

APPLICATION COVER PAGE
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Project Name: Relevance and Rigor in New STEM Career Paths
Requested Funding: \$ 424,766

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	Participating High School or Middle School Name	Lead Contact Name	Grade Levels	Student Enrollment
1.	Churchill High School	Kim Finch	9 - 12	1013
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

BUSINESS, INDUSTRY, LABOR AND POSTSECONDARY EDUCATION PARTNERS

The following individuals and/or organizations have reviewed, discussed, and agreed to their part in implementing the project proposed in this grant application:

	Name	Title	Organization
1.	Monica B. Anderson, PE, LEED, AP	President	Balzhiser & Hubbard Engineers Eugene, Oregon
2.	Artemio Paz, Jr., AIA	Principal	APAZ Architect Springfield, Oregon
3.	Lawrence Fox, PE	President	OBEC Consulting Engineers Eugene, Oregon
4.	Jeffery Graper, PE	President	Systems West Engineers, Inc. Eugene, Oregon
5.	Michael Janes	Senior Research & Development Mgr.	Life Technologies Eugene, Oregon
6.	Lawrence Flick, Ph.D.	Dean	College of Education Oregon State University
7.	Tricia Lytton	Liaison	High School Connections Lane Community College
8.	Terri Ward, Ph.D.	Director	EPIC/Center for Educ. Policy Research, University of Oregon
9.	Dean Livelybrooks, Ph.D.	Tenured Senior Instructor and Dir. of Undergraduate Studies	Department of Physics University of Oregon
10.	Carol McKiel, Ph.D.	Director	TRIO STEM, Lane Community College

Relevance and Rigor in New STEM Career Paths: Abstract

Few initiatives in education are more crucial than increasing preparation for high-wage and high-demand careers in science, technology, engineering and mathematics (STEM). Yet, in too many schools STEM learning means only “science and math,” and takes place only in a classroom. Eugene School District 4J requests \$ 489,474 to develop an innovative CTE STEM curriculum in which students will engage in authentic, problem-based engineering projects that are connected with working professionals in our community. At Churchill High School, we will develop a new “Engineering & Design” CTE program of study, enhance two existing CTE programs, and increase rigor in foundational math and science. We will equip a new STEM learning studio with state-of-the-art engineering technology for hands-on learning. We will collaborate with engineers to ensure **relevance** — aligning curriculum and assessments to industry standards and workplace needs; hosting teachers in worksite immersion programs; and developing and co-teaching STEM activities. We will involve postsecondary faculty to ensure **rigor** — aligning curriculum to meet admission requirements in STEM programs, and implementing the acclaimed ThinkReady system for STEM thinking skills and college/career readiness.

With this project, we aim to increase the number of students – including females and minorities — that are interested in pursuing STEM careers, and to greatly advance students’ STEM knowledge and skills. We will also familiarize teachers with real STEM industry work, and improve their STEM teaching skills, as the foundation for sustained support of students’ college and career preparation.

II. PROJECT DESCRIPTION

A. Project Outcomes and Progress Markers

1. Improved student engagement in CTE. A majority of students at Churchill High School (CHS) will enroll in a CTE Program of Study (POS); a significant portion of these will be in STEM-related pathways and will reflect diverse backgrounds (ethnicity, income-level and gender).

Outcome 1: Progress Markers	#	%
11 th and 12 th grade students who will be enrolled in a CTE POS (an increase of 24% over the 2011-12 year)	350 (or more)	65%
Students who express interest in careers in STEM-related fields will increase over those expressing interest in a 2010 survey		50%
9 th and 10 th grade students who will indicate interest in enrolling in the "E&D" POS in their junior year	150 (or more)	30%
11 th and 12 th grade students who will be enrolled in the "E&D" POS	120 (or more)	22 %
Students in the Engineering and Design (E&D) POS, or plan to enroll in junior year who will be non-white, low-income, and/or female	20	30%

2. Improved teacher knowledge and practice. Teachers of STEM-related courses will have specialized knowledge and skills in STEM education that reflect current industry practice.

