Proposal for Applied Baccalaureate Degree Program: BAS Manufacturing Engineering Technology (BASMET)

March 8, 2022

By Renton Technical College | 3000 NE 4th Street Renton, WA 98056 | rtc.edu

COVER SHEET
NEW DEGREE PROGRAM PROPOSAL

Program Information

Institution Name: **Renton Technical College**

Degree: **BAS Manufacturing Engineering Technology** CIP Code: 14.3601

Name(s) of the existing technical associate degree(s) that will serve as the foundation for this program:

Degree: Machining Technology CIP Code: 48.0510 Year Began: _____

Degree: Welding CIP Code: 48.0508 Year Began: _____

Degree: Aerospace/Industrial Production Tech CIP Code: 47.0607 Year Began: _____

Degree: Mechatronics CIP Code: 47.0303 Year Began: _____

Degree: Mechanical Engineering Tech CIP Code: 46.0401 Year Began: _____

Planned Implementation Date (i.e. Fall 2014): **Fall 2022**

Proposal Criteria: *Please respond to all eight (8) areas listed in proposal criteria FORM D.*
Page Limit: 30 pages

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Introduction

Renton Technical College (RTC) has designed a Bachelor of Applied Science in Manufacturing Engineering Technology (BASMET) degree to:

- Meet the workforce needs of regional employers who employ manufacturing engineers and manufacturing engineering technicians.
- Provide a pathway into these engineering jobs for students with non-conventional backgrounds.

Graduates from the BASMET program will be prepared for a wide variety of engineering positions within manufacturing, including tool designer, manufacturing technician, manufacturing engineer, industrial engineer, production engineer, tooling design engineer, automation engineer, and quality control engineer.

When launched, the program will be one of only two manufacturing engineering programs that prepares students for manufacturing engineering careers, and the only manufacturing engineering program that allows seamless transition of associates degree holders in not just one but many fields of study such as machining, welding, aerospace production technologies, and engineering technologies.

This program will combine heavily scaffolded theoretical content with a heavy emphasis on project-based learning and industry collaborations, providing current students, machinists, welders, mechatronics technicians, drafters, engineering technicians, electronics technicians and so many other manufacturing-based associates degree holders with the opportunity to obtain a baccalaureate degree and advance their careers in manufacturing.

Program Rationale

The BASMET degree is designed to help fill the major gaps in manufacturing engineering education in Washington State.

The **first gap** is that of sheer numbers. Manufacturing engineering (including manufacturing engineering technology[1]) is a high demand area with a well-documented shortage of capacity in the Washington State education system that continues to grow. Current completions from engineering programs (approx. 1000 students per year) are only 57% of the projected annual completions needed for 2020 – 2025 (approx. 1750 students per year)[2]. The existing 4-year engineering programs would have to nearly double in size to make up the projected shortfall. To further focus on manufacturing engineering occupations, the current completions in manufacturing engineering programs (approx. 9 students per year) are only 16% of the current need in King County where most of Washington's manufacturing hubs are[3]. Additionally, the projected growth of manufacturing engineering demand in Washington is expected to be 10% (approx.

[1] The American Society for Engineering Education notes that "The degree is Engineering Technology. The career is Engineering" http://www.asee.org/member-resources/councils-and-chapters/engineering-technology-council
[2] https://wsac.wa.gov/sites/default/files/2017.ASkilledAndEducatedWorkforce.pdf
[3] The Workforce Development Counsel of Seattle King County. (2020 January 1). King County Talent Pipeline. Retrieved from http://www.seakingwdc.org/talent-pipeline-app.

440 new job openings) from 2016 - 2026[4]. This is based on manufacturing engineering jobs are estimated to be 75% of the total industrial engineering job projection.

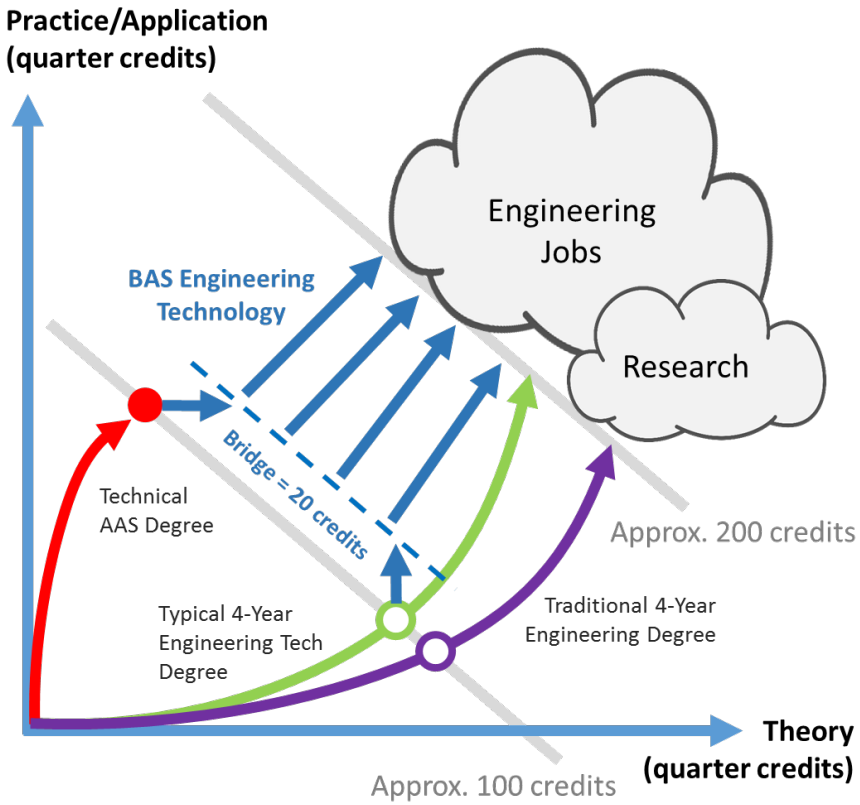

Figure 0.0 - Bachelor of Applied Science in Engineering Technology (Dr. Steve Addison)

In considering the **second gap**, we want to echo the previous words of one of our colleagues in proposing an Engineering Technology BAS at Bellingham Technical College. Dr. Steve Addison writes,

> "The second gap is that left by traditional teaching models for engineering and engineering technology programs. Traditional 4-year engineering programs are heavily weighted towards academic study (for example, non-contextualized, non-applied physics and chemistry) during the freshman and sophomore years, adding in more theory and some practice in the junior and senior years. These programs produce engineers who are mainly intended for research (industry and university) and design
>
> jobs. A traditional 4-year engineering technology program follows a very similar trajectory with slightly less emphasis on theory, and more on the practice. However, the

[4] CareerOnestop. (2017, March 21). Industrial Engineers. Retrieved from https://www.careeronestop.org/Toolkit/Careers/Occupations/occupation-profile.aspx?keyword=Industrial%20Engineers&onetcode=17211200&location=Washington.

> early emphasis on higher-level math courses in these programs is a hurdle to many students."

This gap is perpetuated within manufacturing engineering and manufacturing engineering technology programs. With manufacturing engineering technology programs in Washington being offered only at traditional four-year universities, the programs throughout the first two years are mostly theoretically with hands-on labs and coursework built into the junior and senior years making the first two years a gateway for many students.

Shown in figure 1 above, we intend to bridge associate degree holding students into the degree course work and immediately engage with hands-on curriculum and labs with heavy scaffolding of math, physics, and chemistry concepts.

The **third gap** is that there are many manufacturing engineering jobs that require more emphasis on practical skills than is provided by current degrees. Some of this evidence can be seen from more current job postings for manufacturing engineers:

> "The Manufacturing Process Engineer is responsible for production process integrity and leading Continuous Improvement efforts through a combined focus on Manufacturing, Quality & Engineering concerns. Related duties include process and product handling improvements, development of work cell layouts to increase efficiency and lessen part damage, improved ergonomics and improved templates, fixtures and carts."[5]

More of this evidence can be seen in classrooms within the CTC system where degree-level engineers from traditional 4-year schools can be found taking courses in topics such as machining and electronics.

The proposed program addresses these three gaps by:

1. providing additional capacity in the system,
2. providing students with an alternative hands-on way to acquire the necessary math and engineering science knowledge,
3. placing an emphasis on the application and integration of practical skills, project-based learning, and industry collaboration in the classroom.

The program has been designed to accept students who have a DTA, MRP, AAS-T, AAS or other associate degree, and those who have taken a more trades-oriented pathway. It will be a particularly good fit for students graduating from various manufacturing-related trades programs in the SBCTC system, engineering transfer degree holders and with graduates from nearby colleges and apprenticeship programs such as AJAC. Though these are the good fits, pathways have been designed for even graduates holding an associate of arts having no manufacturing background.

