.

The College needs support by way of time and money, the necessary redesign and updating of existing curriculum, development of new program offerings, and the critically important purchasing of new equipment.

9. Assurances

Please put X's next to all three boxes to verify that…

X☐ faculty and FDCs at all of the campuses offering courses in this discipline/program have received a late-stage draft of the Program Review document.

X☐ all of the division deans offering courses in this discipline/program have been sent the late-stage draft.

X☐ the SAC administrative liaison has reviewed and had the opportunity to provide feedback on the final report.

Appendix 1 *Manual Machining Certificate*

Certificate - Manual Machining						
CURRENT				**NEW**		
MCH 100 §	Machine Tool Basics	1		MCH 100 §	Machine Tool Basics	1
MCH 105 §	Blueprint Reading I	1.5		MCH 110B	Blueprint Reading	3
MCH 110 §	Blueprint Reading II	1.5				
MCH 115 §	Geometric Dimensioning and Tolerancing	3.5		MCH 115A	Geometric Dimensioning and Tolerancing I	2
MCH 120 §	Machine Shop Math	2		MCH 120 §	Machine Shop Math	2
MCH 121 §	Manufacturing Processes I	4		MCH 121 §	Manufacturing Processes I	5
MCH 125	Speeds and Feeds	1				
MCH 130 §	Machine Shop Trigonometry	2.5		MCH 130 §	Machine Shop Trigonometry	2.5
MCH 135	Basic Measuring Tools	1.5				
MCH 145	Layout Tools	1.5				
MCH 150	Precision Measuring Tools	1.5				
MCH 160	Drilling Machines and Operations	2		MCH 160	Drilling Machines and Operations	2
MCH 175	Band Saws	1				
MCH 180	Turning Machines and Operations	4		MCH 180	Turning Machines and Operations	4
MCH 190	Boring on the Lathe	1		MCH 190B	Threading & Boring on the Lathe	4
MCH 195	Threading on the Lathe	3				
MCH 205	Vertical Milling Machines and Operations	3.5		MCH 205	Vertical Milling Machines and Operations	3.5
MCH 215	Horizontal Milling Machines	2.5		MCH 215	Horizontal Milling Machines	2.5
MCH 225	Surface Grinding Machines and Operations	2		MCH 225	Surface Grinding Machines and Operations	2
MCH 228	Abrasives	1.5				
MCH 240	Cutting Tool Technology	2				
MCH 280 §	Cooperative Education: Machine Technology	4		MCH 280 §	Cooperative Education: Machine Technology	4
MCH 286A	Technical Skill Assessment in Manual Machining	3		MCH 286A	Technical Skill Assessment in Manual Machining	5
MSD 115	Improving Work Relations	3		MSD 115	Improving Work Relations	3
Total Credits		**54**		**Total Credits**		**45.5**

Appendix 2 *CNC Milling Certificate*

Certificate - Milling						
CURRENT				**NEW**		
MCH 100 §	Machine Tool Basics	1		MCH 100 §	Machine Tool Basics	1
MCH 105 §	Blueprint Reading I	1.5		MCH 110B	Blueprint Reading	3
MCH 110 §	Blueprint Reading II	1.5				
MCH 115 §	Geometric Dimensioning and Tolerancing	3.5		MCH 115A	Geometric Dimensioning and Tolerancing I	2
MCH 120 §	Machine Shop Math	2		MCH 120 §	Machine Shop Math	2
MCH 121 §	Manufacturing Processes I	4		MCH 121 §	Manufacturing Processes I	5
MCH 125	Speeds and Feeds	1				
MCH 130 §	Machine Shop Trigonometry	2.5		MCH 130 §	Machine Shop Trigonometry	2.5
MCH 135	Basic Measuring Tools	1.5				
MCH 145	Layout Tools	1.5				
MCH 150	Precision Measuring Tools	1.5				
MCH 205	Vertical Milling Machines and Operations	3.5		MCH 205	Vertical Milling Machines and Operations	3.5
MCH 268	CNC Programming-Mill	5		MCH 268	CNC Programming-Mill	5
MCH 272 §	Mastercam Level I	5		MCH 272 §	Mastercam Level I	5
MCH 278	CNC Operation - Mill	4		MCH 278	CNC Operation - Mill	4
MCH 280 §	Cooperative Education: Machine Technology	4		MCH 280 §	Cooperative Education: Machine Technology	4
MCH 288A	Technical Skill Assessment in CNC Milling	3		MCH 288A	Technical Skill Assessment in CNC Milling	5
MSD 115	Improving Work Relations	3		MSD 115	Improving Work Relations	3
Total Credits		**49**		**Total Credits**		**45**

