HELENA COLLEGE
University of Montana

Internal Program Review
Self-Study Report

Program Name
Computer Aided Manufacturing

Credentials Offered
Associate of Applied Science Computer Aided Manufacturing: 71 semester credits
Certificate of Applied Science Machine Tool Technology: 39 semester credits

Self-Study Completed by:
Art Warner, Faculty
Matthew Moyer, Faculty

Date Completed:
September 25, 2015

A. Introduction

Computer Aided Manufacturing prepares students as entry-level machinists in many areas, including aerospace, computer industries, job shop, gun smithing, tool and die making, computer numerical control (CNC) operator, and CNC programmer. Students study machining processes and procedures using lathes, mills, drill presses, cylindrical grinders, and surface grinders.

The first year students use a variety of manual machines, including engine lathes, horizontal and vertical mills, cylindrical grinders, surface grinders, drill presses, and radial arm drills. Students work from blueprints and follow exact specifications and apply practical shop math to accomplish the required tasks. Much of the lab time is used for shop and project work.

The second-year CNC portion of machine shop is devoted to the programming and operation of the CNC machine. Students are prepared to enter the work force as entry level programmers and CAD/CAM technicians. Students program and operate machining centers and turning centers in the lab. Students learn the Mastercam programming system, which allows students to design parts on the computer and manufacture them in the lab. Students work from blueprints and exact specifications that are used in industry. Lab work includes manual and CNC machine use. These machines are used for manufacturing fixtures, project work, and production projects.

B. Alignment with Mission, Strategic Goals and Core Themes

Helena College Mission

Helena College University of Montana, a comprehensive two-year college, provides access to and support of lifelong educational opportunities to our diverse community

Computer Aided Manufacturing Program Mission Statement

Computer Aided Manufacturing is designed to prepare students as entry-level machinists in many areas, including aerospace, computer industries, job shop, gun smithing, tool and die making.

Helena College 2012-22 Strategic Goals

1. Partner for Student Success Integrate Assessment/Planning
2. Attain Excellence
3. Support the Community
4. Advance the Institution
5. Develop Resources

Computer Aided Manufacturing Program Goals

1. Collaborate with business, industry, and the community as partners to provide a quality learning experience that gives graduates the best opportunity to gain employment
2. Solicit input from our constituents including, students, graduates, advisory board members, business, industry, faculty, staff, and administration concerning the operation and improvement of the program and career tracks which align with industry standards
3. Assess student and program performance through the use of outcomes assessment, Program Review and Evaluation Process, job placement rates, employer and graduate surveys
4. Increase enrollment through recruiting efforts including; business, industry, government, professional organizations, and high schools

Computer Aided Manufacturing Program goals are perfectly aligned with Helena College-UM Strategic Goals and Core Themes. This alignment is illustrated in the Goals/Core Themes crosswalk below:

Helena College Strategic Goals	Computer Aided Manufacturing Program Goal Alignment
Partner for Student Success	Increase enrollment through recruiting efforts including; business, industry, government, professional organizations, and high schools
Integrate Assessment & Planning	Assess student and program performance through the use of outcomes assessment, Program Review and Evaluation Process, job placement rates, employer and graduate surveys
Attain Excellence	Solicit input from our constituents including, students, graduates, advisory board members, business, industry, faculty, staff, and administration concerning the operation and improvement of the program and career tracks which align with industry standards
Support the Community	Collaborate with business, industry, and the community as partners to provide a quality learning experience that gives graduates the best opportunity to gain employment
Advance the institution	Building connections with local industry and supporting manufacturing growth in our region and throughout the state
Develop Resources	Collaborate with business, industry, and the community as partners to provide a quality learning experience that gives graduates the best opportunity to gain employment

Helena College-UM Core Theme Alignment with Computer Aided Manufacturing Program

- **Provide Access and Support: High quality educational activities and programs important to achieving student success**
  - Premier Montana 2-year program in Computer Aided Manufacturing
  - The Helena College-UM Computer Aided Manufacturing Program is one of two Associate of Applied Science Degree offerings in Computer Aided Manufacturing in Montana.