[5] https://www.indeed.com/q-Manufacturing-Engineer-l-Washington-State-jobs.html?vjk=ab469ff323eb7c37

ABET Quality Standards and the BAS Engineering Technology

The primary accreditation body for engineering and engineering technology programs in the USA is the Accreditation Board for Engineering and Technology (ABET)[6] – a nonprofit, non-governmental organization recognized by the Council for Higher Education Accreditation (CHEA).

ABET accredits college and university programs in applied science, computing, engineering, and engineering technology at the associate, bachelor, and master's degree levels through its four commissions:

- Applied Science Accreditation Commission (ASAC)
- Computing Accreditation Commission (CAC)
- Engineering Accreditation Commission (EAC)
- Engineering Technology Accreditation Commission (ETAC)

Each commission publishes a set of standards which are designed to assure students, employers, and the broader society that the programs are of high quality and will produce graduates prepared to enter a global workforce.

The ETAC standards do not appear to preclude the accreditation of applied baccalaureate programs (all references in the standards are to "baccalaureate degree programs") but we have been unable to identify any applied baccalaureate programs that are accredited by ABET at this time. Furthermore, a program cannot apply for accreditation until it has started to graduate students.

It is Renton Technical College's full intent to pursue ABET accreditation of the BASMET degree once the programs have had its first round of graduates and meets all the other ABET accreditation requirements. This is an accreditation standard that speaks quality to the larger engineering education community and promotes quality education to adequately prepare students for the engineering workforce. Even though accreditation for a BAS program is unprecedented, we plan to use all the contacts we have within and outside the organization and at ABET accredited institutions to push for accreditation to break the status quo of engineering education accreditation. We believe this is possible because we have already built strong relationships with the engineering faculty at many of the ABET accredited institutions in the state.

[6] http://www.abet.org

1. Curriculum

Advisory Committee Input

Robust advisory committee already exists for RTC's two-year degrees in mechanical engineering technology, machining, welding, mechatronics, and aerospace production technologies. Over the past year, committee members as well as other industry experts in manufacturing engineering have been actively engaged in helping to design the BASMET curriculum, responding to employer surveys regarding the proposed BAS, and reaching out to other employers to gauge interest levels. A list of advisory committee members and engaged industry experts is included in this document as Appendix C.

CIP Code

The curriculum for the BASMET degree is aligned with CIP Code 15.0613 – Manufacturing Engineering Technology

> *A program that prepares individuals to apply basic engineering principles and technical skills to the identification and resolution of production problems in the manufacture of products. Includes instruction in machine operations, production line operations, engineering analysis, systems analysis, instrumentation, physical controls, automation, computer-aided manufacturing (CAM), manufacturing planning, quality control, and informational infrastructure.*[7]

Program Learning Outcomes

The program learning outcomes are written to follow the pattern established by the requirements of the ABET ETAC "Criteria for Accrediting Engineering Technology Programs."[8] They are also consistent with the specifical manufacturing engineering technology outcomes for ABET accreditation and existing ABET ETAC-accredited baccalaureate-level engineering technology degrees.

Program Student Learning Outcomes

The BASMET program learning outcomes encompass not only the specific ABET requirements on outcomes for manufacturing engineering technology but also encompass all the general outcome criterion (a-k) for engineering technology programs.

- Use mathematics, science, engineering, technology, technical skills, and technical literature to solve manufacturing process problems.
- Design, modify, and troubleshoot manufacturing process solutions.
- Create and revise technical and non-technical communications for process design, development, and maintenance.
- Communicate technical and business knowledge in oral and written form to technical and non-technical audiences.
- Conduct and analyze standard tests, measurements, and experiments to improve manufacturing processes.

[7] https://nces.ed.gov/ipeds/cipcode/searchresults.aspx?y=56&aw=Manufacturing,Engineering,Technology
[8] https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-technology-programs-2020-2021/

- Work collaboratively and equitably as a member and leader of a diverse technical team.

General Student Learning Outcomes

The BASMET program outcomes have been mapped to encompass the ABET ETAC outcomes (a-k) as listed below.

a) an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;
b) an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;
c) an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;
d) an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;
e) an ability to function effectively as a member or leader on a technical team;
f) an ability to identify, analyze, and solve broadly-defined engineering technology problems;
g) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
h) an understanding of the need for and an ability to engage in self-directed continuing professional development;
i) an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
j) a knowledge of the impact of engineering technology solutions in a societal and global context;
k) a commitment to quality, timeliness, and continuous improvement.

Curriculum Structure

The curriculum has been designed around four key elements:

A. **Bridge** – allows access to a broad spectrum of prospective students while maintaining a verifiable level of academic knowledge and practical skills at the entry to the Junior year.
B. **MET Core** – provides a solid grounding in the manufacturing engineering science and applied math that is essential to working as a manufacturing engineer.
C. **Supporting Business Skills** – provides students with supportive business skills to the manufacturing engineering technology core such as communication, leadership, financial management, science, math, and ethical decision-making skills.
D. **Projects** – give students the opportunity to apply the knowledge and skills that they have gained, integrate various aspects of their learning, and apply the business skills that they have learned.

Bridge (0 to 30 Credits; 0-3 Quarters as Required)					
Common (and Verifiable) Level of Knowledge and Practical Skills at Entry of Junior Year					
Junior Year	Fall (14cr)	Manufacturing Systems and Processes	Mechanics	Gened (recc. Math)	Intro to MfgET
	Winter (14cr)	Material Science	Thermal Fluid Power	Gened (recc. Chem)	
	Spring (12cr)	Automation/ Programming	Product Development & Tool Design	Technical Writing	
	Summer (7cr)	Electronics Design & Manufacturing			Preliminary Capstone
Senior Year	Fall (12cr)	Metrology and Testing	Quality Control/ Continuous Improvement	Statistics	
	Winter (12cr)	Lean Manufacturing & Systems Design	Operations Management	Economics	Capstone Design
	Spring (12cr)	SME MfgET Certification Preparation	Industrial Organization and Management	Engineering Ethics	Capstone Build
	Summer (9cr)			Diversity/Inclusion Gened	Capstone Test
		Manufacturing	**Engineering & Management**	**Supportive Skills**	**Seminar/ Projects**

Figure 0.1 - Structure of the BASMET Curriculum

A. Bridge

In keeping with SBCTC's aims for applied baccalaureate degrees[9], the BASMET program has been designed to accept students with almost any associates level educational background and to facilitate students re-entering the educational system after time in the workforce. At the same time, it is critical that academic standards are not compromised, and that students are well-prepared for their upper division studies, including both academic knowledge and practical skills.

To achieve this, students will be admitted to the program with relatively few credits of transferrable, college-level work. However, before beginning Junior year coursework, students will demonstrate that they are competent in the following areas which are critical to success in Manufacturing Engineering Technology through course completion or demonstration of their skills to faculty.

Table 1 – Requirements for Admission to the Program and Entry to the Junior Year

Area	Admission to the Program	Entry to the Junior Year
1. Communications	ENGL& 101 – English Comp. I	ENGL& 101 – English Comp. I

[9] https://www.sbctc.edu/colleges-staff/programs-services/applied-baccalaureates/default.aspx

2. General Education	5 credits Humanities 5 credits Social Science	5 credits Humanities 5 credits Social Science
3. Mathematics	MATH& 141 – Precalculus I	MATH& 141 – Precalculus I MFGE 250 – Bridge to Engineering Math and Physics
4. Natural Science	NA	PHYS& 114 – Physics I
5. Manufacturing Theory	NA	MTEC 141 – GD&T 1 MTEC 142 – GD&T 2
7. Workshop Skills	NA	Demonstrated workshop skills equivalent to the FSME Competencies (see below)

Note: Courses can be replaced by equivalent or higher-level courses if approved by faculty.

The FSME (Fundamental Skills for Manufacturing and Engineering) competencies are a set of more than 100 competencies that demonstrate that a student can work safely and productively in a manufacturing or engineering fabrication environment. They are equivalent to about 15 credits of workshop training and are broadly equivalent to the technical content of a manufacturing pre-apprenticeship program. Because of space restrictions for this proposal, the list of competencies is not included here, but a copy is available on request.

Students will meet the workshop skills requirement by taking at least 15 credits of manufacturing electives including courses in machining, welding, mechatronics, aerospace industrial technology, or another manufacturing field. These courses already exist at RTC within its 2-year programs. Any course with the category code of MTEC, WLD, IPT, or MECH or a sister-college equivalent will be accepted. This is acceptable to RTC because we have confidently built our manufacturing curriculum around the FSME competencies, ensuring that they are addressed within the introductory courses of our manufacturing programs.

Students will be allowed to take up to 30 credits of coursework during the Bridge as part of their BASMET studies. All of the courses in the Bridge are lower division (100 and 200) level courses. On entry to the Junior year, students will have 25 credits that count towards the General Education requirements for the degree (ENGL& 101, MATH& 141, PHYS& 114 and 10 credits of humanities or social science credits).