Appendix 3 *CNC Turning Certificate*

Certificate - Turning						
CURRENT				**NEW**		
MCH 100 §	Machine Tool Basics	1		MCH 100 §	Machine Tool Basics	1
MCH 105 §	Blueprint Reading I	1.5		MCH 110B	Blueprint Reading	3
MCH 110 §	Blueprint Reading II	1.5				
MCH 115 §	Geometric Dimensioning and Tolerancing	3.5		MCH 115A	Geometric Dimensioning and Tolerancing I	2
MCH 120 §	Machine Shop Math	2		MCH 120 §	Machine Shop Math	2
MCH 121 §	Manufacturing Processes I	4		MCH 121 §	Manufacturing Processes I	5
MCH 125	Speeds and Feeds	1				
MCH 130 §	Machine Shop Trigonometry	2.5		MCH 130 §	Machine Shop Trigonometry	2.5
MCH 135	Basic Measuring Tools	1.5				
MCH 145	Layout Tools	1.5				
MCH 150	Precision Measuring Tools	1.5				
MCH 180	Turning Machines and Operations	4		MCH 180	Turning Machines and Operations	4
MCH 190	Boring on the Lathe	1		MCH 190B	Threading & Boring on the Lathe	4
MCH 195	Threading on the Lathe	3				
MCH 259 §	CNC Programming-Lathe	5		MCH 259 §	CNC Programming-Lathe	5
MCH 279	CNC Operation - Lathe	4		MCH 279	CNC Operation - Lathe	4
MCH 280 §	Cooperative Education: Machine Technology	4		MCH 280 §	Cooperative Education: Machine Technology	4
MCH 287A	Technical Skill Assessment in CNC Turning	3		MCH 287A	Technical Skill Assessment in CNC Turning	5
				MCH 290	Mastercam Fundamentals Orientation	1
MSD 115	Improving Work Relations	3		MSD 115	Improving Work Relations	3
Total Credits		**48.5**		**Total Credits**		**45.5**

Appendix 4 AAS Machine Manufacturing Technology

AAS - Machine Manufacturing						
CURRENT				**NEW**		
MCH 100 §	Machine Tool Basics	1		MCH 100 §	Machine Tool Basics	1
MCH 105 §	Blueprint Reading I	1.5		MCH 110B	Blueprint Reading	3
MCH 110 §	Blueprint Reading II	1.5				
MCH 115 §	Geometric Dimensioning and Tolerancing	3.5		MCH 115A	Geometric Dimensioning and Tolerancing I	2
MCH 120 §	Machine Shop Math	2		MCH 120 §	Machine Shop Math	2
MCH 121 §	Manufacturing Processes I	4		MCH 121 §	Manufacturing Processes I	5
MCH 125	Speeds and Feeds	1				
MCH 130 §	Machine Shop Trigonometry	2.5		MCH 130 §	Machine Shop Trigonometry	3
MCH 135	Basic Measuring Tools	1.5				
MCH 145	Layout Tools	1.5				
MCH 150	Precision Measuring Tools	1.5				
MCH 160	Drilling Machines and Operations	2		MCH 160	Drilling Machines and Operations	2
MCH 175	Band Saws	1				
MCH 180	Turning Machines and Operations	4		MCH 180	Turning Machines and Operations	4
MCH 190	Boring on the Lathe	1		MCH 190B	Threading & Boring on the Lathe	4
MCH 195	Threading on the Lathe	3				
MCH 205	Vertical Milling Machines and Operations	3.5		MCH 205	Vertical Milling Machines and Operations	4
MCH 225	Surface Grinding Machines and Operations	2				
MCH 259	CNC Programming-Lathe	5		MCH 259	CNC Programming-Lathe	5
MCH 268	CNC Programming-Mill	5		MCH 268	CNC Programming-Mill	5
MCH 272	Mastercam Level I	5		MCH 272	Mastercam Level I	5
MCH 273	Mastercam Level II	5		MCH 273	Mastercam Level II	5
MCH 278	CNC Operation - Mill	4		MCH 278	CNC Operation - Mill	4
MCH 279	CNC Operation - Lathe	4		MCH 279	CNC Operation - Lathe	4

