

Manufacturing Systems Engineering

Post 30-Day Response

1.0 Introduction

Weber State University appreciates the thorough review conducted by the ABET Engineering Accreditation Commission (EAC) regarding the Manufacturing Systems Engineering (MSE) Bachelor of Science program. We acknowledge the feedback provided in the draft statement and recognize the opportunity to further strengthen our program through continuous improvement. Below, we address each identified concern and outline the actions taken to ensure compliance with ABET's accreditation criteria.

2.0 Draft Statement of Accreditation

2.1 Program Weakness

2.2 Criterion 4. Continuous Improvement

This criterion requires that the program regularly use appropriate, documented processes for assessing and evaluating the extent to which the student outcomes are being attained. Although the processes for assessing and evaluating the extent to which student outcomes are attained are documented, the assessment of some outcomes uses artifacts and evaluation methods that

do not provide adequate evidence of the attainment of all elements of the outcome. For example, the artifacts used to assess the attainment of Student Outcome (1) were the student's ability to use personal protective equipment and their ability to read a print (drawing) which appeared to have no relevance to a student's ability to identify, formulate and solve complex engineering problems, as required by this outcome. The assessment of the attainment of Student Outcomes (3), (4) and (5), used artifacts of the culminating design experience reports, specifically the executive summary and the quality plan. These artifacts lacked evidence of student's ability to communicate effectively with a range of audiences, as required for Student Outcome (3). Similarly, these artifacts lacked sufficient evidence of the student's ability to make informed judgements, which considered the impact of engineering solutions in global, environmental and societal contexts, as required for Student Outcome (4). Furthermore, these artifacts lacked evidence of a student's ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives, as required by Student Outcome (5). Without fully evaluating and documenting the extent to which all elements of the student outcomes are being attained, the program may miss opportunities for continuous improvement. Thus, strength of compliance with this criterion is lacking.

2.3 Response to Identified Weaknesses

2.3.1 Criterion 4: Continuous Improvement

ABET Concern: The assessment artifacts and evaluation methods do not provide adequate evidence of the attainment of all elements of Student Outcomes (SOs) 1, 3, 4, and 5.

2.3.1.1 Actions Taken:

2.3.1.2 Assessment Artifacts Expansion: Student Outcome (1):

We have reviewed our assessment artifacts for Student Outcome (1) as shown below in Table 1. We have examined the problem-solving exercises, project-based assessments, and engineering case studies that specifically address the complexity of the criteria defined by ABET. We have incorporated analysis-based assignments that require students to engage with calculus-based solutions for complex engineering problems.

Student Outcome 1 states that graduates must demonstrate “an ability to identify, formulate, and solve complex manufacturing engineering problems by applying principles of engineering, science, and mathematics.” In alignment with ABET criteria and industry expectations, the Manufacturing Systems Engineering (MSE) program at Weber State University employs a multi-faceted assessment approach to ensure students develop and demonstrate proficiency in solving complex engineering problems. This assessment strategy includes MSE 3850: Statistical Process Control and Reliability, MSE 4615: Senior Project I, MSE 4620: Senior Project II, and the SME Certified Manufacturing Technologist (CMfgT) Exam, as well as continuous feedback from the Industry Advisory Board (IAB) to ensure relevance to real-world manufacturing challenges. The following sections provide justification for Selected Courses and Assessment Instruments.

2.3.1.2.a MSE 3850: Statistical Process Control and Reliability

MSE 3850 plays a crucial role in assessing Student Outcome 1 by requiring students to apply mathematical and statistical tools to solve engineering problems and improve manufacturing processes. Classic process engineering methods and due diligence are emphasized with the lab-based exploration of measurement systems analysis, attribute and variable statistical process control, process capability analysis, generic problem solving, failure modes and effects analysis, and an introduction to reliability engineering. Students develop skills in data-based decision-making, process improvement methods, generic problem solving methods, engineering metrics, process stability, sources of variability, process capability, and basic reliability engineering concepts.

The course requires students to analyze real-world manufacturing data using statistical analysis, making informed judgments about measurement systems, metrics, variation, control, stability, capability, and reliability. The capstone project in MSE 3850 directly assesses the student's ability to identify an engineering problem; generate creative potential solutions (brainwriting, benchmarking, provocative opposites and other creative methods) reduce and organize ideas with cause and effect methods (affinity diagrams, fishbones, and mindmaps), evaluate potential solutions (structural versus attitudinal analysis, metric based analysis), and select an optimal solution (paired comparisons, voting systems, criteria weighted analysis). The goal is to fully explore a problem using applied statistical methods—a fundamental skill expected of graduates. The industry advisory board has specifically emphasized the importance of statistical literacy in manufacturing problem-solving and process improvement, reinforcing the need to assess Student Outcome 1 through this course.

2.3.1.2.b MSE 4615: Senior Project I

MSE 4615 is a cornerstone course in which students engage in complex, open-ended engineering design challenges. As per the catalog, this course is structured to guide students through the engineering design process, from problem identification to conceptual design and feasibility analysis. Emphasis is placed on teamwork, project management, technical documentation, and adherence to engineering standards. MSE 4615 directly assesses Student Outcome 1 by challenging students to:

1. Identify and define a complex engineering problem related to manufacturing systems.
2. Apply engineering principles and mathematical models to develop an optimized design.
3. Analyze constraints and trade-offs to formulate a viable solution.

Through detailed design reports, feasibility studies, and technical presentations, students must demonstrate their ability to systematically approach multivariable engineering problems. The IAB has provided extensive feedback on this course, emphasizing the need for students to refine their engineering problem-solving skills before they enter industry roles.