- **Demonstrate Academic Excellence: Integrity, quality and reliability in all academic and non-academic programming**
  - Rigorous Program of Study
  - Curriculum aligns with industry standards

- **Strengthen the Community: Meeting regional workforce needs, strengthening employee knowledge and skills, providing a bridge to additional educational attainment, and serving as a facilitator for cultural enrichment**
  - The Computer Aided Manufacturing Program strengthens the community by preparing students to meet local, regional, state and national workforce needs.

C. Alignment with Community Needs

Potential employers

According to the Bureau of Labor Statistics employment of metal and plastic machine workers is projected to grow 6 percent from 2010 to 2020, slower than the average for all occupations. Employment will be affected by advances in technology, changing demand for the goods these workers produce, foreign competition, and the reorganization of production processes.

One of the most important factors influencing employment growth in these occupations is the use of labor-saving machinery. Many firms are adopting new technologies, such as computer-controlled machine tools and robots, to improve quality, lower production costs, and remain competitive. The switch to computer-controlled machinery requires computer programmers instead of machine setters, operators, and tenders. The lower-skilled manual machine tool operator and tender jobs are more likely to be eliminated by these new technologies because the computer-controlled machinery does the work more effectively.

The demand for metal and plastic machine workers also is affected by the demand for the parts they produce. Both the plastic and metal manufacturing industries face stiff foreign competition that is limiting the orders for parts produced in this country. Some U.S. manufacturers have recently sent their production to foreign countries, limiting jobs for machine setters and operators.

Despite slower than average employment growth, a number of these jobs are expected to become available for highly skilled workers because of an expected increase in retirements, primarily of baby boomers, in the coming years.

In addition, workers who have a thorough background in machine operations, certifications from industry associations, and a good working knowledge of the properties of metals and plastics should have the best job opportunities.

The CAM program is advised by local and statewide constituents. The advisory council includes: Boeing Helena, Pioneer Aero-Structures Helena, S and S Machine Billings, Apex Machine Billings, Flying M Helena, Montana Hydraulics Helena, Neptune Missoula, and Elite Iron Potomac. The advisors meet bi-annually and discuss changes to the curriculum and program. Recently we reviewed the course offerings and updated courses to fit industry needs. The manual machining and the CNC (computer numerical control) portions are to be continued and remain unchanged. Solidworks was reviewed and will be continued to be offered in the first semester. The council agreed this would strengthen the blueprint reading skills of the machinist. The council was asked to keep us informed when they are in need of machinists. Overall the council has kept the program in step with industry and continues to keep the College in tune with industry.

D. Student Participation and Success

Helena College-UM enrolls 1,627 students with a full-time equivalent of 1,066. 789 of our students are full-time (48%); 277 of our students are part-time (52%). The breakdown of General Education to Technical to Trades and non-degree seeking is:

General Education Students: 623 (38% of headcount)
Technical Students: 453 (28% of headcount)
Trades Students: 181 (11% of headcount)
Non-Degree Seeking Students: 89 (5% of headcount)

Our students enroll from Lewis & Clark County at the rate of 75%; and from adjacent counties 12% (Broadwater, Jefferson, Cascade, Powell, and Meagher). The remainder of student enrollment comes from the rest of Montana (11%) and out-of-State/Western Undergraduate (2%).

Computer Aided Manufacturing Program student enrollment history 2009-2014

	2009-10	2010-11	2011-12	2012-13	2013-14
Spring	20	27	30	24	24

Computer Aided Program Student Retention

FY 2009/10	FY2010/11	FY2011/12	FY2012-13	FY2013-14	Five Year Average
100%	75%	40%	58%	71%	69%

From 2009 through 2014, the Computer Aided program capacity has been an average of 83%. With a five-year average of 9 student completers, program completion rates are at 98%.

E. Student Learning Outcomes

Upon successful completion of this program, a student will be able to:

- Perform machining operations to exacting tolerances common in industry.
- Prepare and demonstrate cutting tool applications.
- Prepare, setup and operate precision manufacturing equipment

Assessment of student learning outcomes occurs within individual program courses and all student learning outcomes are assessed through an end-of-program assessment.