MCH 280	Cooperative Education: Machine Technology	4		MCH 280	Cooperative Education: Machine Technology	4
MCH 287A	Technical Skill Assessment in CNC Turning	3		MCH 287A	Technical Skill Assessment in CNC Turning	5
MCH 288A	Technical Skill Assessment in CNC Milling	3		MCH 288A	Technical Skill Assessment in CNC Milling	5
MSD 115	Improving Work Relations	3		MSD 115	Improving Work Relations	3
MCH Degree Elect.		11		MCH Degree Elect.		8
General Ed.		16		General Ed.		16
Total Credits		**106**		**Total Credits**		**98**

Appendix 5

Machine Manufacturing Technology
Advisory Committee Minutes
Wednesday, November 8, 2017

Advisory Committee:

Michael Johnson - Boeing	**Dennis Perez-Boeing**	Dewey Ankeny-A-Dec
Paul Grucko-Premier Mfg. Co.	Melissa Goad-A-Dec	Grant Carsen–A&G
Aleigha Larrondo-A-Dec	Steve Crawford - Acumed	Minh Luu-Ascentec
Matt White-Boeing	**Tracy Rumpca –Ascentec Engineering**	**Brandon McGee-KCR Mfg.**
Andrew Spiering-Valley Machine	**Jeremiah Davis – A-Dec**	**Andra Buyd-A-Dec**
Clyde Loftis-Tosoh Quartz	Kyle Popma-Boeing	

PCC Staff/Students:

Joe Huddleston	**Stedman Bailey**	**Don Birkley**
Scott Stewart	**Karin O'Connor**	Rick Luff
Sarah Tillery	**Rodney Willis**	Alex Vins
Chris Holden	**Diane Jantze**	

NOTE: Those in attendance are listed in **BOLD**

Welcome & Introductions

Minutes

The minutes of the June 7, 2017 Advisory Committee meeting were reviewed and approved.

New Board President

Stacy James will no longer be serving as the Advisory Committee President. Matt White from Boeing was nominated, accepted, and was unanimously voted in as the new Advisory Committee President.

New Business

Sarah Tillery was introduced as the new dean of Engineering & Industrial Technology.

Chris Holden is now employed with PCC as the Director for Oregon Manufacturing Innovation Center (OMIC).

Joe Huddleston shared that we now have the new Okuma mill and lathe and 6 new manual lathes. We can now teach OSP control.

We could potentially use a new National Institute for Metalworking Standards (NIMS) textbook next fall. Our current textbook costs the students $265 and the NIMS book would be $85. NIMS is competency-based not hourly-based and our curriculum is aligned with the NIMS's guidelines.

Enrollment

Sarah Tillery, Dean of Engineering & Industrial Technology, shared the following information about the enrollment of the Machine Manufacturing program:

Academic Year	Headcount (May be duplicated numbers)	Full Time Equivalent (FTE)
2012-13	210	149
2013-14	225	139
2014-15	260	155
2015-16	301	142
2016-17	246	139

Apprenticeships

Chris Holden shared that 4 apprenticeships have been registered. 4 people have also registered with JATC and there is the possibility of having them use the machine shop on Saturdays.

Curriculum

Sarah shared that we are ensuring our classes are in line with the standards of our certificates. We currently offer every course each term, and it is

administratively difficult. We will discontinue offering about 10 classes every term but will still make them available if a student wants to take one. We currently offer almost the full range of classes offered at the high schools in the area.

We have analyzed and reconfigured classes that exist, looked at what can be combined into one class vs. several, eliminated some classes, and included some project classes to make sure we are covering everything needed for the certificates. We are looking at reducing or eliminating Rhino and 3-D Printing and increasing project classes.

We are making some changes to the 1-year Career Pathways Certificate. The number of credits is being reduced from 21.5 to 14.5 so students can get this certificate in the shortest amount of time. Diane Jantze could teach her 1-credit Job-Finding Skills class since we will be reducing the total credits. There was also some discussion of including a Portfolio Review Day, bringing in industry partners to meet with students and give them feedback about the content and quality of their portfolios.

We are hoping that these changes will be evaluated by the Curriculum Office in January, 2018, so the changes can happen in fall term, 2018.

The committee voted on the recommendation to send the changes to curriculum and it was passed unanimously.

Scholarships

4 S-Stem scholarships which are only available to students in first or second term. They are full-ride scholarships and students need to be enrolled full time and be financial aid eligible. You may contact Stedman Bailey with questions or for more information.