2.3.1.2.c MSE 4620: Senior Project II

As the second half of the senior design sequence, MSE 4620 is where students transition from conceptual design to real-world implementation and validation. MSE 4620 requires students to complete the engineering design cycle, including detailed design, prototyping, testing, evaluation, and final presentation. Emphasis is placed on problem-solving, teamwork, technical writing, and meeting customer specifications. This course ensures that students apply

scientific and mathematical principles to refine their designs, test hypotheses, and solve real engineering challenges that often involve dynamic systems, manufacturing constraints, and operational uncertainties. The culminating design experience directly assesses Student Outcome 1 by requiring students to:

1. Apply advanced engineering calculations to validate designs.
2. Perform process simulations and data analysis to optimize performance.
3. Use experimental data to troubleshoot and refine manufacturing solutions.

Industry partners in the advisory board have emphasized that the ability to problem-solve through iterative design and engineering analysis is a key competency expected of MSE graduates. Therefore, MSE 4620 serves as a critical assessment point for demonstrating problem-solving skills in complex manufacturing environments.

2.3.1.2.d SME Certified Manufacturing Technologist (CMfgT) Exam

To ensure an objective, industry-recognized measure of Student Outcome 1, all Manufacturing Systems Engineering students must take the SME Certified Manufacturing Technologist (CMfgT) Exam as part of their program assessment. According to the SME website, the CMfgT Exam:

"Evaluates a candidate's fundamental knowledge of manufacturing processes, engineering materials, automation, production planning, and quality control. The exam covers applied mathematics, geometric dimensioning and tolerancing (GD&T), process optimization, and statistical methods."

The exam serves as a standardized benchmark that validates students' mathematical proficiency in solving manufacturing-related engineering problems and confirms their understanding of key scientific and engineering principles, as required by ABET standards. Feedback from the Industry Advisory Board has strongly supported the inclusion of the SME CMfgT Exam as an assessment tool, as it provides a measurable comparison to national benchmarks and ensures that MSE graduates meet industry-wide competency expectations.

2.3.1.2.e Integration of Industry Advisory Board Feedback

The Industry Advisory Board (IAB) plays an active role in curriculum review and has consistently emphasized the need for MSE graduates to be well-versed in engineering problem-solving, data analysis, and mathematical modeling. In recent meetings, the IAB has supported the continued use of the SME CMfgT Exam as a valuable external benchmark. The IAB has provided direct feedback on student projects, ensuring that senior design work aligns with real-world manufacturing challenges. In response to these recommendations, the MSE program has enhanced its assessment methodology by refining the senior project grading rubrics to explicitly assess students' ability to formulate and solve multivariable engineering problems.

The Manufacturing Systems Engineering program at Weber State University employs a rigorous and multi-layered approach to assess Student Outcome 1. By utilizing MSE 3850, MSE 4615, MSE 4620, and the SME CMfgT Exam, we ensure that students are well-equipped to identify, formulate, and solve complex engineering problems using principles of engineering, science, and mathematics.

Furthermore, continuous feedback from the Industry Advisory Board helps shape and refine the program to align with current industry expectations. By integrating direct assessments, project-based learning, and national certification exams, we guarantee that MSE graduates possess the analytical, mathematical, and problem-solving skills necessary for successful careers in modern manufacturing engineering.

Table 1: Student Outcome 1 Assessment Plan.

Student Outcome	MSE 3850 Rubric	MSE 3700 Rubric	MSE 3910 Rubric	MSE 4615 Rubric	MSE 4620 Rubric	CMFGT Exit Exam	IAB
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	X			X	X	X	X

2.3.1.3 Student Outcome (3):

We have reviewed our assessment artifacts for Student Outcome (3) as shown below in Table 1.1.1.2. We have examined the project-based assessments, and the use of the SME exam to specifically address the complexity of SO 3 criteria defined by ABET.

Student Outcome 3 states that graduates must demonstrate:

"An ability to communicate effectively with a range of audiences."

To ensure students develop and demonstrate proficiency in professional and technical communication, the Manufacturing Systems Engineering (MSE) program at Weber State University employs a comprehensive, multi-layered assessment approach. This approach integrates MSE 4616: Senior Project Planning, MSE 4620: Senior Project II, the SME Certified Manufacturing Technologist (CMfgT) Exam, and direct feedback from the Industry Advisory Board (IAB).

This combination of coursework, standardized assessments, and industry engagement ensures that students gain real-world experience in technical communication, allowing them to effectively convey complex engineering concepts to technical and non-technical stakeholders alike. The following sections provide justification for Selected Courses and Assessment Instruments.

2.3.1.3.a MSE 4616: Senior Project Planning

As the initial phase of the capstone experience, MSE 4616 requires students to develop and present a formal engineering project proposal. This course introduces students to structured engineering project planning, including problem definition, literature review, feasibility analysis,

and preliminary design. Students develop professional documentation and deliver oral and written presentations to faculty, peers, and industry professionals. This course serves as a key assessment point for Student Outcome 3, requiring students to:

1. Develop a detailed written project proposal that includes problem statements, research findings, and initial design considerations.
2. Deliver an oral presentation to faculty and peers, where they must effectively communicate their design ideas, methodologies, and expected outcomes.
3. Engage in technical discussions and respond to questions, demonstrating their ability to convey complex engineering concepts clearly and concisely.

The IAB has emphasized that engineers must be able to clearly articulate their design rationale, defend their decisions, and adjust their messaging depending on the audience—skills that are rigorously developed in MSE 4616.