Outcome 2: Progress Markers	%
Teachers of STEM courses who will complete a one-week internship in a STEM workplace.	90%
Teachers of STEM courses who will attend the "STEM Orientation Mini Conference."	100%
Percentage of the teacher-determined "STEM Expertise" goals that teachers will achieve	90%
Teachers of STEM courses who will become CTE endorsed (or be in progress) in engineering and design (CAD).	two

3. Improved rigor in technical and/or academic content.

(3-a) The full STEM curriculum -- consisting of a new E&D CTE POS; redesigned STEM

courses in two existing CTE POS; and foundational courses in science and math -- will meet or exceed standards for two- and four-year college readiness.

Outcome 3-a: Progress Markers	
Percentage of sequential courses in foundational math and science and in the new CTE POS directly aligned with the courses preceding and following them regarding exit/entry standards for knowledge and skills	100%
Percentage of STEM courses in three CTE POS's aligned with standards and articulated with entry requirements of two- and four-year, postsecondary programs in STEM/engineering fields	75%
Percentage of CTE POS courses and foundational courses in which teachers implement the ThinkReady system of assessing Key Cognitive Strategies	65%

(3-b) STEM course curriculum in three CTE POS will have standards, methodologies, and learning environments that are directly related to current practice in high-wage/high-demand, STEM-related fields.

Outcome 3-b: Progress Markers	
Percentage of STEM courses in three CTE POS to be aligned with several sets of industry standards chosen in consultation with STEM industry professionals (e.g., Nat'l Academy of Engineering, CCTI Core/STEM Career Cluster, Oregon Pre-Engineering Learning Outcomes/ETIC)	85%
Percentage of curriculum of STEM courses in three CTE POS that will consist of "STEM learning opportunities," defined as authentic design/engineering projects and activities that apply math and science content to solving real-world problems, and involve local industry partners	75%

(3-c) Graduates of CHS CTE programs will meet or exceed the requirements of the Oregon Diploma, and will be college-ready for a four-year program in STEM.

3-c. Progress Markers	
Freshmen who will be enrolled in a course pathway of 4 years of math and 4 years of science leading to 4-year college	60%
Percentage of increase on OAKS math and science scores that CHS 10th graders will demonstrate	10%
Increase over 2012 baseline of students reporting that they are college ready based on their high school experience*	20%
*Note: College enrollment/remediation rates will be tracked beginning in 2013.	

(3-d) Graduates of CHS CTE programs will be career ready in STEM-related fields.

3-d. Student STEM Career Readiness: Progress Markers	
Students who will achieve an average standard for performance in <i>Critical Engineering Skills for Success</i> (from Career-Related Learning Standards)	75%
Students who will complete the required minimum of 4-6 Career Related Learning Experiences by the end of 12 th grade	100%

4. Improved partnerships with business, industry, labor, and education.

The school's partnership with STEM industry representatives will be an essential aspect of the development and implementation of the school's STEM-related CTE programs, reflecting breadth, depth, and longevity of involvement.

Outcome 4: Progress Markers	
Number of professionals from more than 8 STEM industry businesses/agencies who will be involved in Project activities	20 professionals
Percentage of new and redesigned STEM courses in three CTE POS that will be developed in collaboration with STEM working professionals	100%
Percentage of new and redesigned STEM courses in three CTE POS that will have learning activities in which STEM industry professionals interact directly with students	80%

B. CTE Program of Study Design

This project will develop a new CTE program of study (POS) in *Engineering and Design* (E&D) at Churchill High School (CHS), and enhance the school's two existing CTE POS – *Rachel Carson Environmental Science* and *Health Services* – with new engineering-related curricula. We will infuse these programs, as well as foundational courses in math and science, with new instructional methodologies based on current engineering industry practice and designed to prepare students for high-wage/high-demand occupations in science, technology, engineering and mathematics (STEM). Our comprehensive approach will give students the **rigor** needed to enter and succeed in four-year postsecondary STEM programs; and the **relevance** to current STEM and engineering industry practice needed to sustain interest, and provide key STEM skills

and familiarity with STEM occupations. The components of the program are:

1. Standards and Content

The E&D POS and other STEM CTE courses will incorporate three tiers of learning.