F. Curriculum and Instruction (Academic Programs Only)

Length of Program: 4 Semesters
Type of Program: Associate of Applied Science
Semester of Entry: Fall

FIRST YEAR

Fall Semester

MCH120	Blueprint Reading and Interpretation for Machining	2
MCH130	Machine Shop	3
MCH132	Introduction to Engine Lathes	5
MCH134	Introduction to Mills	5
M111T	Technical Mathematics	3
Total Semester Credits		18

Spring Semester

MCH136	Advanced Lathes	5
MCH137	Advanced Mills	5
MCH139	Grinding Applications	2
MCH240	Metallurgy	2
MCH245	Shop Practices	2
WRIT121T	Introduction to Technical Writing	3
Total Semester Credits		19

SECOND YEAR

Fall Semester

MCH230	Tooling and Fixtures in CNC	2
MCH231	CNC Turning Operations Level 1	4
MCH232	CNC Turning Programming Operations 2	3
MCH234	CNC Milling Operations Level 1	4
MCH235	CNC Milling Programming Operations 2	3
Total Semester Credits		16

Spring Semester

MCH233	CNC Turning Programming Operations 3	3
MCH236	CNC Milling Programming Operations 3	3
MCH237	CAD/CAM CNC Turning Center	5
MCH238	CAD/CAM CNC Machining Center	5
HR100T	Human Relations	2
Total Semester Credits		18
TOTAL CREDITS		71

Length of Program: 2 Semesters
Type of Program: Certificate of Applied Science
Semester of Entry: Fall

Fall Semester

MCH120	Blueprint Reading and Interpretation for Machining	2
MCH130	Machine Shop	3
MCH132	Introduction to Engine Lathes	5
MCH134	Introduction to Mills	5
HR100T	Human Relations	2
M111T	Technical Mathematics	3
Total Semester Credits		20

Spring Semester

MCH136	Advanced Lathes	5
MCH137	Advanced Mills	5
MCH139	Grinding Applications	2
MCH240	Metallurgy	2
MCH245	Shop Practices	2
WRIT121T	Introduction to Technical Writing	3
Total Semester Credits		19
TOTAL CREDITS		39

G. Faculty/Staff Profile

Warner, Arthur*
Metals - Computer Aided Manufacturing
A.A.S., Helena College
At Helena College since Fall 1989

Moyer, Matthew
Computer Aided Manufacturing
A.S. M. E. Tech; Penn State University
Makino Certified Application Engineer
HAAS Certified Applications Technician
At Helena College since Summer 2012

H. Fiscal and Physical Resources

College current fund support of the Computer Aided Manufacturing program has been stable over the past five years. Infusions of budgetary support for Computer Aided Manufacturing Program occurred when equipment maintenance and repair and purchase of new equipment was required.

Cost per Completion

FY2010/11	FY2011-12	FY2012-13	FY2013-14
33,220.00	29,193.00	34,780.00	34,148.00

I. Recommendations and Preliminary Implementation Plan

Based upon our program evaluation it has been concluded that the following recommendations are critical to the future of the Computer Aided Manufacturing program. Partnerships with industry are critical to staying on the forefront of this ever developing technological program. Manufacturers, Machine Tool builders and Software Developers are constantly redeveloping and improving their products which requires our program to remain completely engaged and constantly in the learning mode.

1. Integrate student acquisition of industry-recognized credentials into the curriculum.

2. Increase instructor professional development through attendance at national educators' conferences and institutes.

3. Build career awareness by partnering with industry partners, secondary schools and US Department of Labor Job Service.

J. Program Review Data Summary

See Program Review Data Summary in Section K.

