

Grand Challenges Scholars Program
University of Portland
Shiley School of Engineering

Dean: Sharon A. Jones, Ph.D., P.E.
GCSP Director (and Associate Dean): Dr. Mark Kennedy, Ph.D., P.E.
5000 N. Willamette Blvd
Portland, OR 97203
503-943-8070
kennedy@up.edu

Dean Signature: _____



GCSP Director Signature: _____



Submitted: February 2017

University of Portland Grand Challenges Scholars Program

Introduction: This document describes the implementation plan for a Grand Challenges Scholars Program (GCSP) at the University of Portland's (UP) Donald P. Shiley School of Engineering. This document meets the requirements for the National Academy of Engineering (NAE) GCSP Operational Document and describes the UP context, the UP GCSP Program elements, and the organizational structure for implementation.

The NAE released a list of fourteen "Grand Challenges" that must be addressed in order to achieve a sustainable, economically robust, and politically stable future for our children and grandchildren. These challenges range from the most basic of human needs to the extraordinary. Developing solutions for the Grand Challenges will require a new generation of college graduates who will collectively:

- Create new capabilities,
- Provide pragmatic solutions for basic human needs,
- Develop new entrepreneurial opportunities,
- Reinvent human interactions,
- Transform systems thinking,
- Be the architects of a sustainable society,
- Be mindful of unintended consequences, and
- Connect technology with society,

The UP Grand Challenge Scholars Program (GCSP) is premised on the belief that undergraduates need to acquire the disciplinary expertise, breadth of knowledge, and social, ethical, technical, and environmental awareness to successfully address these challenges.

The UP Context: UP is a masters comprehensive institution with a robust and extensive liberal arts core curriculum required for every undergraduate student. The University currently enrolls over 3,700 undergraduate students along with 500 graduate students. Our affiliation with the Congregation of the Holy Cross is strong, and as such we are a faculty dedicated to the education *of the whole person*, as espoused by Blessed Basil Moreau, founder of the Order. As a mission-based institution, we combine strong academic programs within a community of scholars who are dedicated to improving the human condition. In 2014, UP was named to the President's Higher Education Community Service Honor Roll, ranked fourth in 2015-16 as a top producer of Fulbright student awardees, and in 2016, *Forbes* placed UP at 18 in its national ranking of the 21 Top STEM Schools.

The Shiley School of Engineering is an integral part of the University with an undergraduate enrollment of 720 undergraduate students across the four traditional majors: Civil, Electrical, Mechanical, and Computer Science. Because of the rigor of the engineering curricula combined with the extensive University core curriculum, students do not have much flexibility in terms of choosing electives. Given these constraints, we strive to meet a vision that prepares students to be innovative professionals with the technical excellence, social integrity, environmental consciousness, and leadership traits essential to identify and solve the world's problems. This vision directly aligns with the goals for the GCSP. Recent changes within the Shiley School have focused on creating innovative learning opportunities that help students persist in engineering and sustain their curiosity for learning. One example is our intentional effort to improve freshman and sophomore retention over the last three years with a NSF-funded multi-stage program focused on at-risk students. Several faculty have been involved with several *ethics-across-the-curriculum* projects as part of the *Dundon-Berchtold Program* that supports faculty-student research and curricular projects related to applied ethics, and we make extensive use of problem-based learning in our *Introduction to Engineering* course. In addition, the Shiley School restructured its

curricula four years ago to allow for multidisciplinary senior design projects and these projects have proved to be a popular option for students with approximately 25% of all projects including students from at least two majors. Faculty collaborate extensively on several School-wide courses including the first-year sequence and several junior-level courses. Excellent undergraduate teaching is the primary evaluation measure for faculty hiring and promotions.

The University supports many co-curricular activities that are synergistic with the Shiley School's vision and the GCSP goals. UP's Franz Center for Leadership, Entrepreneurship, and Innovation hosts a 100K Business Venture Challenge every April. The Franz Center also offers a Scholars Program to help students gain an immersion in entrepreneurship, and a second program to help students gain leadership skills with an emphasis on servant leadership. For the first time in 2016, student leaders in the Shiley School worked with the Franz Center and the Student Entrepreneurship Club to host a Create-a-Thon --- a 24-hour event where student teams came together to solve challenges related to a theme of environmental sustainability with judges from industry. The Shiley School has developed several international experiences that allow students to gain intercultural exposure as part of a four-year degree with over 25% of 2015 engineering graduates participating. And, the Shiley School has recently developed a robust summer undergraduate research program. In terms of service, the Moreau Center supports numerous local, regional, and global service-learning programs that are popular with students, while many engineering student clubs include community service as an integral part of their missions.