2.3.1.3.b MSE 4620: Senior Project II

As the final stage of the capstone experience, MSE 4620 requires students to formally document and present their completed engineering project. This course serves as the second phase of the senior capstone experience, requiring students to finalize their engineering design, conduct testing and analysis, and deliver a comprehensive final report. Emphasis is placed on written and oral communication, teamwork, and the ability to present technical information effectively to multiple audiences. MSE 4620 provides a direct and rigorous assessment of Student Outcome 3 by requiring students to:

1. Prepare a detailed final engineering report, incorporating design decisions, calculations, test results, and implementation strategies.
2. Deliver a formal technical presentation to faculty, industry professionals, and peers, where they must effectively communicate their project's findings, methodologies, and significance.
3. Defend their work through a question-and-answer session, ensuring they can articulate their design rationale and respond to critical feedback.

The Industry Advisory Board actively participates in final project presentations, providing authentic industry-based critiques and recommendations. IAB members have consistently emphasized that strong communication skills are a critical factor in an engineer's ability to secure funding, gain project approval, and effectively lead multidisciplinary teams.

2.3.1.3.c SME Certified Manufacturing Technologist (CMfgT) Exam

The SME CMfgT Exam is an objective, industry-standard assessment that ensures students have the necessary technical knowledge and communication ability required in modern manufacturing systems engineering. The exam is designed to:

"Assess candidates' ability to understand, interpret, and communicate key manufacturing concepts, including engineering documentation, technical specifications, process planning, and quality control methodologies."

The exam plays a crucial role in assessing Student Outcome 3 by evaluating:

1. Students' ability to interpret and analyze technical documents, including engineering drawings, manufacturing process instructions, and statistical process control reports.
2. Their comprehension of manufacturing terminology, ensuring they can effectively communicate technical concepts in industry settings.

The IAB strongly supports the use of the CMfgT Exam as an assessment tool, citing its alignment with national industry standards and its ability to benchmark students' communication skills against practicing professionals.

2.3.1.3.d Integration of Industry Advisory Board (IAB) Feedback

The Industry Advisory Board (IAB) has consistently emphasized the importance of communication skills in manufacturing systems engineering. IAB members, who represent leading companies in aerospace, automotive, and industrial manufacturing, have noted that effective communication is a key differentiator between entry-level engineers who advance quickly and those who struggle in professional roles. Graduates must be able to communicate technical concepts to both engineering teams and business decision-makers, requiring proficiency in both technical and non-technical communication. Oral presentation skills are just as critical as written reports, as engineers are often required to defend design decisions and problem solutions, justify process improvements, and collaborate with multidisciplinary teams. Based on IAB recommendations, the MSE program has implemented several enhancements to its Student Outcome 3 assessment strategy, including:

1. Increased emphasis on public speaking and presentation skills in both MSE 4616 and MSE 4620.

2. Refinement of grading rubrics to ensure that students are evaluated not only on technical accuracy but also on their ability to convey information effectively to different audiences.
3. Expanded involvement of IAB members in project evaluations, providing students with authentic industry feedback on their communication skills.

In response to ABET feedback and IAB recommendations, the MSE program confirmed that the approach of assessing Student Outcome 3 by reviewing the following:

1. Students submit both technical and executive-level reports, ensuring they can communicate at multiple levels of an organization.
2. Peer evaluations are incorporated in project presentations, allowing students to refine their communication techniques through feedback.
3. Student integration of visual communication tools, such as CAD drawings, process flowcharts, and simulation results, into student reports and presentations.
4. Tracking student performance on the SME CMfgT Exam's communication-based sections, using this data to identify areas for continuous improvement.

The Manufacturing Systems Engineering program at Weber State University employs a structured, multi-pronged approach to assess Student Outcome 3. By utilizing MSE 4616, MSE 4620, the SME CMfgT Exam, and continuous feedback from the Industry Advisory Board, we ensure that students develop strong written, oral, and visual communication skills that are crucial for success in modern engineering careers. This comprehensive assessment strategy ensures that MSE graduates are fully equipped to communicate effectively across diverse technical and non-technical audiences, enabling them to thrive in engineering, management, and leadership roles.

Table 2: Student Outcome 3 Assessment Plan.

Student Outcomes	MSE 3850 Rubric	MSE 3700 Rubric	MSE 3910 Rubric	MSE 4615 Rubric	MSE 4620 Rubric	CMFGT Exit Exam	IAB
3. an ability to communicate effectively with a range of audiences.				X	X	X	X



2.3.1.4 Student Outcome (4): Student Outcome 4 states that graduates must demonstrate:

"An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts."

To comprehensively evaluate students' attainment of this outcome, the Manufacturing Systems Engineering (MSE) program at Weber State University utilizes a structured, multi-faceted assessment approach that integrates MSE 3700: Manufacturing Systems Engineering I,

MSE 4615: Senior Project I, MSE 4620: Senior Project II, the SME Certified Manufacturing Technologist (CMfgT) Exam, and direct input from the Industry Advisory Board (IAB). This approach ensures that students gain a deep understanding of the ethical, societal, and global responsibilities inherent in engineering practice while applying these principles to real-world projects, case studies, and standardized industry assessments. The following sections provide justification for Selected Courses and Assessment Instruments.

2.3.1.4.a MSE 3700: Manufacturing Systems Engineering I

MSE 3700 serves as a foundational course for assessing Student Outcome 4 by introducing students to engineering ethics, sustainable design principles, and the impact of manufacturing decisions on society and the environment. This course explores principles of product and process design, including design for manufacturability, environmental considerations, ethical decision-making, and global supply chain impact. Students complete an engineering design project that incorporates sustainability, regulatory compliance, and professional ethics. A key component of this course is the Military Ration Engineering (MRE) Project, in which students may examine the following topics in relation to their project:

1. Develop a new type of Meal, Ready-to-Eat (MRE) ration that meets nutritional, logistical, and environmental requirements for military personnel.
2. Analyze material selection and packaging design, considering biodegradability, waste reduction, and the impact on ecosystems in deployed environments.
3. Evaluate supply chain implications, including geopolitical considerations, fair labor practices, and ethical sourcing of ingredients and materials.