See diagram in Appendix A.

a. Foundational content. This project will require all students at CHS to take four years of math and four years of science. Foundational, high-level knowledge of math and science content is fundamental to applying concepts to engineering and technology tasks – the central process of STEM practice. Standards used in both foundational courses and new CTE STEM courses will be the *Common Core State Standards (CCSS)*, *Framework for K-12 Science Education (Nat'l Research Council)*, and *Next Generation Science Standards (ODE; expected Fall 2012)*.

b. STEM thinking skills. Numerous analyses of 21st century STEM-related high-wage/high-demand occupations have identified skills related to critical thinking and problem-solving as essential (Board on Science Education, 2007). In 2011, the ODE noted, “Problem solving is emphasized across all STEM disciplines, allowing students to discover, explore, and apply critical thinking skills as they learn.” All new and enhanced CTE courses will include curriculum designed to build STEM thinking skills based on the five “Key Cognitive Strategies” (KCS), skills widely identified as essential to STEM careers and confirmed as critical to college readiness through a decade of research by Dr. David T. Conley, founder and CEO of the Educational Policy Improvement Center (EPIC). *The Key Cognitive Strategies are: Problem Formulation; Research; Interpretation; Communication; Precision/Accuracy.*

c. Engineering career and technical skills. Using the ODE Diploma *Career-Related Learning Standards (CRLS)* and engineering industry standards*, a team of STEM professionals and CHS teachers, will develop a list of *Critical Engineering Skills for Success* to be applied by students to real world industry-connected problems, using a proficiency-based system coupled with a rubric that provides clear targets for their demonstrated skill mastery. * *National Academy of Engineering; Common Career Technical Core (STEM); and Oregon Pre-Engineering Learning Outcomes (2007)*.

d. Courses. The new three POS will include new (N) and redesigned courses (RD) in engineering: *E&D POS (general engineering):* Pre-Engineering Technology (ND); Physics (RD); Robotics (RD); Engineering Design (ND); Pre-Calculus; Senior Seminar. *Environmental Sciences POS (new environmental engineering focus):* Engineering Design (RD); Environmental Engineering & Design (ND); AP Environmental Science; Pre-Calculus; Senior Seminar. *Health Services POS (new focus on biomedical engineering):* Anatomy & Physiology; Medical Terminology; AP Biology (RD); Pre-Calculus; Senior Seminar. *See diagram in Appendix B.*

The engineering-focused courses in the existing POS will prepare students for the rapidly growing “green design” and biomedical industries in the Lane County region. In response to evidence that application of math to real-world tasks is the experience most STEM students lack on reaching college, all new and redesigned courses will have an innovative curricular design centered on authentic STEM projects (with participation by STEM professionals). Students will apply math and science content to real-world tasks in an engaging, state-of-the-art engineering learning environment. *See “Partnership” for a full description.*

2. Alignment and Articulation

Courses will be vertically aligned both within CHS and with admission requirements of both two- and four-year colleges to ensure that CTE graduates are four-year college ready. Courses will also be articulated to provide dual credit through “College Now,” and Pathway Roadmaps will be created. See “Partnership” for more on partners’ role.

To provide vertical alignment of STEM/engineering with middle school, CHS feeder school, Arts & Technology Academy will introduce a pre-engineering curriculum (Project Lead the Way) next year.

3. Accountability and Assessment - See “Evaluation”.

4. Student Support Services

Students in the new and enhanced CTE POS will be supported in a number of ways that will provide real-world enrichment opportunities and ensure success:

STUDENT SUPPORTS	
a)	Student worksite internships (min. 24 hrs. total) in local STEM-related businesses
b)	“Power lunches” with industry reps
c)	Single, exploratory hands-on visits to STEM-related sites
d)	With industry partners, participation in engineering fairs and robotics competitions
e)	Participation in OSU’s “Apprenticeships in Science and Engineering” summer program, LCC Career Day, EWEB Career Day, OSU Engineering Expo, etc.
f)	After-school engineering club invention team (through a grant award from the OUS “eCHAMP” Program) to compete nationally with broad technology solutions, following the Lemelson-MIT InvenTeam model
g)	Academic support, tutoring (via LCC/TRIO), college information, counseling and mentoring aimed at traditionally underrepresented groups. (See “Student Diversity”)
h)	STEM career planning and visits to local college campuses through collaboration among new industry partners, the Career Center, academic counseling staff, and School-to-Career office

4. Professional Development

CHS science, math and technology teachers need new expertise and STEM and

engineering industry familiarity, which will be provided by professional development.