Costanzo scholarship for $4,000

Program Review

Has been delayed until fall of 2018. Would like input from industry partners.

Industry Status

Scott Stewart will be the contact for internships.

There are currently 25 high school and college interns being brought into Boeing through January, 2018. Participants must be actively enrolled and 50% complete with their program. Diane Jantze asked what can be done to help students be competitive and was told they should provide a resume, cover letter, instructor references, and photos of their projects. Soft skills that will help them in any job include being on time, being a team player, and working safely, and they should also be able to read precision measurements.

A-Dec is hoping to start internships this summer.

Jobs

Diane Janze requested that industry partners give her information about job leads so she can post them to the Jobs List.

Next Meeting

Discussion took place regarding time and location. It was agreed that the next meeting will take place on February 7, 2018, here in the TCB, from 7:30 – 9:00 am.

Meeting was adjourned.

Appendix 6

Machine Manufacturing Technology
Advisory Committee Minutes
Fall 2018 Meeting

November 7, 2018

Members Present:

- **Scott Stewart**
- **Rodney Willis**
- **Karin O'Connor**
- Matt White
- Kyle Popma
- Corey Woodford
- **Diane Jantze**
- **Stedman Bailey**
- Jason Stewart
- Jim Williams

PCC Employees in bold.

Meeting was called to order at 7:45 a.m.

Welcome and introductions

Minutes from May 30, 2018, were reviewed and approved.

- Discussion ensued regarding how to build Board participation
  - Communication with employers is key. We could invite employers who have participated in co-ops and where we have site visits. Can also contact chambers of commerce and make a flyer to hand out to explain the need for community involvement
  - We should reach out to previous members to find out why they are no longer coming, approach smaller businesses because they may not know about us
  - Perhaps have a portfolio review with a meet and greet after the meeting for students, "machine manufacturing career day." An option is to have Board meeting on first day of class when have most students are here and let the students know during their safety orientation about the option of attending the advisory meeting and advertise to employers that meeting would be Advisory board, meet and greet

- When Stedman gets contacted by employers she could send them information about opportunities for them to get involved and Diane could have same boilerplate

· We also discussed the Board's function, which is to help guide PCC with the development of curriculum that remains current with industry standards and needs. Career Technical Programs required to have advisory boards

PCC Reports

Enrollment Down – Scott Stewart

· However, many new students in shop and Engineering students have expressed interest in how things are made not just designed.

· Talking with high schools is very helpful to let people know about Machine Manufacturing program. Suggestions were made to have a Saturday fair for high school students or have a manufacturing day once a year, perhaps have something for Boy and Girl Scouts like a badge or "go see it" here in the machine shop or MakerLab, let younger people know the possible salary they could start to make and the importance of getting their parents involved, and communicating with the high schools about the scholarships available for women and people of color

- MakerLab is a limited resource because there is only one coordinator, we short on work study student support and someone needs to be present when classes and students come in
- We bussed high school students in for a day class but none of them returned to attend classes so we stopped doing that four years ago
- We have high school Robotics camps in the summer, one all-gender one just for girls

· Suggestion to make a presentation to women in the MakerLab as a way of letting them know about machining industry. Could include information about available scholarships, jobs and possibilities that will open for them

· Have updated and streamlined some classes and it seems to be going okay. Career Pathways is one term of 15 credits vs. two terms of 21. Gets the students out with a certificate faster and able to find employment more quickly. If an employer is looking for something in particular, contact Diane Jantze

· Joe Huddleston retired, Alex Vins is on part-time parental leave. We have two part time instructors, Jesse Moreno and Grant Carson, and two fulltime temporary positions being filled right now by Rick Luff and Matt Graves.

· Friday not open lab anymore but may open it again winter or spring term. There is demand from students who work four-tens and have Fridays off so they could come in

· Program Review been pushed out but we will let everyone know when it will take place. Could possibly be March, 2019

Industry Reports

- Employers are looking for machinists and assemblers but they usually have their own engineering department. Communication with the appropriate group is critical

- Tosoh Quartz is planning to hire about 40 people by end of year (?), machinists and programmers

- Boeing looking to hire also. They would like to provide us with a big banner and safety glasses and other items if we need them – we will bring this up when our department meets about budget. Boeing may be able to provide us with a video of how machined parts are used to build planes

Unfinished Business
None

Next Meeting
Will be Wednesday, February 6, 2019, in the Oak Room in the cafeteria

Meeting adjourned at 9:05 a.m.