4. Apply engineering ethics by discussing potential trade-offs between cost efficiency and sustainability, ensuring that their design upholds professional ethical standards.

This project directly assesses students' ability to apply ethical reasoning and evaluate the broader implications of their engineering decisions, ensuring alignment with ABET's expectations for Student Outcome 4.

2.3.1.4.b MSE 4615: Senior Project I

As the first phase of the capstone experience, MSE 4615 requires students to define and plan an engineering project, incorporating ethical considerations and societal impact assessments. In this course, students will engage in project definition, feasibility analysis, and preliminary engineering design, with a strong emphasis on regulatory requirements, ethical considerations, and sustainability. MSE 4615 ensures that students:

1. Conduct an ethical impact assessment as part of their project proposal, identifying potential risks, regulatory constraints, and sustainability challenges.
2. Analyze economic and societal impacts by considering how their project affects workers, consumers, and global supply chains.

The Industry Advisory Board (IAB) evaluates these project proposals and provides direct feedback on students' ability to integrate ethical considerations into their designs, ensuring that graduates are prepared for real-world decision-making in professional engineering practice.

2.3.1.4.c MSE 4620: Senior Project II

In the second phase of the senior project, MSE 4620 challenges students to complete the full engineering design and implementation process, including testing, validation, and final impact assessments. In this course students will finalize their engineering design, prototype and test their solution, and deliver a comprehensive project report that includes ethical, environmental, and economic evaluations.

MSE 4620 provides a rigorous assessment of Student Outcome 4 by requiring students to:

1. Justify ethical decision-making in their final engineering reports, ensuring their solutions align with industry regulations, sustainability goals, and social responsibility expectations.
2. Conduct an environmental impact analysis if necessary, demonstrating an understanding of how manufacturing materials, energy consumption, and/or waste disposal affect global ecosystems.
3. Analyze financial trade-offs while maintaining ethical integrity, evaluating whether lower-cost alternatives sacrifice safety, sustainability, or social responsibility.

Final presentations for MSE 4620 are evaluated by both faculty and IAB members, ensuring that students receive real-world feedback on the ethical and societal implications of their engineering solutions.

2.3.1.4.d SME Certified Manufacturing Technologist (CMfgT) Exam

The SME CMfgT Exam serves as an objective, industry-standard assessment that evaluates students' understanding of engineering ethics, regulatory compliance, and the broader impact of manufacturing processes. The exam includes case-based questions on ethical decision-making,

requiring students to evaluate professional responsibilities, workplace safety, and conflicts of interest. It also covers sustainability and environmental impact assessments, ensuring students understand how manufacturing processes affect global resources and waste management. The exam also includes standards and compliance sections, testing knowledge of environmental management and workplace safety and health.

The Industry Advisory Board supports the use of the SME CMfgT Exam, stating that it provides a valuable national benchmark for assessing ethical reasoning and regulatory knowledge in engineering graduates.

2.3.1.4.e Integration of Industry Advisory Board (IAB) Feedback

The Industry Advisory Board (IAB) plays a critical role in ensuring that ethical and professional responsibility remain at the forefront of the MSE program's curriculum. Board members have emphasized the following priorities in preparing graduates for industry roles:

1. Engineering ethics must be embedded in real-world projects, not just theoretical coursework.
2. Graduates must be able to navigate complex ethical dilemmas, particularly in areas like supply chain transparency, environmental responsibility, and workplace safety.
3. Manufacturing engineers must understand the impact of automation and AI, including ethical considerations related to job displacement, worker safety, and data privacy.
4. Students must learn to balance cost-efficiency with ethical integrity, ensuring that engineering solutions do not compromise safety, quality, or sustainability.

The MSE program has expanded ethical case study discussions in MSE 3700 and senior project courses and integrated regulatory compliance evaluations into capstone project grading rubrics.

The MSE department faculty encouraged students to present ethical dilemmas during IAB project reviews, allowing them to engage in industry-level ethical decision-making discussions.

The MSE degree assessment plan has detailed ethical assessments in project proposals and final reports, requiring students to articulate the societal, economic, and global consequences of their designs. This includes increased integration of real-world industry challenges, requiring students to address ethical conflicts between profitability and sustainability.

This comprehensive assessment strategy guarantees that MSE graduates are fully prepared to navigate the ethical complexities of modern engineering practice, ensuring they can make informed, responsible decisions that benefit society, the economy, and the environment.

Table 3: Assessment plan for Student Outcome 4.

Student Outcomes	MSE 3850 Rubric	MSE 3700 Rubric	MSE 3910 Rubric	MSE 4615 Rubric	MSE 4620 Rubric	CMFGT Exit Exam	IAB
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments,		X		X	X	X	X

which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.							
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2.3.1.5 **Student Outcome (5)**: Student Outcome 5 states that graduates must demonstrate:

"An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives." To comprehensively assess students' teamwork and leadership abilities, the Manufacturing Systems Engineering (MSE) program at Weber State University implements a structured, multi-tiered approach that integrates MSE 4615: Senior Project I, MSE 4620: Senior Project II, the SME Certified Manufacturing Technologist (CMfgT) Exam, and direct feedback from the Industry Advisory Board (IAB).

This combination of coursework, standardized assessment, and industry engagement ensures that students develop and demonstrate team-based problem-solving skills, project management competencies, and leadership abilities essential for modern manufacturing engineers. The following sections provide justification for Selected Courses and Assessment Instruments.

