School	Business, Agriculture, and Technical Studies
Program Area	Industrial Maintenance & Technical Studies
Major Programs	A.A.S. Technical Studies (60 credits), Credit Diploma, Industrial Maintenance (25 credits)
Review Period	Fall 2012 to Fall 2017
Self-Study Developed	AY 2017-2018
Review Status	Academic Standards Accepted the Program Review Without Contingencies
Program Leaders	Susie Lemaster
Committee Chair	Cindy Henning
Academic Standards Program Review Subcommittee Reviewers	Michael Thompson: Faculty, Math & Sciences Teresa Authier: Librarian Kim Bender: AVP – Institutional Effectiveness Erin Bauer: Chair of SLA Committee Jesse Brumfield: Student Services Representative Sabrina Lane: Administration and Finance Representative Nick Robertson: 18-19 APR – Exercise Science

A. Brief Overview of Program

The Industrial Maintenance program is designed for students who want to gain valuable industry knowledge and want to pursue a basic academic foundation. Students gain knowledge and skills in fluid dynamics, mechanical and electrical topics; all of which are combined to provide the groundwork for direct industry employment. This program prepares individuals to apply technical knowledge and skills to repair and maintain industrial machinery and equipment such as pumps, motors, conveyor systems, production machinery, refinery and pipeline distribution systems.

Industrial Maintenance training first began at Laramie County Community College with the development of the Integrated Systems Technology department in 2005. The award of a $900.000 Department of Labor Grant supplied the equipment to provide training for Industrial Maintenance skill sets including Industrial Safety, Fluid Power, Mechanical Drives, DC and AC Electricity, Electric Motors, Motor Control and Programmable Logic Controllers. Integrated Systems Technology partnered with the newly formed Wind Energy Technology program to provide Wind Energy students introductory, fundamental Industrial Maintenance knowledge and skills preparing then to receive more industry specific training in Wind Energy.

When Heating, Ventilation, and Air Conditioning/Refrigeration (HVAC/R) and Process Technology programs developed, they too followed the Integrated Systems Technology/Wind Energy design, and Integrated Systems Technology courses quickly became the foundation for other developing programs so that all students in the new degree programs had their foundation laid in the Industrial Maintenance curricula.

So then as Integrated Systems Technology (IST) supplied the foundation for Wind Energy, HVAC/R and Process Technology it was determined that those skill sets are fundamental and the Industrial Maintenance Credit Diploma became a stand-alone certification.

Although there have been numerous Wind, HVAC/R and Process Technology students who have completed IST courses over the years, prior to two years ago there was no certification and no Industrial Maintenance Credit Diplomas awarded. Furthermore, the Industrial Maintenance Credit Diploma does not completely align with the Wind Energy or HVAC/R Associate of Applied Science Degrees; each lacking a few IST courses to obtain an Industrial Maintenance Credit Diploma. If alignments were made,

every graduating Wind Energy or HVAC/R Associate of Applied Science student could also achieve an Industrial Maintenance Credit Diploma. For example, if the Industrial Maintenance program made a course modification to allow WTT 1300 Theoretical Concepts of Rotating Machines to qualify for the IST 1780 Electric Motors and IST 1781 Electric Motor Circuits credit, Wind Technology students could obtain an Industrial Maintenance Credit Diploma with no extra courses. Work will be accomplished to make this a reality. A similar situation exists for HVAC/R students, if a few course modifications for the HVAC/R program were made, those students could earn an Industrial Maintenance Credit Diploma as well. Please view the Industrial Maintenance Credit Diploma, the Wind Energy Technology and the HVAC/R Associate of Applied Science Degrees in the folder entitled, "IST, HVAC/R, WIND" in the document directory.

B. Program Achievements Over the Review Period

Although the AQUILA Continuous Improvement Program Review cycle for a Laramie County Community College Program is five years, the Industrial Maintenance Credit Diploma is only entering its 3rd year, 15/16, 16/17 and 17/18. A review of the LCCC catalog shows that in the 14/15 catalog there is no Industrial Maintenance Credit Diploma offered. The 13/14 LCCC catalog shows an Integrated Systems Technology Certificate available with concentration areas in Electrical, Mechanical and HVAC/R. Therefore, the Integrated Systems Technology Certificate ended with academic year 13/14 and transitioned in academic year 14/15 to the Industrial Maintenance Credit Diploma becoming available in academic year 15/16.