Other benchmark programs like this one have previously allowed up to 20 credits of coursework during the Bridge and have required 30 credits of general enducation before entry into the junior year. We have deviated from this to open up this program to students having no experience in a manufacturing or technical environment. Also, manufacturing engineering and manufacturing engineering technology has more emphasis on management and leadership skills which allows better integratation of more general education courses into the junior and senior year.

B. Manufacturing Engineering Technology Core

The manufacturing engineering technology core is a set of 13 courses (6 engineering and management, 6 manufacturing, and 1 in both categories) that provides the foundational technical knowledge that students will demonstrate in their capstone project courses near the end of the program.

ABET Core Outcomes	BASMET Technical Core
a. Materials and Manufacturing Processes	Materials Science and Selection - 5
	Manufacturing Systems and Processes - 4
	Electronics Design and Manufacturing - 3
b. Product Design Process, Tooling and Assembly	Mechanics - 4
	Thermal Fluid Power - 4
	Product Development and Tool Design - 4
c. Manufacturing Systems, Automation, and operations	Automation and Programming - 3
	Lean Manufacturing Systems Design - 4
	Operations Management - 2
d. Statistics, Quality and Continuous Improvement, and Industrial Organization and Management	Quality Control and Continuous Improvement - 5
	Metrology and Testing Methods - 2
	Industrial Organization and Management - 4

Figure 0.2 – MET Core Alignment with ABET Outcomes

The core will address the four major areas of the manufacturing engineering discipline as identified by the ABET engineering accrediting body as well as the ABET general criterion a-k listed above. These four criteria are also in agreement with the Society of Manufacturing Engineers and aligns with their industry certification standards which all students will have the option of taking at the end of the program.

The credits for each course in the MET core were determined by comparing the level of expertise needed in each category for students to pass the SME industry certification as a Manufacturing Engineering Technologist, by comparing competencies required for ABET accreditation, by seeking out the guidance from manufacturing engineering experts currently in the field, and the authors manufacturing and engineering expertise.

Select engineering courses will also include learning outcomes that directly address each of the following three themes:

1) Design
2) Build/Fabrication
3) Instrument, Test and Analyze

These three themes are a core part of ABET accredited engineering programs and synthesize all the general ABET criteria. These three themes are also required to be followed in the program's capstone project courses. Therefore, having the three themes embedded within the manufacturing engineering technology core will be critical to preparing students for their capstone projects.

As an engineering technology degree with emphasis on practical work, all courses in the Manufacturing Engineering Technology Core will be constructed around a significant amount of lab/workshop time. Core course descriptions are in Appendix A. Because the core courses will be heavily focused on practical skills, supportive courses will be taken alongside the highly technical courses where more scaffolding will be needed for student success. These courses will be discussed in greater detail in the next section.

C. Supportive Skills

There are some courses in the MET core that are considered highly technical or highly managerial, meaning they will require much more scaffolding for student success than the others. Highly technical/managerial courses will be supported with general education courses also equipping students with non-technical business skills. The general education courses will equip students with basic skills that are applied in the MET core courses. Having these supportive courses alongside the technical core as opposed to being prerequisite to the technical core will reinforce learning of the basic skills in context of their career skills. While the skills are being taught in detail in the supportive courses, they are being taught again contextually and applied in the technical core courses.

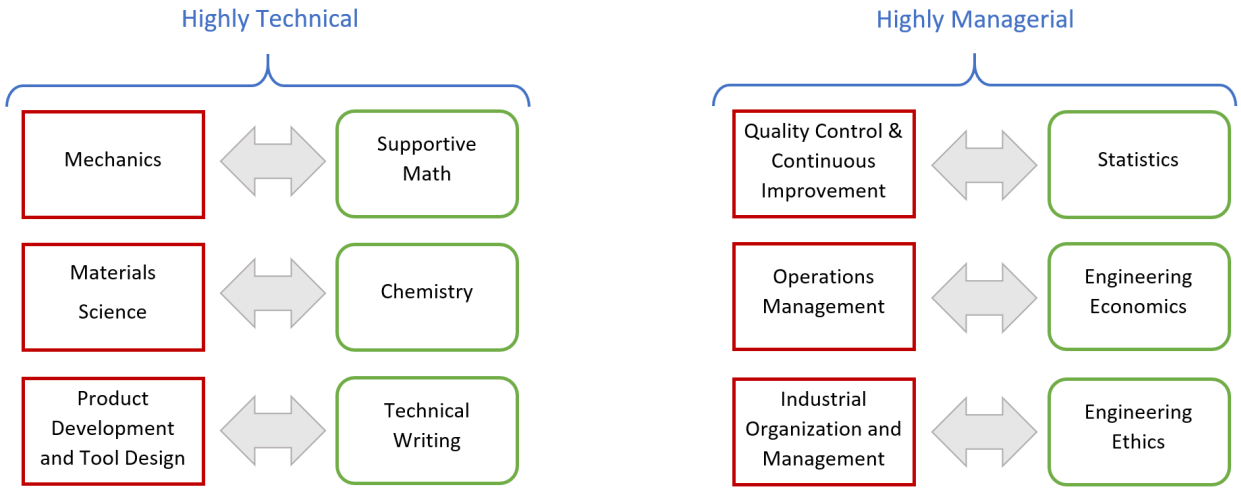

Figure 0.3 - Supporting Business Skills with MET Core

In addition to the need for support and scaffolding in the technical core, the ABET ETAC standards require the development of students' skills in technical areas such as math, science, research and analysis as well as non-technical areas such as communication; the ability to function effectively as a member or leader on a team; the ability to use written, oral, and graphical communication techniques; understanding of and a commitment to addressing professional and ethical responsibilities (including a respect for diversity); ability to apply sound economic principles to engineering decisions; and a knowledge of the impact of engineering technology solutions in a societal, and global context (ABET ETAC outcomes b, g, i and j). The seven courses in the Supportive Skills group are designed to address some of these requirements.

Precalculus 2 is recommended for the general education option in the first quarter of the junior year. This option is designed to help fill in gaps in the student's course of study (particularly math) or build math skills to support the high-level applied math in the **Mechanics** course in that same quarter.

Chemistry is recommended for the general education option in the second quarter of the junior year to help support the applied chemistry taught in the **Materials Science and Selection** course in that same quarter.

Technical Writing will support nearly all the engineering and management courses in the MET core but particularly the **Product Development and Tool Design** course which will involve much technical documentation of a product design.

Statistics will heavily support the applied statistics in the **Quality Control/Continuous Improvement** Course and the research and experimentation components throughout much of the technical core such as in the systems design course where design of experiments is applied. It will also directly satisfy ABET outcome d.

Engineering Economics will be a created course for this program that will support the **Operation Management** course which involves lots of financial decision making.

Engineering Ethics will be another created course for the program to support the **Industrial Organization and Management** course.

A **diversity/Inclusion general education elective** will continue to support ABET ETAC outcomes i and j as well as supporting the leadership and management skills of the students. The approved electives will be selected by the program faculty in cooperation with the dean of general education.

D. Seminars/Projects

The ABET ETAC standards require that "baccalaureate degree programs must provide a capstone or integrating experience that develops student competencies in applying both technical and non-technical skills in solving problems." The projects and seminar in the BASMET program are designed to address this requirement, and also to give students the opportunity to further build their portfolio, which will be critical for job placement. They include:

- **Introduction to Manufacturing Engineering Technology** teaches students an all-encompassing view of what a manufacturing engineer and manufacturing engineering technologist does and some of the techniques necessary to develop realistic and comprehensive plans for technical

projects.

- **Preliminary Junior capstone**, to be carried out during the summer quarter of the first year, serves as a foundational process design experience that supports the Senior capstone sequence.

- **Senior Capstone Design, Build, Test**, together, constitute a 3-course, 3-quarter Senior year project sequence that builds on and integrates the knowledge gained through the extensive lab-based, hands-on curriculum and the supportive business and management skills in the earlier courses.

General Education Requirements

As noted earlier, students will have at least 25 credits of General Education at the beginning of the Junior Year. The remaining 35 credits needed to meet the requirements for an Applied Baccalaureate degree[10] are satisfied by program courses shown in Table 2. These are the supportive business skill courses.