Appendix 7

Machine Manufacturing Technology Advisory Committee Meeting
Wednesday March 7, 2018
Minutes

Advisory Committee:

Aleigha Larrondo-A-Dec	**Dennis Perez-Boeing**	Rob Auda-Dependable
Andrew Spiering-Valley Machine	**Kyle Popma-Boeing**	Pattern Works
Audra Boyd-A-Dec	**Matt White-Boeing**	William Geery-Boeing
Brandon McGee-KCR Mfg.	Mellissa Goad-A-Dec	
Brian Sanneman-Arnprio Aerospace	**Minh Luu-Ascentec**	
Chris House-Ascentec	Nikalas Schonstall-Acumed	
Craig Wahlstrom-Coorstek Co.	Paul Gruck-Premier Mfg.	

PCC Staff/Students:

Joe Huddleston	**Stedman Bailey**	**Don Birkley**
Scott Stewart	**Karin O'Connor**	Rick Luff
Sarah Tillery	**Rodney Willis**	Alex Vins
Chris Holden	Diane Jantze	**Matt Graves**

Guests:
Jeremiah Davis-A-dec **Justin Hart-American Precision Industries**
Sam Minter-PCC Student

NOTE: Those in attendance are listed in BOLD

Welcome
Called to order at 7:35 a.m.
Introductions
Minutes from November 8th meeting were reviewed and approved.

Enrollment Status / FTE – Sarah Tillery
Enrollment fairly steady. A little down but so is all of PCC due to having good employment in the area.

Staffing
Joe Huddleston is retiring, Pat Kraft retired in June of 2017. PCC has implemented a hiring freeze so Sarah has asked departments to look at potential options depending upon what administration may say. The Dean of Instruction will provide information regarding all positions in the district in April.

Degrees and Certificate Updates – Sarah Tillery
Sarah talked about changes to curriculum based on feedback from Advisory Board and what we had to do based GD&T program – see attached. Content is not being lost but there was a lot of

duplication in some classes. We have reduced the number of credits in all areas because it was expensive and time consuming for students to complete program.

Courses being "sun-setted" will no longer be offered at Sylvania beginning Fall 2018. Rhino Cad will be moved out of Machine Manufacturing and we hope it will offered through the CAD program.
Question arose regarding the removal of Metallurgy; the Board feels it is important. It has very small enrollment and 95% enrolled from OIT and covered by other areas. Scott Stewart will investigate why we removed it.

Don Birkley has developed a great lab for GD&T (measurements) in addition to class time. Have increased the units to 4. If employers have someone who needs brush-ups send them to class. Scott clarified that we have open enrollment so no set times they have to be there. Lots of GD&T tests are online.

Summer Camps – Sarah Tillery
Have offered some sort of camp in conjunction with First Robotics for grades 9 - 12. We will not be offering credit this summer because it is expensive for students and the four credit class was too full of course material to cover in the number of camp days available. We are narrowing the scope to determine a project that can be created in the MakerLab and in the Machine Shop.

Mentor Graphics was bought out and is no longer in existence so PCC is trying to market our program and get donations. We will use some monies from our division and previous years' camps. If you know of any donors, please let us know. The Girls Camp is scheduled for July and the all-gender for August. We will have a luncheon where students highlight/demonstrate what they have made and the Board will be invited.

National Industry for Metal Working Skills (NIMS) - Chris Holden
Chris has worked with employers in east county to get programs that are NIMS certified. He said that PCC is becoming NIMS certified. Credentialed projects include some cost and are more popular on east coast. NIMS created credentialed projects are "stackable" and high schools in east county are doing some of these projects with students. NIMS hopes to have a standard in the machining world so there is additional credibility. He also said that PCC received a $273,000 grant to help fund development and advancement and Chris going to talk with faculty about how we can use that. We are trying to get schools and employers to train to NIMS standards in classes or internships.
Justin Hart, from American Precision Industries, said it would be nice to get NIMS curriculum to work toward it and incorporate it into their training. Clackamas CC and Redmond high school using NIMS
Minh Luu, from Acentec, wrote a manual to NIMS standards for A-dec three years ago. They bring new employees on and train them using the manual.

Boeing does not use NIMS because of the cost involved with everything do with NIMS.

Industry Status / Other Business

Boeing is doing outreach at colleges right now, looking to hire 100 people in a year. Boeing's internships last seven weeks but have two cohorts. If interns complete the program, they are offered jobs and Boeing pays for schooling and provides stock options.