Teacher Professional Development
WORKPLACE IMMERSION: A one-week full-time internship for all 10 STEM CTE teachers in an engineering firm or STEM-related agency, where they will: <ul style="list-style-type: none">• Identify needed knowledge and skills• Learn and document authentic practices• Write their own goals related to acquiring STEM expertise• Solidify partnerships with professionals and project partners• Conclude by meeting as a group to infuse learned skills into the curriculum
STEM-INSTRUCTIONAL SKILLS: A two-day Mini Conference conducted by OSU to learn about problem-based, interdisciplinary, teamwork type modes of STEM education
CTE AND TECHNICAL SKILLS ENHANCEMENT: <ul style="list-style-type: none">• At least two teachers will become CTE endorsed• Teacher Greig Thompson, a former research scientist and engineer in physics, atmospheric sciences, and oceanography will serve as “STEM Teacher Leader”• STEM teachers will attend two half-day sessions for training and practice in using collaborative digital technology (e.g., Prezi, Google Docs, Electronic Portfolios) led by teacher leaders, district staff, and industry professionals• STEM teachers will learn about using the “National Career Readiness Certificate”

C. Innovation

While the proposed new and enhanced programs of study build on CHS’s reputation for rich CTE resources, the STEM/engineering focus is a new direction for both the school and the district. Eugene does not now have a full-scale, coherent pre-engineering program; it currently offers engineering only as a component in one course in two schools. In response to the 21st century career landscape, this launch of a comprehensive CTE engineering program represents a new curricular priority of the district, and the first, deliberate step in an initiative that will continually expand over the long term to prepare our students for STEM-related fields. Concurrent with this project is the introduction of pre-engineering into a middle school feeder to CHS, signifying the district’s commitment to a complete STEM pathway.

Two significant aspects of curricular emphasis in this proposed program not only

distinguish it from traditional CTE programs but also reflect a shift in the overall significance and role of CTE in the school:

1. Industry in the classroom. The high level and comprehensive nature of involvement by local industry firms and individuals is unprecedented. As outlined in the “Partnership” section, industry partners will be involved in nearly every aspect of the process, from course design to instructional strategies, to curricular activities and assessment. The roles are multi-faceted, fulfilling functions ranging from strategic planning to co-teaching, hosting interns and monitoring achievement of project outcomes.

At the front and center of our learning approach is a “STEM Education” practice described only recently in the ODE “Oregon STEM Education Initiative” (2011) and rapidly becoming a state education priority. The practice mirrors the work that professionals in all STEM-related fields do – applying math and science concepts to problem-solving in collaboration with others to address real-world problems – and is the central learning mode in our uniquely industry-relevant CTE courses. Very innovative for our district, our new instructional strategy is designed to “level the playing field” by offering all CTE students the chance to conduct authentic engineering work and, thereby, form a self-identity as a STEM professional, including those from traditionally underrepresented groups such as females and minorities.

Projects- and problem-based learning by student design teams that include frequent interaction with industry professionals will pervade our new and enhanced courses, and we anticipate a level of intense engagement by students in this kind of learning that we have not seen before. The infusion of industry participation in all aspects of curriculum

development and delivery has potential for significantly increasing students' understanding of, and interest in, STEM-related careers.

2. CTE interwoven with college readiness. Coupled with the strategy of industry involvement is the necessary rigor that ensures that students will actually perform at a sufficiently high level to be prepared for postsecondary programs and occupations in high-wage, STEM-related careers. We recognize that it is not enough to offer authentic, industry-connected learning for students if the overall level of learning is below that required to enter and be successful in higher education programs that lead to high-level STEM occupations. For this reason, we have chosen to put great emphasis on ensuring the college readiness level of the CTE program and its foundational courses.