Table 2 – General Education Requirements Satisfied by Lower and Upper Division Courses

	At Entry to the Junior Year	Program Course(s)	Credits at the End of BASMET Degree	Min Required Credits for a BAS Degree
Communications	ENGL& 101	Tech. Writing	10	10
Quantitative/ Symbolic Reasoning	MATH& 141	NA	5	5
Humanities	Any 5 credits	Eng. Ethics	10	10
Social Sciences	Any 5 credits	Eng. Economics	10	10
Natural Sciences	PHYS& 114	Statistics	10	10
Any of the Above	NA	Any (Recc. Math) Any (Recc. Chem) Diversity Elective	15	15
TOTAL	**25**		**60**	**60**

[10] http://www.sbctc.edu/resources/documents/colleges-staff/programs-services/applied-baccalaureate/RecommendationforGenEdRequirementsforBASJuly2015.pdf

Program Credits

The credit total for the BASMET degree is 92 to 122 credits, depending on how many courses are required in the Bridge, and is broken down as follows. Including the Associates degree from the student, this amounts to a student having total credits from 182-212.

Table 3 – Program Credits

	Lower Division	*Upper Division*
From Student's Associates Degree (or Equivalent)	90+	
BAS Manufacturing Engineering Technology		
Bridge	0 to 30*	
MET Core		46
Seminars		1
Projects		10
Supportive Skills Courses	25	10
TOTAL	115+	67

Table 4 - Summary of Program Requirements

Course ID	Description	Credits
Prerequisites to the Program		
ENGL& 101	English Composition	5
HUM	Any Humanities Course	5
SOC	Any Social Sciences Course	5
MATH& 141	Precalculus 1	5
Entry into the Junior Year Requirements (Courses may be substituted for transfer equivalents)		
PHYS& 114	Physics 1	5
DFT 250	Bridge to Engineering Math and Physics	4
MTEC 141	Geometric Dimensioning and Tolerancing 1	2
MTEC 142	Geometric Dimensioning and Tolerancing 2	4
MTEC, IPT, WLD	Manufacturing Electives	15
General Education Requirements (Supportive Skills)		
ECON& 1XX	Economics	5
ENGL& 235	Technical Writing	5
MATH& 146	Statistics	5
PHIL& 2XX	Engineering Ethics	5
GEN	Additional GenEd (recommended diversity)	5
GEN	Additional GenEd (recommended chemistry)	5
GEN	Additional GenEd (recommended math)	5
BASMET Core		

MFGE 301	Intro to Manufacturing Engineering Technology	1
MFGE 311	Materials Science and Selection	5
MFGE 312	Manufacturing Systems and Processes	4
MFGE 313	Electronics Design and Manufacturing	3
MFGE 314	Mechanics	4
MFGE 315	Thermo Fluid Power	4
MFGE 316	Product Development and Tool Design	4
MFGE 317	Automation and Programming	3
MFGE 411	Quality Control and Continuous Improvement	5
MFGE 412	Metrology and Testing Methods	2
MFGE 413	Lean Manufacturing Systems Design	4
MFGE 414	Operations Management	2
MFGE 415	Industrial Organization and Management	4
MFGE 416	SME Certification Prep	2
MFGE 391	Preliminary Capstone Project	4
MFGE 491	Senior Capstone 1	1
MFGE 492	Senior Capstone 2	1
MFGE 493	Senior Capstone 3	4

Teaching Model

The BASMET teaching model is designed to provide as much flexibility for students as possible while recognizing that manufacturing engineering technology involves a significant amount of lab and workshop time.

The **MET core courses** in the Engineering Technology Core will be developed as evening-hybrid courses with a combination of online and classroom instruction in the evening during the week, and significant on-campus Saturday labs. These courses will also take advantage of open pedagogy models of instruction, utilize (and begin to create) Open resources, reading apprenticeship, and universal design for learning. Industry will be significantly engaged and be present in the classroom in ways that are unprecedented for Renton Technical College.

The **Supportive Skills** courses that are taught will be offered primarily online or flex due to the limitations of our general education department to offer evening course options. As opposed to the MET Core courses, the supportive skills courses will primarily be taught by adjunct and/or associate faculty.

Program Evaluation Criteria and Process

RTC's Policy and Procedures Manual requires that formal review of programs be conducted on a three-year basis. RTC employs a variety of additional methods in order to gather feedback and recommendations from a diversity of stakeholders, including regional employers and students.

Because the BASMET degree is new to the college, additional reviews and assessments will be implemented during the early stages of the program to ensure quality, equity, legitimacy and to help make any changes necessary for program and student success.

Formal Program Reviews

During the first three years of its operation, the BASMET program will undergo formal reviews annually. These reviews will provide early feedback on the success of the program and/or indications of problems that might need to be fixed, including the evaluation of disaggregated retention and completion data. In addition to looking at the instructional process, these reviews will also examine the wrap-around services provided by Students Services to potential students, students, and alumni to ensure that they are successfully supporting students during the entire process from initial inquiry to job placement and beyond.

After 3 years of successful operation, the program will move to RTC's regular 3-year program review cycle.

Other Reviews and Assessments

The BASMET program will also benefit from the following reviews and assessments, which will provide information for the program reviews as well as operational data for the Program Director and faculty.

- *Program Advisory Committee:* A committee comprised of industry experts and educators will provide perspective, evaluation, and feedback on the program.
- *Program Viability Studies:* The Program Dean or Director will develop assessment criteria, including qualitative and quantitative measurements. Administrative review will be done no less often than annually.
- *Student Self-Reflection:* Upon graduating from or leaving the program, students will be surveyed as to what they perceived to be the strengths and weaknesses of all aspects of their experience, including classroom activities, pedagogical techniques, the relevance of specific courses, and other criteria, as appropriate. The responses will also be disaggregated demographically and academically.
- *Employer Survey*: Students will be tracked after graduation, and the employers of those hired will be surveyed as to their impressions of how well the program prepared these students for the real-life workplace.
- *Faculty Evaluations:* On a regular basis, the program faculty will meet as a team to discuss the program and its current curricula, and how they might be improved. The faculty will also meet with the Advisory Committee at least quarterly to ensure that the curriculum meets current industry needs.
- *Course Evaluations:* To provide specific feedback from the students' perspective, surveys of student assessments on course and instructor effectiveness will be distributed at the end of each quarter and monitored by the Program Director.
- *Internship and Capstone Projects:* Reviews of internship and capstone projects will be coordinated by the program faculty and director. These reviews will incorporate feedback from students, instructors, staff and (where appropriate) employers.
- *Wage Progression and Employment Status:* The Program Director, working with RTC's Institutional Research staff, will develop reporting processes for graduates of the BASMET program that are consistent with RTC practices.

2. Faculty and Staff

Projected Teaching Faculty Numbers

The number of teaching faculty needed for the BASMET program is based on the number of credits to be taught, and a target teaching load of 45 credits per year for a full-time faculty member as well as adjunct support.

Table 5 - Projected Teaching Faculty Numbers

	AY 21/22*	AY 22/23	AY 23/24	AY 24/25	AY 25/26	AY 26/27
CREDITS						
Core Curriculum Courses	0	25	46	46	46	46
General Ed Adjunct Courses	0	15	30	30	30	30
Summer Adjunct Courses	0	7	16	16	16	16
TOTAL CREDITS	0	47	92	92	92	92
TEACHING FACULTY FTE						
Core Curriculum Courses	1.0	0.6	1.0	1.0	1.0	1.0
General Ed Adjunct Courses	0	0.3	0.7	0.7	0.7	0.7
Summer Adjunct Courses	0	0.2	0.4	0.4	0.4	0.4
TOTAL FTE	1.0	1.0	2.0	2.0	2.0	2.0

*In the first year, release time will be given to hired faculty to develop curriculum.

Note: summer quarter is separate from AY contract and requires separate adjunct contracts.

Qualifications for Teaching Faculty

All full-time faculty teaching core courses in the BASMET program, including the Program Director, will have a minimum of a Master's degree (Doctorate preferred) in a relevant field with significant teaching and/or industry experience. Teaching experience at the bachelor degree level or higher and experience in advising students will be preferred.

All full- and part-time faculty members hired to teach technical courses will meet the certification requirements for professional and technical instructors in the Washington Administrative Code.

Anticipated faculty assignments for upper division courses, including academic qualifications for identified teaching faculty members, are shown in Appendix C. Contacts within local industries and businesses able to help with curriculum design, student recruitment, and student placement.

It is the intent of the college to meet FTE load by reallocating full time and adjunct faculty currently at the RTC to teach in the BASMET program. The college will work to reduce the workload of full-time faculty in associate's programs to make space for them to teach in the BASMET program. The college is making program revisions within relevant programs to find efficiencies to free up qualified faculty workload. The reallocated full-time faculty will also be responsible for development, implementation and quality control of the curriculum along with maintenance of accreditation and industry standards for the program.

The Program Director

The Program Director, a fully administrative position, will share three BAS programs administrative duties which include:

- Course scheduling and staffing.
- Supervision of program faculty and program support staff.
- Development of the program budget, and financial management.
- Maintenance of accreditation and industry standards for the program.
- Recruitment and admissions.
- Oversight of projects.

Once the program is in full operation (AY 22/23), it is planned that the Program Director's time be split program-related administrative duties of three BAS programs.