Ascentec has internship programs right now. Students and instructors are welcome to visit. When students visit they have been very impressed with machinery available. Scott Stewart said he will try to put together a tour from PCC. Ascentec is creating a job of quality inspector and will train someone but s/he need to have basic skills. The individual would need to have a thick skin and be able to say things nicely because quality Inspectors are the ones who tell employees things are not to spec. Person would need to be able to brain storm with others when specs are not right. S/he have to understand GD&T because it makes the person more credible. They want to roll the interns into full time employees they offer to pay for the last term of school if they will work for them.

A-Dec has traditionally hired temps but they are not as engaged. The company wants to get students because then they want to do the work and have a career. They are working on creating presentations to bring in four interns who will move through different shops to get exposure. The internship lasts twelve weeks. A-DEC requires that all employees go through a rotation in all areas while onboarding and teach GD&T classes onsite

American Precision will have a large number of people retiring so need to bring in young people. When they hire someone s/he also goes through rotations in different areas and the company will set up their internship that way, making it a holistic process. They have two summer interns for machine shop and two for engineering techs and will be working with Robotics groups to look for interns in machine technology and manufacturing.

Machine Manufacturing student Sam Minter demonstrated his project, a radial wobbler steam engine, and impressed the board.

A general discussion ensued regarding the need to bring trade training back into high schools; it is starting to happen. Boeing has dealt with Franklin Roberts, interim dean of the division, to help educate teachers and gave them input about their rebuilt shop. People need to understand that you don't have to stay in a machine shop but those skills are building blocks to purchasing, quality, etc.

Set next meeting date as June 6, 2018.

Adjourned at 9:00 a.m.

Machine Manufacturing Program Review Addendum – Spring 2019

For the TSA in each Machine Manufacturing class (MCH 286 – Manual Machining, MCH 287 – CNC Milling, MCH 288 – CNC Turning), students must meet a majority of certificate outcomes in their final class project. Faculty utilize the attached PCC TSA Assessment Project Outline to review each student's project. Beginning in the next academic year, faculty will also utilize the attached Outcomes Checklist to further assure that students meet the outcomes for each TSA.

The vast majority of students in MCH that persist through the program to the end of their TSA class meet the TSA standards. This is partially explained by the fact that these classes are self-paced and give those students who start their projects at the beginning of the term ample time to start over and redo their projects several times as needed during the class. (Usually students who do not have good time management skills drop out of the program or these classes before the end of the TSA class term.) This repetition allows their learning throughout these capstone classes; however, this may also miss the mark in preparing them for timely machining that's needed in industry production work.

Students are evaluated throughout their work on these projects as instructors watch how students work with and interpret blueprints, and then make and assemble each piece of their projects. Faculty share these evaluations with students once their projects are completed and give them constructive feedback on how to improve their skills in future work.

Next year, each student's data will be entered into the attached spreadsheet. This will allow faculty to review the trends in student's learning over time. Assessable skill descriptions will be added to the "To Be Evaluated" column by the SAC by the beginning of fall term. At the end of next year, MCH faculty intend to look for patterns in this data to consider how they may need to change their curriculum in courses that feed into MCH 286/287/288.

In addition, MCH faculty think it would be helpful to get information about the skills/content area students continue to need assistance with when they reach the TSA classes by doing one or more of the following:

- Recording (on a clipboard on the center desk in the shop) each time a student needs significant help with a skill that should have been successfully exhibited in a previous MCH class. Data would include a description of the skill and the class number. The instructor of record for each of these courses can review this when determining student grades, and the SAC can look for patterns in this data over time.
- Calculating how long each student takes to complete their projects in the TSA classes using TutorTrac since students sign in each time they work in the shop. Students need to be able to complete TSA class projects in a timely manner so that they are prepared for production work after graduation.
- Recording (on another clipboard on the center desk) each time a student scraps a piece of their project and starts over. Data recorded would include the class number, what they scrapped, and at what stage in their project.
- Developing and distributing a survey to students at the end of the term asking them what two or three skills they continued to struggle with during this class that they wish they had more instruction around.