Two major components of our program ensure increasing college readiness for CTE students – the vertical alignment process to be facilitated by UO EPIC alignment specialists, and use of the ThinkReady performance task system for building and assessing higher order thinking skills (“Key Cognitive Strategies”) widely identified as critical for college readiness and STEM-related fields. With this project, Churchill will be the first school in Oregon to implement the ThinkReady system. *See Appendix C.*

In our CTE courses, there is a paired emphasis on core math/science content and industry-driven design/engineering tasks. Integrated STEM learning is a necessary combination to prepare for the interdisciplinary nature of STEM professional practice.

Also innovative are the proficiency-based systems we will use in building thinking skills and engineering-specific career and technical skills. Students will have clear targets for demonstrated skill proficiency, be given multiple opportunities to demonstrate mastery, and be score-assessed in a method that allows them to self-monitor and refine

skills until they reach mastery (ThinkReady and CESS Rubric – see “Evaluation”). This system provides unprecedented accountability for students, teachers and school.

The increased emphasis on four-year readiness reflects an expansion of CTE that is closely woven with the district’s efforts to improve college readiness. As 21st century career preparation increasingly requires college education, students are seeking career connections with their high school studies. We view our CTE project initiative as directly supporting the goal of “40-40-20” outlined by the governor.

D. Diploma Connections

The proposed CTE program will help students toward the Oregon Diploma in:

1. Credit Requirements: The school’s new requirement for four years of math and science will ensure that students meet or exceed the state diploma requirement of three years each of science and math. The new CTE course offerings in a new career area (Industrial and Engineering Systems) and enhancements of two other career areas will provide new potential areas of interest and opportunities for students to fulfill the career and technical education course requirement (3 courses). Student support in the form of counseling, tutoring and mentoring, particularly for under-represented students, will ensure that all students meet academic requirements.

2. Credit for Proficiency: We will pursue approval for the proficiency-based systems for developing and assessing skills in our new CTE program to meet “Credit for Proficiency” requirements, so that students can earn credits using these systems.

3. Essential Skills: The new and enhanced CTE courses will be highly engaging for students, and will offer new chances for students to gain proficiency, particularly in their ability to meet the “apply math” skill requirement.

4. Personalized Learning: The project will help students to meet the requirement of completing four to six Career Related Learning Experiences by providing worksite-based course lessons, student worksite internships, “Power lunches” with industry reps, and access to OSU’s “Apprenticeships in Science and Engineering” summer program. For achievement of Career-Related Learning Standards, students will have numerous opportunities with their CTE courses to self-assess and work toward meeting clear targets of skill mastery using an industry-specific rubric derived from the CRLS. The CHS Counseling Office will facilitate each student’s development of an Education Plan and Profile that will correlate closely with the articulated courses in the new CTE Program. STEM learning will help students meet the Extended Application requirement.

E. Activities and Timeline

Project Timeline

Date	Project Activities	Outcome
May '12	Survey of Student STEM Interest/Identity (9 th and 10 th grds) Student enrollment in E&D POS: 2012-13	Outcome 1
June '12 – June '13	Alignment of STEM courses vertically to STEM pathways and postsecondary programs (EPIC); LCC articulates syllabi for College Now and, identifies CTE credit student opportunities	3-a, b, c
May-Jun '12	Technology infrastructure to support increased student use established with district Computing and Information Services	3-b, 3-d
June-Jul '12	4J STEM Curriculum Specialist with LCC/Engineer design CESS rubric using K-12 Framework and Industry standards	3-a, 3-b
June '12	STEM Advisory Board assembled (quarterly meetings with schedule: Aug.'12, Oct.'12, Jan.'13, Mar.'13, May '13)	Outcome 4
Jun-Jul '12	Partner (Industry+Education) Implementation Board assembled (to meet 1 to 2x per month)	Outcome 4
Jun-Aug '12	Critical Engineering Skills for Success (CESS) Rubric created; diversity/gender/inclusive practices included and posted	3b, 3d
Aug '12	District begins renovation for new engineering studio	3-b