The Program Director will be required to have:

1) Applicable experience managing BAS programs within the CTC system.

Laboratory Support

Provision is made in the budget for multiple Lab Technicians to support the program as part time, student employees.

Student Services

The need to provide specialized support to BASMET students, particularly through the selective admission process which may be new to many applicants, is recognized by the plan to provide 1 FTE of additional resources within RTC's Student Services departments throughout the program. **It should be noted that this new hire will also manage student service and support duties for the other two BAS programs at RTC.**

Library and LRCC

The RTC Library provides a variety of print, media, and online digital resources to students, faculty, and staff. The collection of books, reference materials, journals, and multi-media resources focuses on supporting RTC's instructional programs. All the digital resources including specialized online reference databases, a large collection of eBooks, and digital journals are available from any computer on campus or through remote access. A professional library staff is ready to provide research and reference assistance either in the library, online, or within program courses as specialized workshops.

The RTC Library has sufficient physical space to support the BAS in Computer Network Architecture. Seating for more than 130 library users is available at individual carrels, study tables and on lounge furniture. In addition, 11 study group rooms have the capacity to accommodate anywhere from four to 10 people per room. The library contains more than 40 public use computers, several public use scanners, printers, photocopiers and audio-visual viewing stations for videotapes, CDs and DVDs.

A part-time Librarian (.5 FTE) was hired to deliver the upper level research instruction to support 300/400 level courses for RTC's as well as to curate the collections in a dedicated way that is responsive to the needs of faculty, students and industry.

The Learning Resource and Career Center (LRCC), the open computer lab and student tutoring and support center on campus, Internet access, and a variety of assistive technologies. The LRCC also provides laptop loaners which can be used to access RTC's advanced manufacturing-specific virtual servers.

The Information Technology staff as well as the computer troubleshooting and repair center in the LRCC provides all the student technical support. There is an Information and Digital Literacy classroom and multiple media-enhanced small group study rooms as well as reflection areas for quiet study.

3. Admissions Process

RTC adheres to the open access mission and values of the State Board of Community and Technical Colleges, documented in Chapter Three of the SBCTC Policy Manual. Admission requirements are flexible to allow for broad participation, but selective enough to recruit students with the greatest likelihood of success.

Program Admission Requirements

Admission to the BASMET program is open to students who meet the following requirements:

1. An earned associate degree (or equivalent) from a regionally accredited institution with a minimum of 90 quarter credits.

2. Completion of at least 20 credits of college-level General Education with a minimum of a 2.0 GPA in each course as follows:
    - English Composition (ENGL& 101 or equivalent) – 5 credits
    - Humanities – 5 credits
    - Social Sciences – 5 credits
    - Precalculus I (MATH& 141 or equivalent) – 5 credits

Admission to the program does not guarantee entry to the Junior year.

Credit may be awarded for military experience, as demonstrated through a student's military transcript, based upon guidelines from the American Council of Education. Credit for prior learning and experiential competencies gained through work or apprenticeships will be assessed on an individual basis, according to institutional guidelines described in RTC's Policies and Procedures Manual.

Applicants must also submit:

a) A formal resume.

b) A 500-1500-word admission response describing the candidate's interest in the degree, their background and experience, how completion of this degree meets their personal education and employment goals, his or her understanding of the commitment that will be required to complete the program, and any other information that may support entry to the program.

c) Two sealed letters of recommendation attesting to the student's ability to succeed at the baccalaureate level, preferably one from an instructor and one from an employer or supervisor.

d) non-refundable application fee as required by the college.

Selection Criteria

Complete applications will be blindly reviewed by an Admissions Committee chaired by the Program Director. The admissions committee will include a variety of faculty and academic counselors. Applicants will be ranked based on the criteria listed above. Prior to reviewing applicants, the Admissions

Committee will design comprehensive rubrics for evaluating the resume, admission essay and references. These rubrics will ensure that a consistent and rigorous method is applied to each application equally.

Qualified applicants will be evaluated on the basis of first-received, first-admitted. Each application will be evaluated and granted admission in the order applications are received up until all slots for the entry term are filled. If there are more *accepted* applications than available slots, qualified students will be placed on a waiting list, again in the order of the dates on which their applications were received.

It is anticipated that the college will use a weighted method for selection criteria for the BASMET program like that used in other SBCTC colleges awarding applied baccalaureate degrees. An example is shown in Table 5. The final decision on admission to the BASMET program will be made by the Program Director who will reference the rubrics, comments, and recommendation of the committee members to make the decision.

Table 6 – Example of Weighted Criteria for Selective Program Admission

Application Requirements	Max. Pts	Notes
Cumulative College Level Associate Degree GPA	**20**	Multiply cumulative GPA by 5 to determine total points
Resume	**30**	Based on evaluation rubric
Essay	**30**	Based on evaluation rubric
Recommendations	**20**	based on evaluation rubric
TOTAL	**100**	

Encouraging Diversity

The issue of diversity in the admission plan has short and long-term timeframes:

Short Term

The BASMET program is non-traditional – at least from an engineering point of view – because the Bridge allows those who start down a "trades" path to enter the engineering field.

As a result, we will be able to approach students currently enrolled in trades programs at RTC and partner colleges, and offer them an opportunity to see if an engineering technology pathway is right for them – either immediately, or later in their career. Since non-traditional programs tend to have a more diverse enrollment than traditional engineering programs, we hope to see a more diverse group of students interested in and applying for admission to the BASMET program. We will, therefore, be catering marketing materials describing how these students could take advantage of the opportunity.

RTC will also hold zoom rooms and open sessions and workshops within student services and keep teaching faculty integrally connected to student services for guiding and supporting historically marginalized students complete their applications. RTC has been holding a stance of support from first contact to degree for decades and plans to keep improving the clarity of pathways for historically marginalized students, especially with the assistance of the Guided Pathways grant. As the college is developing the Statement of Need, the Guided Pathways team is being looped in on the development of the BASMET degree and giving guidance on how to make sure it aligns with Guided Pathways goals.

RTC holds one of the most diverse student populations in the region. Having such as population strategically places the BASMET program for maximum social justice potential in the field of engineering.

Finally, the Bridge also allows us to admit older workers who have already amassed considerable practical experience, but who did not take a traditional calculus track in high school or college. This opens the door to another student population not well served by existing programs in the region. It may be of value to older workers in physically challenging occupations such as machining and welding, who may be looking to use their extensive knowledge and abilities in a less physically demanding field.

Long Term

We plan to address the long-term diversity of the program by committing to a diverse full time and adjunct teaching faculty and staff for the BASMET program, targeting other AA and AAS programs with high levels of minoritized students and retention of minoritized students, as well as nurturing our current high school to technical college pipelines to include those towards the BASMET program in our region.

Specific Measures

In addition to the work above, the following measures will be adopted in the BASMET program to encourage diversity:

- Recruitment materials for the BASMET program will be designed to appeal to all ages, races, ableness, and genders.
- Efforts will be made to ensure representatives from industry partners represent a variety of backgrounds, and speakers invited to campus will be carefully selected to emphasize diversity.
- We plan to reach out to nearby colleges once the BASMET program is approved to start developing formalized pathways.
- Because the BASMET program will use selective admission, the Program Director will carefully monitor diversity in student enrollment in the program to determine the extent to which it represents the local community and to determine if action needs to be taken to change the recruitment processes. RTC's Institutional Research area and will provide the data necessary for this, and the criteria that we will use to assess diversity will be developed in collaboration with RTC's Diversity, Equity, and Inclusion Council.

4. Student Services Plan

Generally Available Services

RTC's Student Services organization is aware and supportive of the BASMET program.

Students in the BASMET program will have access to all the support, advising, and counseling services generally available to students at RTC. These services include:

- Admissions, Registration, Enrollment
- Advising & Counseling Services
- Accessibility/Disability Resources
- Testing Center
- Affinity Groups (LGBTQA+, BIPOC)
- Technology Services
- Behavior Health Services
- Financial Aid
- Learning Resource and Career Center
- Workforce Education Funding
- Veteran Services
- Associated Student Government

The majority of the BASMET courses are hybrid/flex and weekend model. Consequently, students will have similar access as other RTC students because RTC is transitioning more into this model of instruction.

Prior Learning Assessment

Veteran students in the BASMET program will be able to apply credit for prior learning in accordance with BTC's Non-Traditional Credit - Prior Learning Assessment policy[11]. Assessment of work submitted to gain credit for prior learning will be the responsibility of qualified program faculty.

Tutoring Services

RTC's Tutoring services are free online or in-person (through the LRCC) service which helps students to achieve success in math, accounting, chemistry, biology, writing, English, and many other courses. Tutors are recruited to provide support for subjects as requested by RTC students.