Machine Manufacturing Technology: AAS Outcomes Checklist

Student Name: _____ Class: _____ G#: _____

Outcome	Met?	To Be Evaluated	Comments
Demonstrate knowledge in understanding of machine shop safety.	☐	Safe & rigid set up in the machine. Mechanical understanding of safety.	
Utilize an industry mechanical drawing (blueprint) to select and interpret processes, procedures, inspection equipment and operation of necessary machine tools to produce the part/product to industry specifications.	☐		
Verify acceptable dimensional tolerances by the use of precision measurement and inspection tools.	☐		
Accurately perform conversions, computations and calculations that result in parts production to specification, while maintaining optimal machining controls.	☐		
Write CNC programs for Fanuc (G & M compatible) controlled CNC turning and machining centers using basic programming skills.	☐		
Perform safe maintenance, setup, and operating procedures with the manual machine tools group.	☐		
Perform safe setup and operating procedures with the computer numerical control (CNC) turning and machining centers.	☐		
Construct and verify computer designed 2-D and 3-D part models and tool paths commonly machined with CNC turning and machining centers.	☐		

PCC TSA CNC Lathe Assessment Project Outline

Student's Name _____ Date _____

Instructor of Record _____ Term: _____

Part – Base – Value 100 points

1. Manufacture on Haas CNC Lathe – Start 2 parts, one to be graded.
2. Raw stock: 2-1/2" CRS Rod. Saw to 3-1/8" long
3. Machine in 2 operations.
4. All CNC "G" code to be manually programmed -Mastercam not allowed.
5. Instructor to inspect each CNC program before run.
6. Instructor to inspect each CNC setup before run.
7. 1st operation – Grip on area that finishes at 2" diameter. Machine 2.375 diameter area, face base, finish 1.75" c/bore.
8. 2nd operation – Grip on 2.375 Diameter using supplied lathe soft jaws. Machine 2" diameter area, 3/16 fillets, upper step are. Drill through, c/sink and finish internal thread.
9. Supply 100% inspection report.

Part - Large Thread– Value 100 points

1. Manufacture on Haas CNC Lathe.
2. Raw stock: CRS – Diameter to be determined by student and approved by instructor.
3. Saw to 4.25" long.
4. Machine in 3 operations.
5. All CNC "G" code to be manually programmed -Mastercam not allowed.
6. Instructor to inspect each CNC program before run.
7. Instructor to inspect each CNC setup before run.
8. 1st operation – Machine entire outside and end internal 1" diameter c/bore to finish.
9. Inspect external thread with thread wires, record values.

a. Thread wires used: _____
b. Measurement over wires: _____
c. Computed actual pitch diameter: _____
d. Listed Machinery Handbook Tolerance: Min - _____ Max-_____
e. List Machinery handbook version and page number: _____

10. 2nd operation – Using manual mill and 5C hex collet holder, mill flats (6 places).
11. 3rd operation - Using manual mill and 5C hex collet holder, drill and tap internal hole.
12. Supply 100% inspection report.

Part – Small Thread – Value 100 points

1. Manufacture on Takasawa CNC Lathe.
2. Raw stock: CRS – Diameter to be determined by student and approved by instructor.
3. Saw to 4.87" long.
4. Machine in 3 operations.
5. All CNC "G" code to be manually programmed -Mastercam not allowed.
6. Instructor to inspect each CNC program before run.
7. Instructor to inspect each CNC setup before run.
8. 1st operation – Grip on area that finishes as thread. Turn .75 sphere area and sphere base to finish and overall length to 4.765" (.015" oversize). Turn hex area oversize and concentric to sphere area.
9. 2nd operation – grip on oversize hex diameter, face to overall final length, c/drill, use tailstock and turn thread complete.
10. Inspect external thread with thread micrometer, record dimension: _____
11. 3rd operation - Using manual mill and 5C hex collet holder, mill flats (6 places). Drill and ream .25 diameter holes (6 places).
12. Supply 100% inspection report.

Part – 1 Inch Step Riser – Value 100 points

1. Manufacture on Manual Lathe.
2. Raw stock: 2-1/2" CRS Rod. Saw to 1.5" long
3. Machine in 2 operations.
4. Supply 100% inspection report.

Part – 2 Inch Step Riser – Value 100 points

1. Manufacture on Manual Lathe.
2. Raw stock: 2-1/2" CRS Rod. Saw to 2.5" long
3. Machine in 2 operations.
4. Supply 100% inspection report.

Part – Swivel Top – Value 100 points

1. Manufacture on Manual Lathe.
2. Raw stock: 1.25" CRS Rod. Saw to 1" long
3. Machine in 2 operations.
4. Supply 100% inspection report.