K. Appendix (Additional data or exhibits)

Program Review Data Summary

Helena College – Machine Tool/Computer Aided Manufacturing 2/19/15

Program Review Data Summary								
Alignment with Community Needs (AAS/CAS Only)								
Data Definition:	Current MT	Projected MT	Current U.S.	Projected U.S.			Program Notes	Source
A. Provide the total number of projected job openings from related occupations for Montana and the U.S.	110 (2012)	140 (2022)	140,300 (2012)	160,700 (2022)			Machinists; CNC Machine Operators, Data=CNC M Ops	CareerOneStop/US Dept of Labor
B. Provide percent change in job openings for related occupations for Montana and the U.S.		+22%		+15%			See links for specific employ/wage data	CareerOneStop/US Dept of Labor
C. Provide the median hourly wage or annual salary for related occupations	$15.67 hourly		$17.26 hourly				Wage information as of 2013	CareerOneStop/US Dept of Labor
Data Definition:	Year 1 2009	Year 2 2010	Year 3 2011	Year 4 2012	Year 5 2013	5 Year Ave	Program Notes	Source
D. Provide 5 years of in-field job placement rates for all program graduates	*67%	N/A	*71%	N/A	N/A	69%	*Perkins 4P1 Reports 09-11	Helena College Graduate Survey and/or OCHE Perkins Data
E. For applied programs with program admission provide five years of student application totals	N/A	N/A	N/A	N/A	N/A	N/A		Program Records
F. For applied programs with program admission provide five years of students accepted totals	N/A	N/A	N/A	N/A	N/A	N/A		Program Records
Student Participation and Success								
Data Definition:	Year 1 09/10	Year 2 10/11	Year 3 11/12	Year 4 12/13	Year 5 13/14	5 Year Ave	Program Notes	Source
A. Provide 5 years of transfer rates to 4-year colleges (AA/AS)								Institutional Research
B. Provide program capacity (headcount)	30	30	30	30	30	30	1st and 2nd Year	Institutional Research
C. Provide 5 years of enrollment (annual unduplicated headcount)	20	27	30	24	24	25		Institutional Research
D. Provide 5 years of enrollment (annual FTE)	25	33	26	24	25	27	Total MACH course credits/15	Institutional Research
E. Annual percentage of program capacity	67%	90%	100%	80%	80%	83%		Institutional Research
F. Provide 5 years of retention rates for full-time students	100%	75%	40%	58%	71%	69%	Entering students returning	Institutional Research
G. Provide 5 years of retention rates for part-time students	N/A	0%	0%	N/A	0%	0%	the following fall semester	Institutional Research
H. Provide 5 years of successful program course completion rates.	95%/100%	99%/97%	91%/100%	93%/95%	97%/100%	95%/98%	Pass or C- or better each term	Institutional Research
I. Provide 5 years of graduation rates for full-time students *rate of students graduating within 150% of completion time*	100% Fall 07	80% Fall 08	100% Fall 09	75% Fall 10	100% Fall 11	91%	% entering students graduating with 3 years	Institutional Research
J. Provide 5 years of graduation rates for part-time students *rate of students graduating within 150% of completion time*	N/A	N/A	N/A	0% Fall 10	N/A	0%	No part-time students entering Fall 10 graduated	Institutional Research
K. Provide 5 years of annual degree & certificate completions	7	15	9	6	8	9	AAS + CAS	Institutional Research
L. Provide 5 years of degree production rates – *proportion of degrees/certificates granted per 100 FTE enrollment*	28	45	35	25	32	33	# of completers per 100 FTE enrollment	Institutional Research
M. Provide 5 years of pass rates on occupation/industry specific licensing or certification exams (as applicable)	–	–	–	–	–	–		Program Records
Fiscal and Physical Resources								
Data Definition: Instructional costs include salaries, operations, less grant funding, gifts/donations from partners	Year 1 09/10	Year 2 10/11	Year 3 11/12	Year 4 12/13	Year 5 13/14	5 Year Ave	Program Notes	Source
A. Provide 5 years of instructional cost/student (FTE)	$4,473	$4,461	$5,150	$6,176	$5,683	$5,189	H06020/FTE	Institutional Research/Finance
B. Provide 5 years institutional expenditure/student (FTE)	$6,872	$6,024	$6,328	$7,473	$7,639	$6,867	Total Budget/FTE	MUS-OCHE
C. Provide 5 years of instructional cost/student completion	$15,974	$9,815	$14,879	$24,704	$17,760	$16,626	H06020/Completions	Institutional Research
D. Provide 5 years institutional expenditure/completion	$34,209	$33,220	$29,193	$34,780	$34,148	$33,110	Total Budget/Compl	MUS-OCHE
E. Provide 5 years of student program fees-fund balance(s)	$3,135	$2,775	$2,850	$2,696	$3,995	$3,090	Fees (H60530)	Finance/Program Records
F. Provide 5 years of student program fees-student costs	$1,956	$391	$3,250	$4,340	$7,744	$3,536	Fees (H60530)	Finance/Program Records
G. Provide five years of tuition revenue (Annual FTE x Res Tuition)	N/A	$89,001	$67,964	$64,968	N/A	$73,978	Resident tuition revenue x Annual FTE	MUS-OCHE