2.3.1.5.a MSE 4615: Senior Project I

As the first phase of the capstone experience, MSE 4615 requires students to form teams and collaboratively define, plan, and initiate an engineering project. This course introduces students to structured project management in engineering design. Students work in teams to define project scopes, assign roles and responsibilities, establish milestones, and develop preliminary engineering solutions.

This course serves as a primary assessment point for Student Outcome 5 by requiring students to:

1. Form multidisciplinary teams where they must take on diverse roles such as project lead, technical analyst, documentation specialist, or financial planner.
2. Establish a structured project plan, defining objectives, milestones, and individual responsibilities.
3. Develop strategies for conflict resolution and effective communication, ensuring that all team members contribute equitably.
4. Engage in leadership rotation, allowing students to experience both leadership and support roles throughout the project lifecycle.

Faculty advisors play a key role in evaluating final team projects, providing critical insights into leadership effectiveness, team cohesion, and collaboration strategies. Additionally this course requires a peer review component where each student evaluates the other members of the team. The IAB strongly emphasizes the importance of collaboration and leadership in manufacturing engineering, noting that graduates who excel in teamwork are more successful in professional environments.

2.3.1.5.b MSE 4620: Senior Project II

In the second phase of the senior design experience, MSE 4620 challenges teams to transition from planning to full-scale project execution. Students will finalize their engineering design, manage project implementation, conduct testing, and deliver a comprehensive final report. Emphasis is placed on team leadership, project management, and effective collaboration.

MSE 4620 provides a direct and rigorous assessment of Student Outcome 5 by requiring students to:

1. Execute their engineering project as a fully functional team, where they must navigate real-world design challenges, unexpected constraints, and evolving project requirements.
2. Adapt team leadership strategies as the project progresses, ensuring effective problem-solving and consensus-driven decision-making.
3. Document and analyze team effectiveness, using peer evaluations, self-reflections, and faculty feedback to assess how well teams functioned.
4. Prepare and deliver a final group presentation, requiring the team to demonstrate their ability to communicate, coordinate, and defend their collective work.

Faculty advisors play a key role in evaluating final team projects, providing critical insights into leadership effectiveness, team cohesion, and collaboration strategies. Additionally this course requires a peer review component where each student evaluates the other members of the team.

2.3.1.5.c SME Certified Manufacturing Technologist (CMfgT) Exam

The SME CMfgT Exam serves as an objective, industry-recognized assessment that evaluates students' understanding of teamwork, leadership, and project management within engineering environments. The exam includes:

1. Questions related to team-based manufacturing problem-solving, ensuring students can function effectively in a professional engineering team.
2. Leadership and project planning assessments, validating students' ability to define objectives, delegate responsibilities, and monitor team progress.
3. Workplace communication and conflict resolution scenarios, testing students' ability to manage diverse team dynamics.

The Industry Advisory Board strongly supports the inclusion of the SME CMfgT Exam as a tool for measuring teamwork-related competencies against national industry benchmarks.

2.3.1.5.d Integration of Industry Advisory Board (IAB) Feedback

The Industry Advisory Board (IAB) plays a crucial role in ensuring that teamwork and leadership skills are effectively integrated and assessed within the MSE program. Board members, representing leading companies in aerospace, automotive, and industrial manufacturing, have highlighted several key expectations for engineering graduates:

Engineering graduates must be able to work in cross-functional teams, collaborating with professionals in mechanical engineering, electrical engineering, business, and supply chain management.

Strong communication and coordination skills are essential, particularly in high-stakes manufacturing environments where efficiency and precision are critical. Leadership development should be emphasized, ensuring that students graduate with the ability to lead teams, resolve conflicts, and make data-driven decisions. Real-world project experience is

crucial, as employers expect new engineers to have practical experience in team-based engineering problem-solving.

To address these priorities, the MSE program has the following implementations:

1. Team-based assignments in MSE 4615 and MSE 4620, ensuring students gain substantial collaborative experience.
2. Refined project assessment rubrics to explicitly measure team effectiveness, leadership contributions, and collaborative problem-solving skills.
3. Expanded IAB involvement in project evaluations, allowing students to receive authentic industry feedback on their teamwork performance.
4. Mandatory peer evaluations in team projects, where students assess each other's contributions and leadership effectiveness.
5. Structured leadership rotations, requiring each team member to take on a leadership role at different phases of the senior project depending on activity.
6. Expanded case studies on team management, integrating real-world scenarios that challenge students to resolve conflicts, optimize task delegation, and foster inclusive collaboration.
7. Continuous improvement tracking, where student teams conduct self-assessments to reflect on their team performance, challenges faced, and strategies for improvement in weekly meetings.

The Manufacturing Systems Engineering program at Weber State University employs a structured, multi-faceted approach to assess Student Outcome 5. By integrating MSE 4615, MSE 4620, the SME CMfgT Exam, and direct feedback from the Industry Advisory Board, we ensure

that students develop strong teamwork, leadership, and collaborative problem-solving skills that are critical for success in the modern engineering workforce. This comprehensive assessment strategy guarantees that MSE graduates are fully prepared to function effectively in professional engineering teams, lead projects, and contribute to the success of complex manufacturing operations.

Table 4: Assessment Plan for Student Outcome 5.

Student Outcomes	MSE 3850 Rubric	MSE 3700 Rubric	MSE 3910 Rubric	MSE 4615 Rubric	MSE 4620 Rubric	CMFGT Exit Exam	IAB
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.				X	X	X	X

2.3.2 Course Rubrics

As further note, the faculty have reviewed course rubrics for MSE 3850, MSE 3700, MSE 3910, MSE 4615, and MSE 4620. These rubrics meet the expectations of the instructors of those courses and therefore there was no trigger for improvement in these courses. An example completed course rubric is shown in Table 5. Please note that this rubric is generated from the average of the course rubrics as shown in Table 6.