BASMET program faculty will work with the LRCC staff to help them understand the requirements of the program and the standards that students are expected to achieve to be successful – particularly in math. As part of this collaborative approach, program faculty will provide Tutoring staff with exemplars of documents (reports, PowerPoint presentations, Excel spreadsheets) so that they can more effectively help students achieve the expected standards. Tutoring staff are also able to provide technology support for BASMET students on request to provide academic support as needed.

Program-Specific Services

Financial Aid

The financial plan shown in Section 5 below provides for 1 FTE of financial aid support within RTC's Student Services department throughout the program to provide specialized support to BAS students – particularly through the admission/funding process. RTC is hiring this person to establish formal

[11] www.rtc.edu/veteran-services

admissions processes before recruitment to the program begins, and before students start taking Bridge courses in spring and summer 2022. We will benchmark other CTC colleges for minimum and preferred qualifications for the BAS Financial Aid FTE.

Initially, the position will report to the Financial Aid director and Vice President of Student Services, with a "dotted line" reporting link to the BASMET Program Director. As the program develops, the reporting arrangements will, of course, be reassessed periodically and this reporting structure may change.

Program Specific Admissions and Enrollment Support

Admission to RTC and the BAS program is a two-tier process. First, prospective students meet with an Entry Advisor in the Student Success Advising/Counseling office to answer general questions and review transcripts. Once a program of study is chosen, the student is then assigned to a Career Counselor based on area of study or enrollment status, i.e. running start, worker retraining, etc., who is responsible for assisting the student with the general RTC application (if not already a current student) and BAS program specific application. Due to the nature of the varying types of students entering the BAS program – current students, new students, transfer students, etc. – at times the BAS Program Director also assists students with entry advising and the BAS program specific application.

The instructional faculty and administrators will meet with all in student services quarterly to discuss the detail of the BASMET program during its development year to ensure that student services staff have all the information and resources needed to advise students at the entry level and current student level. These meetings will also be directed to find integration methods of student services with the program to create a normalized experience for students.

Program specific applications are then forwarded to the BAS Program Director for initial review. The Program Director contacts students to let them know that their application was received and the timeline for an admissions decision. As needed, the Program Director also consults with the student and Career Counselor to discuss any additional courses the student may need to meet all minimum admissions requirements. Once the application deadline has passed, the BAS Program Director convenes the BAS Admissions Committee where admissions decisions are made based on the Admissions Criteria outlined in Table 5.

After acceptance to the program, students can register for classes. The registration process is available via mail, in-person at the Enrollment Services office, and online at http://rtc.edu/registration. Credit evaluation and transfer review are handled by RTC's Credentials Evaluator in the Registrar's Office.

The additional advising and admissions workload will be primarily shared by the current Enrollment Services department and the BAS Program Director. The teaching faculty will relieve the Program Manager of many of the external relations and curricular duties previously performed by the Program Manager, allowing the Program Manager to focus more time on internal student relations such as advising and counseling.

5. College Commitment and Financial Plan

Financial Plan

The financial plan assumes the following:

1) Student enrollment was projected lower than stated in the statement of need due to college's decreased commitment to faculty staffing. Multiple entry points were the original intent for the program. Single Fall entry is now the realistic intent for the BASMET program. Projections below show enrollment into junior year across five years:

AY 22/23	AY 23/24	AY 24/25	AY 25/26	AY 26/27
15	15	22	22	20

2) The attrition rate is assumed to be 20% for each cohort (based on 1-year persistence rates in Application Development BAS at RTC)[12]. This attrition rate is the same as that expected in RTC's last BAS proposal based on this same data.

3) Our BAS program director is currently overseeing two programs: computer science and computer network technology. The program director will absorb the BASMET program as well to recruit students into the program, develop and formalize the admissions processes, and start development of the instructional resources. Program director cost is based on $72,000 salary per FTE.

4) 1.0 FTE full-time faculty from advanced manufacturing associate programs with engineering credentials in Fall 2021 to develop and teach the curriculum for the program then to teach the core curriculum in Fall 2022. 0.33 adjunct FTE is also being absorbed. These absorptions are accounted for in the "College Support" portion of the budget.

5) Bridge courses will no additional FTE requirement. This is due to many bridge courses already running below capacity (Machining = 87%, Engineering Design = 82%).

6) Library and student services support for the program will be absorbed by current BAS library and student services support faculty and staff (.5 for library and 1.0 for student services). Cost is based on a current $72,000 salary per FTE.

7) Work study lab technicians will support the program as needed starting AY 22/23 using current RTC work-study funds that will not impact the BASMET financial plan.

8) Full time and adjunct salaries are based on the current 2018-2021 FTE Contract. This is $80,000 per FTE of full-time faculty and $760 per credit adjunct faculty.

9) Benefits for faculty and staff are assumed to be 38% of gross salary.

10) An annual COLA at 3% has been included in the salary + benefit numbers.

12 https://tableau.sbctc.edu/t/RTC/views/RetentionandCompletionDashboardDisaggregated/RetentionPersistenceComparison?%3Aembed=y&%3AshowAppBanner=false&%3AshowShareOptions=true&%3Adisplay_count=no&%3AshowVizHome=no

11) The per credit tuition fee is based on the proposed FY 2020-21 rate, assuming that students are taking full credit loads (maximum discount) and have Resident status. This amounts to $202.60 per credit of upper division.

12) There will also be a student fee of $28.04 per credit.

13) Teaching will occur in all 4 quarters, with the summer quarter being a lighter load due to the reduced instruction time available. Student will take 47 credits of mixed division courses over the 4 quarters of the first year, and 45 credits of mixed division courses over the 4 quarters of the second year.

Table 8 shows the financial plan for Fall 2022 and the first 5 full years of the BASMET program.

Facilities, Equipment, and Instructional Resources

RTC is in the fortunate position of having substantial resources and capabilities for training in the fields of machining, welding, mechatronics, mechanical engineering technology and aerospace production technologies. BASMET students will have access to various labs and workshops during their studies. Because the program is designed to be primarily hybrid/evening/weekend, many of RTC's manufacturing facilities will also be available for classroom use.

RTC has agreed to commit the use of space in Building F on the main campus, which holds multiple machining centers, two classrooms, and a manufacturing technology computer lab. Two engineering technology computer labs in building J are also available for use.

Maintenance and refurbishment of the spaces will be completed as needed for the ongoing daytime associate's programs being held in the same place and as permitted by the college's normal operating budget. New refurbishments or equipment are not allotted for in the BASMET initial financial plan. However, the college does not foresee refurbishments necessary. The college is also committed to pursuing grants for equipment purchases as well as using the engineering and manufacturing expertise through the current college faculty to design and build needed equipment.

College Commitment

RTC's Business Office has reviewed the proposed budget and confirmed that the college is fully committed to reassigning positions and absorbing as many program costs as possible into RTC's current expenditures.

Table 7 – Program Costs and Funding

Student FTE

	*AY 21/22**	*AY 22/23*	*AY 23/24*	*AY 24/25*	*AY 25/26*	*AY 26/27*
Junior Year	0	15	15	22	22	20
Attrition		-3	-3	-4	-4	-4
Senior Year			12	12	18	18
Projected Enrollment (FTE)	0	12	24	30	36	34

Student Credits

	*AY 21/22**	*AY 22/23*	*AY 23/24*	*AY 24/25*	*AY 25/26*	*AY 26/27*
Junior Year	0	564	564	846	846	752
Senior Year	0	0	540	540	810	810
Total Credits	0	564	1104	1386	1656	1562

Faculty and Staff FTE

	*AY 21/22**	*AY 22/23*	*AY 23/24*	*AY 24/25*	*AY 25/26*	*AY 26/27*
Program Director (FTE)	0.3	0.3	0.3	0.3	0.3	0.3
Teaching Faculty - BASMET (FTE)	1.0	0.6	1.0	1.0	1.0	1.0
Teaching Faculty - Other (FTE)	0.0	0.5	1.0	1.0	1.0	1.0
Student Services (FTE)	0.5	1.0	1.0	1.0	1.0	1.0
Librarian (FTE)	0.5	0.5	0.5	0.5	0.5	0.5

Program Costs

	*AY 21/22**	*AY 22/23*	*AY 23/24*	*AY 24/25*	*AY 25/26*	*AY 26/27*
Program Director	$19,800	$20,394	$21,006	$21,636	$22,285	$22,954
Teaching Faculty - BASET	$80,000	$45,778	$86,758	$89,361	$92,042	$94,803
Teaching Faculty - Adjunct	$0	$17,222	$37,089	$38,202	$39,348	$40,528
Student Services	$36,000	$74,160	$76,385	$78,676	$81,037	$83,468
Librarian	$40,000	$41,200	$42,436	$43,709	$45,020	$46,371
Faculty & Staff Salaries	$175,800	$198,753	$263,674	$271,584	$279,731	$288,123
Benefits @ 38%	$66,804	$75,526	$100,196	$103,202	$106,298	$109,487
FACULTY & STAFF COSTS	$242,604	$274,280	$363,870	$374,786	$386,029	$397,610