PCC MMT TSA CNC Lathe Inspection Form

Student's Name: _____ Instructor: _____

Part Name: _____

In the columns below, list the print dimension and tolerance as listed on the drawing, followed by the actual measurement recorded when measured. <u>All dimensions must be inspected.</u> This sheet to be turned in with finished parts after all parts are complete.

1. Listed: _____ Actual: _____
2. Listed: _____ Actual: _____
3. Listed: _____ Actual: _____
4. Listed: _____ Actual: _____
5. Listed: _____ Actual: _____
6. Listed: _____ Actual: _____
7. Listed: _____ Actual: _____
8. Listed: _____ Actual: _____
9. Listed: _____ Actual: _____
10. Listed: _____ Actual: _____
11. Listed: _____ Actual: _____
12. Listed: _____ Actual: _____
13. Listed: _____ Actual: _____
14. Listed: _____ Actual: _____
15. Listed: _____ Actual: _____
16. Listed: _____ Actual: _____
17. Listed: _____ Actual: _____
18. Listed: _____ Actual: _____
19. Listed: _____ Actual: _____
20. Listed: _____ Actual: _____
21. Listed: _____ Actual: _____
22. Listed: _____ Actual: _____
23. Listed: _____ Actual: _____
24. Listed: _____ Actual: _____
25. Listed: _____ Actual: _____
26. Listed: _____ Actual:
27. Listed: _____ Actual: _____
28. Listed: _____ Actual: _____
29. Listed: _____ Actual: _____

Student's signature confirming measurements: _____

Point Reduction Chart For MMT Project Work

	-15 points	-10 points	-5 points	No Deduction
Size/ Dimension Out of Tolerance	More Than Three Tolerance Ranges Out	More Than Two Tolerance Ranges Out But Less Than Three	More Than One Tolerance Range Out But Less Than Two	Meets Specs.
External Threads	More Than Three Pitch Dia. Tol. Ranges Small	More Than Two Pitch Dia. Tol. Ranges Small But Less Than Three	More Than One Pitch Dia. Tol. Range Small But Less Than Two	Meets Specs.
			Bad Finish	
		Incorrect Included Angle Of Thread		
Internal Threads (Using Over and Under Thread Gauge Standards)	More Than Three Pitch Dia. Tol. Ranges Out	More Than Two Pitch Dia. Tol. Ranges Out But Less Than Three	More Than One Pitch Dia. Tol. Range Out But Less Than Two	Meets Specs.
			Bad Finish	
Overall Appearance (Blemishes, Burrs, Required Surface Finishes)	If Part Cannot Be Fixed	If Part Can Be Fixed And Still To Spec.	Minor Cosmetic , Minor Burrs	Meets Specs.
GD&T Specifications	More Than Three Tolerance Ranges Out	More Than Two Tolerance Ranges Out But Less Than Three	More Than One Tolerance Range Out But Less Than Two	Meets Specs.

Parts receiving a 69% or Less have the option to re-do the part with an averaging of the first and second attempt being your final grade.

Academic Year: 2019-2020

Student Name	G#	Degree/ Cert	Milling/ Turning	Course	Term	Grade	TSA Met?	Machine Shop Safety	Blueprints	Dimension Tolerances	Computation	CNC Programs	Manual Tools	Setup/ Operate CNC	2-D/3-D Models	Time Mgmnt	Notes

2017-2018 TSA Results - Machine Manufacturing Technology

Measured devience from test blue prints

	meets	1 range out	2 ranges out	3 ranges out	4 ranges out
point value	0	1	2	3	4

	TSA outcomes					
Student	**DIMENSIONAL**	**THREADS**	**SURFACE FINISH**	**GD&T**	**OVERALL SCORE**	**FINAL GRADE**
1	4		1		5	A
2	2		3		5	A
3	1	1	1		3	A
4	4			1	5	A
5	2				2	A
6	12	2	4	2	20	C
7	3				3	A
8	3		1		3	A
9	8				8	A
10	5				5	A
11	16	2	5	2	24	C
12	4	1			5	A
13	1			1	2	A
14	5	1	6		12	B
15	5				5	A
16	1	4			5	A
	76	**11**	**21**	**6**		

Observation:

Dimentional tolerence had a combined 76 errors.

Focus on machine control offset pages to offset dimensional tolerence mistakes.

Surface finish had a combined 21 errors.

Focus on speed and feed calculations to offset surface finish mistakes.

Points are added when a part is made with a mistake or a flaw is discovered in the assembly of the project. Point values are predetermined and outlined in a rubric included with the TSA test.