When the MSE program was first established, the faculty spent a great deal of effort defining a matrix of courses and student outcomes. For each course in the curriculum, a level of applicability for each student outcome was assigned. The levels of applicability are low, medium and high in the matrix. Only the student outcomes that ranked high in the matrix were assigned a performance indicator (PI) in the course rubric. Levels of applicability were assigned to courses outside the MSE program as well, but none of them ranked higher than medium, so they were not connected to a PI and are therefore not shown in the assessment plan.

After each semester, faculty prepare a rubric for each MSE course indicated in the assessment plan. The levels of achievement vary somewhat by instructor but in general are (0) unacceptable, (1) poor, (2) average and (3) good. A recent example of a course rubric for MSE 3700 is shown in Table 4.

Table 4: Example Course Rubric.

MSE 3700 PROJECT EVALUATION								
PROJECT:	Elkquisite Bites						EVALUATION SCALE	
SEMESTER:	Fall 2023						3.0	GOOD
REVIEWER:	Mary Foss						2.0	AVERAGE
DATE:	12/1/2023						1.0	POOR
						0.0	UNACCEPTABLE	
ADEQUATE PROBLEM DEFINITION & PROJECT TECHNICAL DESCRIPTION	APPROPRIATE USE OF EXPERIMENTS, TESTING, MEASUREMENTS, & PROTOTYPING	APPROPRIATE DESIGN ASSUMPTIONS, TECHNIQUES, & ENGINEERING ANALYSIS	APPROPRIATE UTILIZATION OF ENGINEERING TOOLS (ie. CAD SOFTWARE, ANALYSIS SOFTWARE, etc.)	APPROPRIATE USE OF GRAPHS, TABLES, & FIGURES	APPROPRIATE FORMAT, TECHNICAL WRITING TECHNIQUE, & LOGICAL FLOW OF INFORMATION	COMPLETE, ACCURATE REFERENCES	DEMONSTRATED APPLICATION OF ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	DEMONSTRATED APPLICATION OF ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
2	2	2	3	3	3	3	2	2
<p>This course focuses on effective design and implementation of reliable, economically competitive, and environmentally benign manufacturing processes and systems. Topics will include an overview of the manufacturing systems approach in production, control, quality, automation, an introduction to facilities planning and design, an introduction to operations research and simulation in manufacturing, and engineering economics. Students will also be introduced to DoD systems engineering terminology.</p> <p>ABET Learning Outcomes Assessed</p> <p>2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.</p> <p>4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.</p>								

The results of each individual MSE student are then compiled into a summary sheet. An example is shown in Table 6.

Table 6: MSE 3700 Student Outcome Summary Sheet.

SO		Expected Result	Average (Fall 2023)
2	DEMONSTRATED APPLICATION OF ability to apply engineering design to produce solutions that meet specified needs with consideration of public	>2	2.125

	health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors		
4	DEMONSTRATED APPLICATION OF ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	>2	2.5

The faculty makes improvements in the program utilizing this assessment instrument upon larger sample sizes that have some statistical significance affecting the continuous improvement of the program. The process for using the rubrics to improve courses is illustrated in the self-study. The continuous improvement process for courses occurs on two levels--the course level and the program level.

At the course level, the instructor makes independent improvements to the course. When the score, S, for a given PI is 2 or greater, no action is required by the instructor to improve the course. When S falls below 2, the instructor identifies corrective actions and course improvements to implement the next time that he/she teaches the course. At the program level, the instructor, with input from department faculty, makes improvements to the program by

identifying areas of improvement in supporting courses. If the mean score for a given course is 2.0 or greater, no action is required to improve the program, but a mean score of less than 2.0 suggests deficiencies in the course that require discussion and correction by the instructor and/or program faculty and related supporting courses. For the rubric shown in Table 6, no program-level action is required.

2.4 PROGRAM WEAKNESS: Criterion 8

The Accreditation Policy and Procedure Manual (APPM) Section I.E.5.b.(1) states that the review team will examine the facilities to assure that instructional and learning environments are adequate and safe for the intended purposes. Throughout the facility tour, the team observed little to no evidence of posted safety signage in many laboratories. Furthermore, there was inconsistent availability and accessibility of personal protective equipment (PPE) and safety items. Unless instructional and learning environments are safe for their intended purposes, the safety of both students and staff members is at risk. Thus, the program lacks strength of compliance with the requirement implicit in APPM.

2.4.1 Department Response

The Manufacturing Systems Engineering (MSE) program respectfully submits the following clarification and contextual response related to the program weakness identified in the ABET Draft Statement of Accreditation. While the stated concern pertains to laboratory safety signage, accessibility of personal protective equipment (PPE), and emergency response resources in

various lab spaces observed during the site visit, it is essential to note that the specific laboratory facilities referenced in the finding are not affiliated with or utilized by the MSE program.

2.4.1.a Clarification of Laboratory Ownership and Usage

The laboratories identified in the ABET team’s observation—specifically those located in NB-112, NB-102, NB-118, NB-120, NB-126A, and NB-136—are under the jurisdiction of the Electrical and Computer Engineering (ECE) Department. These labs serve courses and research activities specific to the ECE curriculum and are not used in the instruction or delivery of MSE courses. At no point are MSE students required to enter or work in these spaces as part of their program of study, nor do MSE faculty deliver instruction in these rooms.

As such, the finding, although valid and appropriately addressed by the ECE department, does not reflect a condition present within the instructional or learning environments overseen by the MSE program.

2.4.1.b Current MSE Laboratory Practices

Laboratory instruction within the MSE program is conducted in facilities such as the Concept Center High Bay, automation and robotics lab, metal cutting lab, plastics and composites lab, Miller Welding, Metal Forming and Casting Lab—spaces that are distinct from those cited in the ECE report. These facilities maintain a longstanding culture of safety and compliance, guided by the following ongoing practices:

- Clearly posted safety signage at all points of laboratory entry indicating PPE requirements, safety procedures, and emergency protocols.