Even as the Industrial Maintenance Credit Diploma is yet to produce a graduate, a look at the history of Integrated Systems Technology courses touts great successes as they are the foundational courses for other programs such as Wind Energy Technology, HVAC/R (Heating, Ventilation, Air Conditioning and Refrigeration), and Process Technology.

IST (Integrated Systems Technology) courses service an average of 70 students a year with an enrollee success rate of 92.26% and a retention rate of 97.59% over five years; 4.52% higher than the LCCC institutional average retention rate.

Program enrollment Trends for Previous Five Years:
IST supports an Industrial Maintenance Degree, Wind Energy, and HVAC. IST and Wind Energy are growing at a faster rate than most programs. HVAC is undergoing program modifications this year and should start to grow in the fall of 2018. The 3-year averages for these programs per the IR report for program review are:
Industrial Maintenance – 50 FTE (1 year of data – new program)
Wind Energy – 19.11 FTE
HVAC – 15.64 FTE

C. Mission and Values

MISSION:
Mission statement: Industrial Maintenance is a technical, systems-based approach in training technicians for gainful employment in the Industrial maintenance workplace. In a "hands on" environment students actively expand knowledge and apply skills pursuant to successful careers transforming lives, enhancing community and meeting industry needs through inspired learning.

VALUES:
1. Excellence in instruction within high quality, student-centered education involving active learning incorporating a culture of safety.

2. Respect for individuals as learners, endeavoring to improve their circumstance through education and industry employment.

3. Expand relationships with community and industry partners.

4. Growth and development of faculty through professional development, college service, teamwork, collaboration and problem solving.

D. Program Competencies and Outcomes

a) Program Student Learning Competency #1: "Electrical Safety in the Workplace": Students will demonstrate knowledge and skills related to the practice of electrical safety in the workplace to include:

1. CFR (Code of Federal Regulations) 29 CFR 1910.147 OSHA Lock out/Tag out
2. NFPA (National Fire Protection Association) 70 E, *Handbook for Electrical Safety in the Workplace*
3. Characteristics of Electricity as they relate to the human body.

Safety is an ongoing fundamental theme in Industrial Maintenance courses and is progressively layered in each subsequent Electrical IST course. Students learn safety regulations and demonstrate where to find them in the Code of Federal Regulations and the NFPA 70E. In conjunction with the knowledge gained in the classroom setting investigating federal OSHA regulations and the National Fire Protection Agency 70E *"Electrical Safety in the Workplac*e" students implement and practice 29 CFR1910.147 Lock Out/Tag Out procedure in the lab, implementing an environment and culture of "Safety First". The students are expected to perform safety procedures each and every time they are in the lab environment. There is zero tolerance on the established safety procedure in the lab and no student is allowed to perform maintenance without following that procedure. Every instance a student is in the lab environment, specific Lock Out/Tag Out procedures are followed demonstrating practice toward competence of the objective. At the end of the semester a verbal final proving acquired knowledge and applied skills is administered by the instructor using the uploaded rubrics to measure competence and collect data. See rubric for each IST class in the Industrial Systems Technology folder in the document directory.

Program Student Learning Competency #2 "Meter Usage": Students demonstrate the ability to decide what type of meter to use to measure electrical component characteristics (resistance, voltage, current) and must decide where and how to connect a meter in an electrical circuit (series, parallel, series-parallel) to measure specific electrical characteristics.

Students apply the knowledge gained in the classroom setting investigating types of meters and how to connect them in specific electrical circuits (series, parallel and series-parallel) to measure specific electrical characteristics (resistance, voltage, current). Students demonstrate the ability to decide which meter to use and how to connect them in an electrical circuit that they have constructed in a real world electrical trainer with real world components in a lab environment demonstrating the practical application of that knowledge. Every instance a student is in the lab environment, meter use procedures are followed demonstrating practice toward competence of the objective. At the end of the semester a verbal final proving acquired knowledge and applied skills is administered using the uploaded

documents as rubrics to measure competence and collect data. See rubric for each IST class in the Industrial Systems Technology folder in the document directory.