	*AY 21/22**	*AY 22/23*	*AY 23/24*	*AY 24/25*	*AY 25/26*	*AY 26/27*
Goods & Services	$0	$5,950	$5,400	$5,000	$4,000	$3,000
Professional Development	$0	$3,000	$4,000	$4,000	$4,000	$4,000
Equipment & Software	$0	$9,000	$8,000	$8,000	$5,000	$5,000
Marketing & Outreach	$10,000	$10,000	$8,000	$8,000	$5,000	$5,000
Library Resources	$0	$9,000	$9,000	$9,000	$9,000	$9,000
OTHER COSTS	$10,000	$36,950	$34,400	$34,000	$27,000	$26,000

Program Income

	*AY 21/22**	*AY 22/23*	*AY 23/24*	*AY 24/25*	*AY 25/26*	*AY 26/27*
Tuition	$0	$114,266	$223,670	$280,804	$335,506	$316,461
Additional Student Fees	$0	$15,815	$30,956	$38,863	$46,434	$43,798
From State Allocation	$0	$0	$0	$0	$0	$0
College Support (Absorbed Salaries)	$242,604	$258,357	$329,577	$339,465	$349,648	$360,138
TOTAL FUNDING	$242,604	$388,438	$584,204	$659,132	$731,588	$720,398

	*AY 21/22**	*AY 22/23*	*AY 23/24*	*AY 24/25*	*AY 25/26*	*AY 26/27*
TOTAL COSTS	$252,604	$311,230	$398,270	$408,786	$413,029	$423,610
TOTAL FUNDING	$242,604	$388,438	$584,204	$659,132	$731,588	$720,398
BALANCE	**-$10,000**	**$77,208**	**$185,934**	**$250,346**	**$318,559**	**$296,787**

6. Program-Specific Accreditation

Upon SBCTC approval of the Manufacturing Engineering Technology degree, RTC will immediately file a Substantive Change Request with the Northwest Commission on Colleges and Universities (NWCCU).

As noted in the Introduction, the primary accreditation body for engineering and engineering technology programs in the USA is ABET. It was also noted that, although the ABET ETAC standards do not appear to preclude the accreditation of applied baccalaureate programs, there are no examples of such programs being accredited. Furthermore, a program cannot apply for accreditation until it has started to graduate students. Therefore, our plan is to develop the BASMET program in a way that is consistent with the quality standards established by ABET ETAC, and with the intention of applying for accreditation if and when this becomes possible.

7. Pathway Options

Masters' Degrees

Several potential post-baccalaureate pathways for BASMET graduates have been identified, including (but not limited to) those shown in Table 7.

Table 8 – Potential Post-Baccalaureate Pathways

Oregon Institute of Technology	Master of Science - Engineering	Portland Blended and Online
University of Washington	Industrial and Systems Engineering	Seattle In Person/Online
CityUniversity	Master of Science – Project Management Master of Science – Management and Leadership	Renton – Online/Mixed Modes

Professional Engineer Status

In Washington State, neither the lack of ABET accreditation nor the program being Engineering Technology rather than Engineering would prevent program graduates from seeking Professional Engineer status, although it does lengthen the approval process[13].

[13] http://www.dol.wa.gov/business/engineerslandsurveyors/engintraining.html

8. External Expert Evaluations

At the current time, we are not aware of any PhD programs in Manufacturing Engineering Technology – the pathways after a MS Engineering Technology are typically in Engineering Management, or in Engineering[14]. As a result, we have been unable to identify external reviewers with PhD qualifications in Engineering Technology.

We have, however, been able to engage reviewers from Western Washington University (WWU) and Central Washington University (CWU) who have extensive teaching and research experience in the field as well as an industry expert in the field of manufacturing engineering and manufacturing engineering technology.

> **Jeremy Dickson** is a Manufacturing Engineer with the Boeing Company that has extensive manufacturing engineering experience. He graduated from a Mechanical Engineering Technology program from Central Washington University and is currently pursuing his MS in Manufacturing Engineering from Oregon Institute of Technology.
>
> **Jeff Newcomer** is current chair of the Engineering and Design department at WWU, where he teaches upper division courses in the Manufacturing Engineering program as well as a broad range of courses in the Engineering and Design department. He is actively involved in working with the Washington Council for Engineering and Related Technical Education.
>
> **Dr. Craig Johnson, P.E.** is a Professor in the Department of Engineering Technology, Safety and Construction at CWU, and is the Coordinator of Mechanical Engineering Technology and Industrial Technology. He is a licensed Professional Engineer. He has taught undergraduate courses in in Metallography, Plastics, Ceramics, Composites, Casting, Advanced Foundry, Statics, Strengths, Industrial Design, CAD, CADCAM, FEA, Machine Design, Diffraction, Economics, Dynamics, Tool Design, Aviation Systems, Aerodynamics, and Hydraulics; and graduate courses in Numerical Analyses and Composites.
>
> **Charles Pringle, P.E.** is a Professor, Mechanical Engineering Technology at CWU, where he teaches in both baccalaureate and master's level Engineering Technology programs. His primary research interests are in Systems Engineering, and Energy Management/Conservation. He has also published papers relating to classroom pedagogy and systems.

The full text of their reviews, together with each reviewer's professional vitae and RTC's response to their recommendations, will be provided in a supplementary document upon completion of the review.

[14] "On Engineering Technology Education: BS to PhD" by Enrique Barbieri, Vijay Vaidyanathan & Owe G. Petersen https://www.researchgate.net/publication/261358920_On_Engineering_Technology_Education_BS_to_PhD

Appendix A – Course Descriptions

Note: The following course descriptions do not include lower division courses that might be taken during the Bridge to meet the requirements for entry to the Junior year. All course numbers are subject to change to fit the college's needs.

Seminars/Projects

MFGE 301 – Introduction to Manufacturing Engineering Technology **1 credits**

Introduces students to the Manufacturing Engineering Technology program at RTC. Presentations from the manufacturing engineering industry will be provided as well as information on orientation within the program. Includes a technology orientation and a review of math and Excel related to engineering applications.

Prerequisites: Entry into Junior Year

MFGE 391 – Preliminary Capstone Project **4 credits**

This course examines the manufacturing engineering design process and teaches students realistic and comprehensive project planning and small-scale engineering project execution. Topics include how to effectively manage resources, coordinating multiple tasks associated with design projects, conflict resolution, and the use of Project Management tools to develop and manage project plans. Students work in teams to develop their problem-solving and teamwork skills. This course serves as a foundational engineering design experience supporting the Senior Capstone Project.

Prerequisites: ENGT 301

MFGE 491 – Senior Capstone Project I **1 credit**

Senior Capstone Project 1 is the start of the culminating project sequence in Manufacturing Engineering Technology that builds on the knowledge gained through the extensive lab-based, hands-on curriculum. Students work in teams to design and plan a process design project with real world applications. Students will apply the engineering design process including defining functional requirements and conceptualization, identifying risks and countermeasures, and selection. Student teams begin with some of the first steps in a manufacturing design project.

Prerequisites: ENGT 391

MFGE 492 – Senior Capstone Project II **1 credit**

Senior Capstone Project 2 is where much of the analysis of student's designs happens. Student teams take their concepts and preliminary design from Senior Capstone 1 and conduct the relevant analyses of their design.

Prerequisites: ENGT 491

MFGE 493 – Senior Capstone Project III **4 credits**

Senior Capstone Project 3 is where the bulk of the student team's design work happens. Student teams not only lay out the final design details of their manufacturing design project, but they build a functional prototype and conduct tests of their prototype to measure its performance in relations to the functional requirements. Students will revise their designs iteratively and complete their capstone project with presentation to their class and industry partners.