- Emergency equipment (e.g., first aid kits, fire extinguishers, eyewash stations) that are properly labeled and strategically located within each lab space.
- Mandatory lab safety training for all students prior to their engagement in hands-on activities, reinforced with written documentation and in-person walkthroughs.

MSE faculty actively reinforce a safety culture through the integration of safety briefings into laboratory course sessions, emphasizing the role of risk awareness and mitigation as a key learning objective.

2.4.2 Program-Level Continuous Improvement Actions

While the MSE program was not the source of the observed weakness, we are committed to continuous improvement and interdepartmental alignment. As part of the broader College of Engineering, Applied Science & Technology (EAST), the MSE program will take the following proactive steps in solidarity with our colleagues and in the spirit of shared institutional responsibility:

1. Collaborate with the new ECE lab manager (Jack Fernald) to review and align general laboratory safety protocols across departments, ensuring consistency in signage, PPE access, and emergency planning where facilities may be shared or adjacent.
2. Conduct an internal audit of MSE-controlled lab spaces in Fall 2025 to verify that all signage, equipment, and safety materials meet current institutional and ABET expectations. This audit will be documented and any findings will result in immediate corrective actions.

3. Develop a standardized safety signage template in collaboration with the EAST Dean's Office to be used across all MSE labs for consistency and visibility.
4. Work with Facilities Management and Environmental Health & Safety to assess whether any additional infrastructure (e.g., fire extinguisher signage or improved PPE labeling) would enhance the already established safety practices in MSE teaching labs.
5. Explore the feasibility of a shared lab technician or technical support staff member between the MSE and MET programs to further support equipment maintenance, safety training, and documentation. A joint position could also facilitate better continuity in lab safety oversight and serve as a conduit for industry-relevant certifications (e.g., OSHA-10 or ARC flash training).

In summary, while the ABET team's safety-related finding appropriately applies to laboratory spaces administered by the ECE department and not to the MSE program, we appreciate the broader implications of fostering a uniformly safe and clearly marked instructional environment. The MSE program remains fully committed to upholding rigorous safety standards in its dedicated teaching labs and will participate constructively in college-wide efforts to ensure all engineering students benefit from a cohesive and safe learning environment.

2.5 Criterion 8: Institutional Support: ABET Concern:

The lack of dedicated technical staff for lab maintenance presents a potential risk to future compliance.

2.5.1 Department Response

We appreciate the ABET review team's attention to the adequacy and safety of instructional and learning environments. However, we would like to clarify that the observations noted in the draft statement regarding safety signage, availability of personal protective equipment (PPE), and overall compliance with APPM Section I.E.5.b.(1) were related to a different building that houses other programs and does not accurately reflect the conditions in the Manufacturing Systems Engineering (MSE) program's dedicated facilities. The MSE program operates in a distinct facility with well-established safety protocols, including:

Dedicated Maintenance Personnel:

The MSE program has a full-time maintenance staff member responsible for ensuring compliance with all safety procedures, conducting routine equipment inspections, and maintaining accessibility to required safety resources.

Lab Aides and Safety Audits:

The program employs multiple lab aides who actively participate in safety audits, monitor lab conditions, and replenish PPE as needed. These aides receive specific training in safety compliance and conduct scheduled safety checks to ensure adherence to OSHA and university safety policies.

PPE Availability and Signage:

All MSE laboratories are equipped with clearly designated PPE stations, ensuring that safety gear is readily available for students, faculty, and staff. Updated and standardized safety signage is prominently displayed in all MSE labs, including emergency procedures, PPE requirements,

fire extinguisher locations, and hazard warnings. Annual safety walkthroughs are conducted to ensure compliance with university and industry safety standards.

Safety Training and Compliance Measures:

All students enrolled in MSE lab courses complete mandatory safety training before working in laboratory spaces. Safety procedures are reinforced through lab orientations, instructor-led safety briefings, and periodic refresher training sessions. Incident response protocols are clearly defined and communicated to all lab users, ensuring that any safety concerns are addressed immediately and effectively.

Given these existing safety protocols, we respectfully request that the weakness be reconsidered in light of the fact that the MSE program's instructional spaces were not the intended focus of the review team's observation. The MSE program maintains a strong commitment to safety, and we welcome further clarification on any specific areas for improvement that pertain to our facilities.

2.6 PROGRAM CONCERN: Criterion 8. Institutional Support

This criterion requires that resources including institutional services, financial support, and staff (both administrative and technical) provided to the program be adequate to meet program needs. The program uses multiple laboratories, well- equipped with new equipment, to deliver its curriculum. However, there are no dedicated technical staff members responsible for maintaining and administering the laboratories, but rather these duties are the responsibility of faculty

members. While this criterion is currently satisfied, as the equipment ages, there is the potential that faculty members may not be equipped and available to provide adequate maintenance of the laboratories and the equipment. Thus, future compliance with this criterion may be jeopardized.

2.6.1 Department Response

We appreciate the ABET review team's evaluation of institutional support and recognition that the Manufacturing Systems Engineering (MSE) program's laboratories are well-equipped with modern technology to support student learning and research. We would like to provide additional context regarding the program's technical support structure and ongoing efforts to ensure the long-term sustainability and maintenance of laboratory resources.

While the review team noted the absence of dedicated technical staff members responsible for maintaining and administering laboratories, it is important to highlight that there is a full-time staff member responsible for laboratory management. There was also an active requisition for a dedicated faculty member at the time of the program evaluation. This request was initiated to further strengthen institutional support for the program.