Operational Outcome #1 "Industrial Technology AAS": In addition to the Industrial Maintenance Credit Diploma and the Technical Studies AAS, the Industrial Maintenance program is also in the process of developing Industrial Maintenance Credit Diplomas in concentration areas, which can lead to an Industrial Technology AAS in specific areas of emphasis. The Industrial Maintenance program plans to revise structure and develop additional curriculum for fall 2019 to develop the Industrial Technology Associate of Applied Science. The Industrial Technology program of study leads to an Associate of Applied Science degree and prepares students for work in an industrial career field. This program provides the necessary skills and associated background knowledge to prepare for a career in a variety of industrial environments. This degree is designed to build upon LCCC credit diplomas in Automotive Technology, Diesel Technology, Process Technology, Welding, Industrial Maintenance or Heating Ventilation Air Conditioning and Refrigeration. See the proposal in the Industrial Technology AAS folder in the document directory.

Operational Outcome #2 "Technical Studies AAS": The Industrial Maintenance program has added an AAS in Technical Studies (see MCOR in section II.A.4). The Technical Studies Associates of Applied Science degree will assist our industry partners and Industry Tradesmen and Air Force members with training in other fields the opportunity to earn an Associates of Applied Science degree. The Associate of Applied Science degree in Technical Studies is intended for individuals who desire to build upon a Department of Labor-recognized apprenticeship training program, or the completion of the Technical core for the award of United States Air Force Community College of the Air Force (CCAF) Degree both of which bring demonstrated knowledge, skills and competencies in their field as the technical foundation of the degree. Students will complete course work in the general education core and a selection of management courses to complete the degree program. Students will be advised and their apprenticeship or CCAF technical core will be evaluated for awarding of credit on an individual basis.

b) Program Competency #1 aligns with Program Value #1 Excellence in instruction within high quality, student-centered education involving active learning incorporating a culture of safety.

c) Operational Outcomes #1 and #2 align with Program Value #2 Respect for individuals as learners, endeavoring to improve their circumstance through education leading to industry employment.

E. Abbreviated Summary of Program Data (KPIs)

Because the Industrial Maintenance program is relatively new and has a short operation period, there are no three-year average ratings for the KPIs, only current year ratings.

Program Demand:
This new program is so far performing at the lower range for participation with a current year annual FTE at 19 and the number of participants enrolled at 50.

The Industrial Maintenance program would like to increase its annual FTE by 20% over the next two years and increase its number of participants enrolled by 20%. These goals for increased enrollment should be attainable with the program's new recruitment plan and effort.

Student Success:
The program has a very strong current-year course success rate of 91%. However, no other measures are available yet for graduation rate for concentrators and number of degrees/certificates.

The Industrial Maintenance program is satisfied with its success rates. These numbers indicate that the program design and curriculum are working, but the program is looking forward to the first cohort of completers to track cohort success over time to identify areas of improvement.

Transfer Preparation:
The program is not a transfer program, and it is too new for transfer data to display.

Efficiency:
The sole data entry for this category is for the average, section fill rate indicator. The program has a strong performance here with a current year rate of 75%.

The Industrial Maintenance program would like to increase the average, section fill rate to 80% over the next two years. This goal should also be attainable if the program increases its participant enrollment by 20%. The collaboration of the Industrial Maintenance, Wind and HVAC faculty to strategically schedule course offerings will also be instrumental in achieving this goal.

F. Accomplishing the Program's Previous Action Plan Goals

Not applicable, the Industrial Maintenance program is in its third year and has had no previous program review.

G. Summary of Review Action Plan Goals

a) Action Plan Goals

Goal One:

Increase the number of students earning an Industrial Maintenance Credit Diploma.

Goal Two:

Development of Motor Control trainers to expand skills-based (lower cognitive level) laboratory "trainers" and exercises with more challenging, customized and upgraded hands-on, project-based, real-world trainers.