Aug. '12	(3-4) Teachers: one-week immersion with business partner for CTE skills and curriculum work	Outcome 2
Sept. '12 – Dec. '12	Teachers create electronic files in a standard format with descriptions, texts audio video pieces, diagram to share	Outcome 2
Aug '12	Teacher STEM Orientation Mini-Conference at OSU College of Education	Outcome 2
Sept. '12	Teacher two-half day sessions for training in collaborative open digital technology	Outcome 2
Sept. -June	Industry/business partner interactions (i.e. co-teaching, power lunches, student lessons at work sites established)	Outcome 4
Sept.-Oct.	Students technology readiness, and establish online CRLS portfolios; Informal and academic student supports posted and confirmed with students	3-b, 3-c, 3-d
Oct- Jun Ongoing	Student job related experiences posted, Engineering Club established	3-b, 3-d

Oct'12 – May '13	ThinkReady Performance tasks begin as formative assessment tool	3-a
Oct. - May	School to Career staff complete monthly industry partner reports	Outcome 4
Nov. '13- May'13	OAKS testing for juniors and seniors that did not meet as juniors.	3-c
Jan. '13	Online practice Career tests for students to prepare for National Career Readiness Certificate exam	3-d
Jan. '13	Two or more teachers complete CTE endorsement process	Outcome 2
Spring '13	ODE Career Cluster industry skill set assessments	3-d
Spring '13	Student STEM post survey	Outcome 1
Spring '13	Student enrollment in CTE and STEM pathways scheduled for 2013-2014 year	Outcome 1
June '13	Student STEM presentations/ Sustainability cycle determined	3-c

F. Evaluation

The project director, assisted by the project coordinator, and STEM Partnership Coordinator, will oversee data collection and make progress reports to the ODE and the STEM Implementation Board. Data will be collected on the achievement of outcomes, using the following methods:

Outcome	Evaluation Method
1. Engagement	Student surveys administered by counselors to 9 th and 10 th graders to assess intent to enroll, and student surveys administered to 12 th graders to measure increased interest in STEM professions (SKILLS)
2. Training	Teacher documentation of attendance at professional development sessions and their CTE endorsement, and reflection reports on the extent of their meeting their STEM Expertise Goals
3. Rigor: 3-a Alignment of courses	Course syllabi review by the STEM Curriculum Specialist to assess vertical alignment within CHS courses. On-line survey of higher education faculty to assess alignment to postsecondary courses.
3-b Alignment with industry	A task force of the Partner Implementation Board will review teacher course syllabi to measure the extent of alignment with industry standards. Teachers will complete industry partner reports of authentic STEM learning opportunities included in each course.
3-c College Readiness	<i>Foundational content</i> will be measured by OAKS tests in math and science. Thinking skills will be measured by the innovative EPIC ThinkReady system which serves as a tool for both instruction and formative assessment.
3-d Career Readiness	Measured by the rubric, "Critical Engineering Skills for Success" (CESS) to be designed by a task force of the Partner Implementation Board (consisting of industry partners, CHS teachers and the district's STEM Coordinator)
4. Partnerships	Teachers and school-to-career staff will complete industry partner reports that detail the frequency and roles of involvement by industry partners on a regular basis.

See *Appendix E* for details about assessment of the three tiers of learning that will take place simultaneously in the new CTE program, as well as the ThinkReady system and Engineering skills rubric.

III. PARTNERSHIPS

In **developing the proposal**, we held meetings with *education and industry leaders* who advised on recruiting partners, roles for partners, components to strengthen the curriculum, and Advisory Board structure. These included state board of education member, Art Paz; Chamber of Commerce representative Sheryl Balthrop; former mayor, industry leader Jim Torrey; OSU College of Education Dean, Larry Flick; UO EPIC senior scientist Dr. Terri Ward; and Regional CTE Coordinator Kristin Gunson.

A three-way partnership between CHS, industry, and higher education will guide program **implementation**, to ensure **relevance** and **rigor** through an unprecedented level of involvement by STEM industry professionals and postsecondary faculty.