The MSE program recognizes the importance of proactive equipment maintenance and laboratory oversight and has developed a long-term sustainability plan to implement regular maintenance schedules to extend the lifespan of laboratory equipment, establish a structured training program for student lab aides, equipping them with the skills to assist in routine laboratory upkeep, and strengthen collaborations with industry partners to secure additional support for equipment upgrades and best practices in laboratory operations.

The Manufacturing Systems Engineering program at Weber State University is fully committed to ensuring that laboratories remain well-maintained and effectively supported, both now and in the future.

Given the program's proactive efforts, existing institutional resources, and ongoing hiring initiatives, we strongly believe that future compliance with this criterion is well-supported and sustainable. We welcome continued dialogue with ABET regarding these developments and appreciate the opportunity to further strengthen institutional support for our program.

3.0 Summary of Next Steps for the Continuous Improvement of the MSE Program

To ensure that the Manufacturing Systems Engineering (MSE) program remains aligned with institutional goals, state and national educational standards, and industry expectations, the following strategic initiatives are identified as next steps in the program's continuous improvement process. Each initiative has been developed in response to stakeholder input, enrollment trends, curriculum reviews, and faculty discussions.

3.1 Revise Program to Align with New State General Education Requirements

The program will be updated to meet newly mandated changes in state general education requirements. This includes removing general education requirements while still ensuring compliance while maintaining the program's rigor and cohesion.

3.2. Increase Flexibility Through Cross-Listed or Alternative Departmental Courses

To address challenges related to small enrollment in certain required courses, the program will revise its curriculum to allow students to take comparable courses from other departments. For

instance, students may fulfill the Engineering Economics requirement by enrolling in the ECE department's offering. This strategy improves scheduling flexibility and increases course viability through shared enrollment.

3.3. Hire Replacement Faculty Following Attrition

A search is currently underway to fill a vacant faculty position due to recent attrition. The search has progressed to the second round of interviews. This position is essential for maintaining teaching capacity, supporting assessment, and advancing strategic initiatives such as outreach and industry engagement.

3.4. Introduce Technical Electives in Engineering

The program will be revised to include a defined list of technical electives in engineering. This change will allow students greater flexibility in customizing their degree path, improve transfer student accommodation, and help differentiate the MSE program from closely related majors (e.g., mechanical engineering) during the first two years.

3.5. Evaluate the Addition of a Co-op Requirement

The program will explore the feasibility and benefits of requiring a cooperative (co-op) work experience as part of the degree. This would increase student exposure to industry, enhance job readiness, and further align the program with applied engineering practices.

3.6. Develop a Combined BS/MS Pathway

Work will begin on designing a streamlined, accelerated BS/MS pathway to allow high-achieving students to begin graduate-level coursework in their senior year. This will increase the

program's appeal to prospective students and support the development of advanced technical and research skills.

3.7. Investigate Alignment with Industrial Engineering Standards

The department will review the curriculum to determine the feasibility of modifying the program to meet industrial engineering accreditation standards or broadly incorporate principles from the field. This may expand career opportunities for graduates and increase the program's competitiveness.

3.8. Integrate AI Tools in Existing Courses Based on Industry Feedback

Feedback from the Industry Advisory Board has emphasized the growing importance of artificial intelligence in manufacturing. The program will incorporate exposure to AI tools, such as machine learning for process optimization or predictive maintenance, into relevant courses.

3.9. Consider Adding a Technical Writing Course

To strengthen students' professional communication skills, the program will evaluate the addition of a technical writing course. This course may be drawn from existing university offerings or tailored specifically for engineering students.

3.10. Collaborate with Faculty from Neighboring Departments

To ensure course coverage and increase interdisciplinary depth, the program will identify faculty from related departments (e.g., ECE, ME, CS) to teach within the MSE curriculum, particularly in areas where their expertise aligns with core program needs.

3.11. Petition for MSE Courses to Count as Electives in Other Programs

To improve enrollment and program visibility, the department will engage with chairs of other engineering and technology programs to allow select MSE courses to fulfill technical elective requirements in their curricula.

3.12. Expand Outreach and Visibility with Support from the Dean's Office

The department will work with the Dean's Office to implement a targeted advertising and outreach strategy. This may include updates to program brochures, online presence, recruitment materials, and participation in university-wide promotional events.

3.13. Strengthen Industry Representation through Local Engagement

Faculty will continue to represent the MSE program at local chapters of professional societies (e.g., SME, ASME, IISE). Increased visibility among local industry leaders can lead to internship partnerships, project sponsorships, and co-op opportunities. The incoming faculty hire will play a key role in this initiative.

3.14. Enhance the Student Outcome of Automation

The program will focus on strengthening student competencies in automation, a key outcome area. This includes evaluating curriculum content in robotics, PLCs, and control systems, and assessing the potential value of offering certifications (e.g., FANUC, Siemens, or Allen-Bradley) to improve student qualifications.

3.15. Additional Continuous Improvement Opportunities (to be Investigated)

- Stackable credentials: Explore micro-certificates or badges for targeted competencies in lean manufacturing, data analytics, or Six Sigma.

- Online or hybrid course delivery: Consider flexible formats for working students or adult learners.
- Faculty development: Increase support for faculty training in emerging technologies and pedagogy.
- Enhanced capstone experience: Expand industry-sponsored capstone projects to promote applied, interdisciplinary learning.

4.0 Conclusion

Weber State University is committed to continuous improvement and ensuring that our Manufacturing Systems Engineering program fully meets ABET's accreditation standards. We believe that the actions taken address the concerns raised during the review and strengthen the overall program quality. We appreciate ABET's commitment to educational excellence and look forward to further collaboration to maintain the highest standards in engineering education.