Goal Three:

The Industrial Maintenance Credit Diploma is in process of formulating an advisory board

Goal Four:

Multi-discipline strategic planning with related instructional programs such as Wind Energy Technology, HVAC/R (Heating, Ventilation, Air Conditioning and Refrigeration and Industrial Maintenance.

b) Origin of Action Plans:

The program review process and its feedback information identified strengths and weakness in the Industrial Maintenance program and action plans were formulated to make improvements to the program. As the Industrial Maintenance program analyzed data from the Institutional Research department and synthesized the self-study narratives from the current program review process, it

became very apparent that the IST courses/Industrial Maintenance program really provide a support function for the Wind Energy Technology program and the HVAC/R (Heating, Ventilation and Air Conditioning/Refrigeration) programs. Although the Integrated Systems courses support many students in these other programs, Industrial Maintenance has not produced any Industrial Maintenance Credit Diplomas completers. Further analysis of the Industrial Maintenance Credit Diploma, the Wind Energy Technology and HVAC/R Associate of Applied Science degrees revealed that with a minor Industrial Maintenance course modification, every Wind Energy Technology student could achieve an Industrial Maintenance Credit Diploma and an Industrial Maintenance Operational Outcome. An action plan became clear in its program review findings to *increase the number of students earning an Industrial Maintenance Credit Diploma*.

H. Identified Strengths, Concerns, Opportunities, and Challenges for Student Learning and Program Operations Resulting from the Review Process)

a) Student Learning

Strengths:

- Collaboration with the NSF (National Science Foundation) ATE (Advanced Technological Education) grant to develop the Integrated Systems Technology/Industrial Maintenance curriculum.
- Developed industry, scenario-based learning tasks that meet course and program student learning competencies.
- Collaboration with Wind Energy Technology and HVAC/R instructors ensuring cohesive transition from IST courses to specific program of study.
- Students' progression through the program(s) is usually cohort based.

Concerns:

- There has been pressure to increase the number of students in the lab environment while working with the Industrial Maintenance trainers, which could impact the quality of instruction (limited number of trainers).

Opportunities:

- Development and expansion of real world "hands-on" trainers.
- Development of multiple pathways for student learning in the Industrial Technology Associate of Applied Science.

Challenges:

- Summative verbal assessment time constraints.

b) Operational Outcomes

Strengths:

- The Integrated Systems Training lab is a $900,000 facility that lays the foundation for students interested in an electrical or mechanical career field.
- The hands-on trainers allow students to work on equipment in a controlled, instructor led environment. The curriculum has been developed by LCCC instructors to keep up with industry demands.
- For safety reasons, the lab sizes are restricted to a student to instructor ratio of 6:1.

- The electrical instructor is a licensed journeyman electrician and adjuncts are out of industry.
- The Industrial Maintenance program is the only one of its kind in the region.

Concerns:

- Although the Integrated Systems courses support many students in other programs, Industrial Maintenance has not produced any Industrial Maintenance Credit Diplomas.

Opportunities:

- There is a great opportunity to increase the number of students earning an Industrial Maintenance Credit Diploma by a few minor program modifications so that every Wind Energy Technology and Heating, Ventilation and Air Conditioning/Refrigeration student earn an Industrial Maintenance Credit Diploma.

Challenges:

- No Program Director - I was hired in August of 2010, prior to December 2016 the program has always enjoyed a Program Director, first in Integrated Systems Technology and then in Industrial Maintenance. In December 2016, the position of Technical Studies Program Director was eliminated. For a program to be successful investment in the program must be made. Without investment how can the program succeed? There are many responsibilities to maintain a successful program as outlined in this study. Observing successful programs at Laramie County Community College reveals there is usually a Dean, Program Director, and/or Program Chair and instructors. It is impossible for one person to perform all these functions.

I. Continuous Improvement: Follow-Up Reporting and Planning for Strengthening Program Performance

To be consistent with its continuous improvement processes, LCCC includes follow-up action planning in its academic program review activities. Program review includes a peer-review step where an Academic Standards Subcommittee for Program Review rates program performance using an Academic Program Review Rubric. Programs perform well on the majority of self-study sections, but occasionally the rubric rating identifies a few areas that need additional attention. For these situations, the program review process includes a structured follow-up planning phase to support program strengthening of these areas.

In early May, after programs have had their self-studies peer reviewed, the Academic Standards Committee notifies those programs that are to participate in additional continuous improvement planning. Academic Standards accepted the Industrial Maintenance program review without contingencies, so it was not required to submit follow-up action planning.