We anticipate the role of partners in implementing the project to be the following: STEM Advisory Board. Approximately 12 STEM industry and education (9-12; and postsecondary) representatives will meet quarterly to provide input, ideas, advice and resources to guide the district's STEM initiative and the growth of the CHS E&D path of study. The board will assist in sustaining industry involvement to ensure the industry-centered design of the program in the long term. They will connect the CHS program with regional CTE and STEM needs and opportunities, and guide efforts to expand the scope of the STEM CTE program into other grade levels and across the district.

Partner Implementation Board. More "hands-on" than the Advisory Board, this group of about 15 STEM industry and education representatives will meet 1-2 times per month. They will oversee the implementation process, helping to resolve issues, seize opportunities, and monitor progress toward outcomes. Special task forces will work on standards, course alignment, STEM project development, and partner recruitment.

Alignment to four-year college readiness. To ensure full vertical alignment within CHS

and with regional four-year postsecondary institutions, trained facilitators from the University of Oregon EPIC will facilitate regular meetings between CHS teacher teams and faculty of regional colleges such as OSU, UO, and OIT. The partners will focus on developing and redesigning courses that focus on STEM preparatory content and skills to ensure that CHS graduates are fully prepared to succeed in the rigorous postsecondary STEM majors at those institutions. Higher education faculty, paid a modest stipend, will serve as consultants to ensure content and skills in the courses are aligned with entrance requirements at their respective institutions, and CHS teachers will “map backwards” to align exit/entry standards of all courses along their STEM pathways, a process begun last year. *See Appendix C for a full description.*

College and career pathways. New and enhanced CTE courses will be identified by Lane Community College (LCC) to be given *College Now* status for dual credit. LCC will facilitate articulation of new and enhanced STEM courses with LCC courses by inviting teachers to visit related LCC classes (such as Robotics) and collaborate with faculty. CHS will identify connections between their CTE POS and LCC Career Pathways in STEM areas such as Drafting. We will meet with postsecondary representatives to ensure that students have various options for postsecondary study, and will create CHS Pathway Roadmaps to several two- and four-year degrees and certificates, such as Engineering at Oregon State University, Biology at University of Oregon, Civil Engineering at Oregon Institute of Technology, and Manufacturing Technology at Lane Community College.

STEM instruction. The central partnership strategy in instruction is teacher collaboration with STEM industry professionals to infuse “contextual learning” into our

curriculum. Partners will collaborate to align curriculum with industry standards and current workplace skill needs. With teachers they will co-develop and co-teach authentic problem-solving tasks and collaborative engineering projects that directly contribute to real projects in our region –ranging from single-class period activities to full-scale, multi-week project. In co-teaching, professionals will guide students in design, use of advanced technology and specialized equipment, effective teamwork, and role-playing in real industry occupations.

Over the course of the year, industry partners will guide the district in renovating and equipping an existing 11,500 SF facility to build a new, state-of-the-art engineering learning studio that is designed to replicate features of the real workplace. Serving as the center for STEM learning and partner interface, the studio will include features such as design team stations and engineering lab open space. Industry partners will donate or loan equipment and materials where possible. As part of this project, we will purchase current technology (hardware and software) and engineering equipment/tools, including CNC and CAD software, a CNC Machine, a 3D large-scale printer, oscilloscopes, machine equipment, Vernier probes, MacBook laptops, and other items.

Industry partners will host student teams and individuals at their workplace in familiarization with occupations and engineering functions, and practice in real-life, hands-on engineering as part of single-class activities, multiple day projects, and internships. Every student will be placed in an industry workplace for a required internship that consists of a minimum of 24 hours. Field trips to LCC's RTEC Center will provide hands-on engineering simulation using the college's new Amatrol simulation systems in engineering and manufacturing.

Since participation in opportunities outside campus will require easily available student transportation, an important component of the project is a van for school staff to drive students to worksites, competitions, and internships.