Prerequisites: ENGT 492

Manufacturing Engineering Technology Core

MFGE 311 – Materials Science and Selection **5 credits**

Examines the relationship between design, materials properties, and materials selection. The fundamental principles behind materials science, classification and specification is addressed with a focus on metallurgy, engineered materials, and materials testing in the manufacturing environment.
Prerequisite: Bridge to Engineering Mathematics (Bridge), Recommended: CHEM&121

MFGE 312 – Manufacturing Systems and Processes **4 credits**

Examines the relationship between design, manufacturing processing and materials properties. The fundamental principles behind the various manufacturing processes will be discussed with the intent of providing a working knowledge of various manufacturing methods. For each manufacturing method, students will assess the capabilities, limitations, and potential of the processes. Examples are drawn from the aerospace, heavy machinery, and marine industries.
Prerequisite: NA

MFGE 313 – Electricity and Electronics **3 credits**

A foundational course for all students who will be working with electronic equipment in industry. Topics include DC and AC components, circuit analysis techniques, semiconductors, electromagnetism, sources, energy conversion and electrical instruments. The focus of the course is on gaining a basic knowledge of electronics and understanding the concepts used in industrial electronics applications.
Prerequisites: MATH&141

MFGE 314 – Mechanics **4 credits**

This is a contextualized, project-based learning experience of traditional statics, dynamics, and strength of materials focusing exclusively on applications in mechanical and manufacturing engineering technology. It examines analytical and experimental techniques common in engineering, interpretation of experimental data, comparison of measurements to numerical/analytical predictions, finite element analysis, and engineering report writing. Topics covered in the course include static and dynamic analysis, stress and deformation, fracture, creep, stress-strain relations, and cyclic fatigue properties of engineering materials.
Prerequisites: ENGL& 101, Bridge to Engineering Mathematics, Familiarity with 3D Modeling Software.

MFGE 315 – Thermo Fluid Power **4 credits**

This course is contextualized, and project based to provide students with the fundamental aspects of fluid mechanics and heat transfer in a context consistent with manufacturing engineering practice. Topics include thermodynamics, fluid statics and dynamics, conduction, convection, radiation, and heat exchangers.
Prerequisites: ENGL& 101, Bridge to Engineering Mathematics

MFGE 316 – Product Development and Tool Design **4 credits**

Fundamental concepts of product design and tooling used for machining, locating, and transferring multiple parts for fixed and flexible manufacturing. Topics discussed are design, setup, and development of tooling for robots, computer numerical control machines and other production equipment.
Prerequisites: MFGE 312, MFGE 314, 3D Modeling Software experience.

MFGE 317 – Automation and Programming **3 credits**

Covers concepts, devices, and common practices associated with modern industrial control systems and automation. Students learn familiarity with CADCAM and other programming technologies for the design of automated systems that include CNC machines, PLC's, robotics, and automated materials handling equipment. Industrial safety practices and procedures are emphasized throughout the course.
Prerequisites: MFGE 311 and 312

MFGE 411 – Quality Control and Continuous Improvement **5 credits**

This course equips students with the managerial concepts and quantitative tools used in effective and efficient quality control in manufacturing and service organizations. Topics include statistical methods for quality control, well-known continuous improvement methodologies such as Design of Experiments, Taguchi Concepts, Six Sigma, Total Quality Management (TQM), ISO 9000 and AS 9100.
Prerequisites: Introduction to Statistics

MFGE 412 – Metrology and Testing Methods **2 credits**

This course covers the concepts and application of dimensional metrology and testing methods for product quality. Topics include length standards and traceability, measurement error, the use of coordinate measuring machines, and tolerance qualification with gauging, and non-destructive testing.
Prerequisites: NA

MFGE 413 – Lean Manufacturing Systems Design **4 credits**

This course introduces students to Lean theory including concepts such as value stream mapping, workplace organization and standardization, 5-S and cellular flow. The focus of the course however is on lean production planning and process engineering. Topics include lean methodology, process planning and simulation, methods engineering, forecasting, and assembly methods.
Prerequisites: MFGE 411

MFGE 414 – Operations Management **2 credits**

This course covers the design and optimal layout of industrial facilities, materials handling systems, and warehousing for the most efficient flow of raw materials, work-in-process, and completed product. Students, working in groups, will be required to develop a written proposal for a newly designed or modified facility including a financial justification for the project, and carry out a verbal presentation of their results that include facilities and materials layout, the economics of the design, and management of human factors, maintenance, industrial safety, health, and environment.
Prerequisites: NA

MFGE 415 – Industrial Organization and Management **4 credits**

In this course, students will learn effective management, leadership, and motivation skills applicable to the manufacturing and industrial environment. Emphasis will also be on managing labor relations, personal effectiveness, and on sustainable manufacturing and building a diverse and inclusive manufacturing workforce that fosters growth, lifelong learning, and continuous improvement.
Prerequisites: NA

MFGE 416 – SME Certified Manufacturing Engineering Technologist Preparation **4 credits**

This course helps students prepare to take the MfgET certification exam to gain MfgET certification, an industry recognized credential that states your qualification for entry-level manufacturing engineering work.
Prerequisites: At least 75% completion of upper division coursework.

Business and Supporting Skills

ENGL& 235 – Technical Writing **5 credits**

This course focuses on various aspects of professional and technical writing. Students study user guides, reports, proposals, and other forms of business correspondence in order to successfully write for the workplace.
Prerequisites: ENGL&101

ECON& 2XX – Engineering Economics **5 credits**

This course focuses on forecasting and estimating techniques; and on tools used to analyze projects, compare alternatives, and make sound business decisions based on economic principles such as time value of money, internal rate of return, and cost-benefit ratios. The course includes the use of Excel as a tool for analysis and decision making.

PHIL& 2XX – Engineering Ethics **5 credits**

This course aims to raise students' awareness of ethical dilemmas that might occur at work, to show how such ethical issues are subject to management analysis and decision-making action, and to provide students with the conceptual tools necessary to identify and then develop an acceptable resolution of these dilemmas. The course will include the presentation of ethical arguments to groups, and debate on their merits.

Note: Co-listed with BAS Operations Management

MATH& 146 – Introduction to Statistics **5 credits**

This course is an introduction to statistics and how it may be applied in the analysis of numerical data. It includes the following topics: structure of data sets, central tendency, dispersion, means, standard deviation, correlation, and regression, binomial and normal probability distributions, sampling methods, confidence intervals and hypothesis testing.

Prerequisites: Completion of MATH 095, AMATH 190, or AMATH 195

Appendix B – Program Faculty

Key faculty members identified to date are listed below.

Batholomew Kimani	PhD, Education – CityUniversity MS, Materials Science – Washington State University BS, Materials Science and Engineering – Washington State University
Melvin Hortman	MS, Engineering Technology – Central Washington University BS, Mechanical Engineering Technology – Central Washington University Certificate in eLearning Design and Development – Renton Technical College

Adjunct faculty are still to be identified. Additional faculty may be added as new areas of emphasis are identified, or if student enrollments exceed the currently anticipated numbers. The faculty and administrators responsible for technical courses will meet certification requirements for professional and technical administrators and instructors in the Washington Administrative Code WAC 131-16-094.

The following table indicates the primary courses that faculty would teach. Faculty will be chosen to supervise the project courses based on their area of expertise, and on the subject chosen by the student(s).

Appendix C – Program Advisory Committee and Involved Industry Experts

Machining Advisory Board	
Bianchi, David	CEO; HE Parts
Blechschmidt, Sean	Eng/Ops Director; Proto-Design
Campbell, ThuyVan	Associated Machine & Fabrication
Cote, Jesse	Representative; Aerospace Machinists Dist Lodge 751
Gary, Charlie *	Machinist; Zetec
Goes, John**	Vice President; Ellison Technologies
Knebel III, Andy	CO; Renton Coil Spring Co
Milenkovic, Matt	Recruiter; Exotic Metals
Munsinger, Mike	Machining Manager; Aero-Plastics
Plante, Tom	Maintenance Manager; J. D. Ott Co.
Jon Clark	Renton School District
Creed Nelson	Renton School District
John Jorgensen	Upbeat Enterprises
Will Willhoite	HCHW Value Stream Leader Ingersoll Rand
Welding Advisory Board	
Barnes, Lisa	Owner / Newport Manufacturing
Castro, Ray	SSA/CEM Foreman
Fuala'au, Tui	Nucor Steel Seattle, Inc./ Roll/Guide Shop Lead
Gallegos, Joe	Lead; SSAT/CEM Mechanics
Hanes, Ken	District Sales Manager; National Standard
Ord, Michael	Outside Sales; Praxair Auburn
Sanchez, Eddie	Local 86
Dan Schneider	Shop Foreman / Newport Manufacturing
Mechatronics Advisory Board	
Addison, Steve	Program Director; Machinist Institute
Flanagan, Brad	Starbucks
Peters, Roger	Senior Business Developer; AJAC
Reeves, Rob	HR Manager; Exotic Metals
Rivera, Tia	Workforce Development Mgr; Boeing
Underbeg, Jackie	Amazon
White, Tim	Boeing Company
Aerospace Advisory Board	
Ernie Antin	Director of Manufacturing; Exotic Metals
Carl Hansen	The Boeing Company; Tooling Manager
Douglas Klein	Mahr; Regional Sales Engineer
Tara Mitchell	Origin Alliance
Richard Nelson	Kinematics

Bryan Price	Red Dot Corp
Rob Reeves *	Exotic Metals; Recruiting Manager
Mark Rosettie	Skills Inc; Lead HR Generalist
Chris Westling	Exotic Metals; Manufacturing Manager
Dan Parker	The Boeing Company; Workforce Development