Professional development. At least ten industry partner firms will host STEM CTE teachers in weeklong immersion internships at their workplace. Teachers will be immersed in design, research, problem solving, teamwork, communication, experimentation, and other types of activities that comprise the daily work of STEM professionals. *See Appendix D for a list of partners in the existing POS at Churchill.*

Oregon State University's Center for Research in Lifelong STEM Learning will conduct a STEM orientation workshop and a series of STEM instructional workshops for teachers. Lane Community College's High School Connections Liaison will provide assistance to teachers and industry partners in developing industry-relevant STEM learning activities and assessing student performance. *The **ongoing role** of the partners is described in the "Sustainability" section.*

IV. BUDGET

C. Sustainability

We envision the *E&D* CTE program growing as new courses are developed and more students enroll because they are attracted to the engaging, authentic learning mode. We will sustain STEM professionals' involvement by ensuring that time demands are reasonable the first year, and by continuing to add new partners during the project. The Advisory and Implementation Boards will provide ongoing ties to industry and will be a forum for new program ideas to emerge. Partners in this project have indicated their long-term commitment, and in-kind and monetary contributions will be sought each

year. The investment made in aligning STEM CTE courses to college and career readiness standards will help promote student achievement every year as teachers repeat teaching courses. Staffing the new POS required only one (half-time) teacher so it is less vulnerable in future staffing cuts. Equipment will be maintained by current staff.

Ethnically and socioeconomically diverse, Churchill is well suited to lead the state in modeling how diverse students learn STEM and plan for future careers. Churchill will become a regional center known for its assets – rigor in courses with pervasive STEM opportunities; extensive interaction with real engineers and their projects; and a well-equipped, hands-on learning space.

V. BONUS SECTIONS

B. Entrepreneurship. In the new Environmental Engineering & Design course of the *Environmental Sciences* POS, students will design, plant and sustain a working orchard on the front lawn of the school's campus. The authentic project will focus on entrepreneurship, with students selling a portion of the fruit and nuts that are grown. Planning and operating the orchard as a business, students will acquire first-hand experience in projecting costs and income; deciding which products to cultivate to meet demand; testing labor methods for efficiency; setting prices; planning community distribution and marketing; and forecasting weak harvests and long-term growth. The project might involve setting up a "Farmer's Market" on school grounds.

The orchard would create a meaningful connection with the schools' neighborhood, as community members participate in harvesting and summer upkeep. Both students and local markets would benefit if students interacted with grocers and farmers markets to

provide goods for sale. Fresh produce could be supplied for free to community members in need, as well as be a source of local, fresh fruit in the school's cafeteria.

The district's maintenance staff is enthusiastic about a student-maintained orchard, and would assist by providing equipment and training. Students would acquire business knowledge and skills from the involvement of local businesses, including orchards and farms, farmer's markets, grocers, as well as guidance from environmental engineer partners on this project to design a water-catchment system and other structures to offset or support the irrigation systems. Other partners might include UO Landscape Architecture, Open Source Ecology, School Garden Project, Victory Gardens and Healing Harvest, and Food for Lane County.

C. Student Diversity

There are several specific activities within this project that are intended to recruit and support female, minority and economically disadvantaged students – groups that are traditionally underrepresented in STEM high-wage fields. First, with the introduction of new rigor in math, science and STEM CTE courses, there will be increased academic support such as progress monitoring, tutoring, and intervention classes. Project partners at Lane Community College's TRIO have agreed to provide tutoring to our high needs students in STEM/Engineering courses.

For recruitment to the new and enhanced POS, counselors will meet with all 10th, 11th and 12th grade students to plan enrollment. During these meetings, staff will identify barriers they observe from students of underrepresented groups, and will develop a

plan of action to improve programs and services. We will present orientations about the STEM POS for girls and minority groups during student club meetings.

During the Career and College Knowledge course in which all 11th and 12th grade CTE students are enrolled, sessions focusing on STEM fields will be presented to introduce students to the college and career pathways. STEM/engineering industry partners will present as guest speakers and provide career guidance in AVID support classes and at college and career information nights for CTE students and families. Female senior staff of Balzhiser & Hubbard Engineers have agreed to speak and co-teach in classrooms, serving as role models for girls. The school's "AVID" classes for students who will be the first generation to attend college in their family will include modules on STEM/engineering fields, field trips to colleges and businesses, and guest speakers.