Program Elements: The GCSP at UP requires that each student completes five components designed to prepare him/her to successfully contribute solutions to the Grand Challenges. To allow as many students to participate as possible, we designed the GCSP to include various options for most of the components along with various levels of depth. Components designated at the expertise level include a direct connection to a Grand Challenge that helps the student to develop higher order competencies of application, analysis, evaluation, and/or creation. Components designated at the exposure level provide students with the breadth needed to understand Grand Challenges. The basic structure for the proposed program is outlined below (note that each component is required for all GCSP scholars):

1. **Creative Learning Experience** (Expertise Level Only)
2. **Interdisciplinary Experience** (Exposure Level Only)
3. **Entrepreneurship and Innovation Experience** (Exposure and Expertise Levels)*
4. **Global and Cross-Cultural Perspectives** (Exposure and Expertise Levels)*
5. **Social Consciousness Through Service-Learning** (Exposure Level Only)

* Either component 3 or 4 **must** be completed at the **expertise** level

The culminating component of the program is the creative learning experience that has to be pre-approved by the GCSP Director; this is where we expect students to bring together the competencies gained from the other four components to examine a Grand Challenge in depth.

Where applicable, we will create lists of specific courses and experiences that are approved for this program to help students more easily navigate the program. In addition, we will create rubrics both to help the GCSP Steering Committee (makeup of this committee described later) evaluate if a component has been successfully met, and templates to help students understand what is expected for each element of the portfolio. If a student wishes to complete elements other than the approved program components, s/he needs to submit a formal request to the GCSP Director. The Director may approve or modify alternative program elements in consultation with the GCSP steering committee. By developing pre-approved lists and rubrics, along with a flexible pathway to completion that minimizes extra courses beyond the curriculum, we designed the GCSP Program so that it is accessible to a diverse student body and we can grow it over time in a sustainable manner.

As adapted to the University of Portland context, these five GCSP components include:

1. A pre-approved **creative learning experience** connected to a single Grand Challenge. Pre-approval for this experience must be obtained from the Director. Three alternatives for the creative learning experience are proposed:

Expertise Level Only

- Students can complete this component as a **senior design capstone project**. Because of the Shiley School context (undergraduate focus), senior design teams typically include two to four students working on a substantive year-long, real-world project with both a faculty and industry advisor. Most capstone projects result in a working prototype. Students are appropriately matched with projects and teams during the spring semester of the junior year. The coordinator for the senior design program anticipates working closely with the GCSP Director. As such, students pursuing the GCSP designation can develop an appropriate scope of work related to a single Grand Challenge with pre-approval from the GCSP Director.

The student team will participate in the annual Founders Day events; a day set aside in April with no classes so that seniors can showcase their capstone experiences to external audiences via oral and/or poster presentations. All students accepted into the GCSP will be strongly encouraged to attend the Founders Day showcase.

Faculty advisors who mentor students on GCSP projects will receive a \$1,000 stipend. In the early years of the GCSP Program, students may receive special permission to work solo (without a team) to meet the requirements for this component.

- Alternatively, this component can be completed with a **paid 10-week summer research project** focused on a single Grand Challenge with a faculty advisor. Once again the advisor will receive a \$1,000 stipend to mentor the student. The pre-approval for this option occurs as part of the application process for summer undergraduate research students during the spring semester. These students will also be required to showcase their work during Founders Day.
- Lastly, students can complete this component by taking a **directed study course** for a minimum of three credit hours. As with the other two alternatives, pre-approval will be required along with the identification of an academic adviser who will receive a \$1,000 stipend to mentor the student.

With either option, the deliverable products (written report, posters and oral presentations) will require students to extensively reflect on how their capstone, research or directed study experience contributed to solving one of the grand challenges.

The creative learning experience will provide the primary opportunity for faculty supervision of student work related to the GCSP. The Director will form a GCSP “teaching circle” which includes all faculty who are mentoring GCSP students as part of the students’ creative learning experience. Similar “circles” have been successfully used for outreach to untenured faculty who need guidance developing a habit of successful teaching and scholarship. These GCSP circles will meet regularly to facilitate discussion and the exchange of ideas among GCSP faculty regarding best practices in the context of the GCSP.

2. **Authentic experiential learning that must include interdisciplinary experience** in fields such as public policy, business, law, medicine, and ethics.

Exposure Level Only

As noted earlier in the description for the UP context, all majors complete the same core curriculum which is a rigorous and extensive liberal arts core of 39 semester credits that includes 30 semester credits of humanities and social science courses. One of the objectives of the **UP core curriculum** is to help students view complex issues from multiple lenses. Students pursuing the GCSP designation will be required to establish a connection between their experience in two core curriculum courses to a grand challenge. One of these two courses must be **Ethics** with the second course being selected by the student from the following: **History, Theology, Social Science, Literature, or Fine arts**. Students will demonstrate a connection by:

- Completing a required assignment for the core elective course that has embedded elements of a grand challenge, or
- Writing a reflective paper related to the grand challenge in addition to the normal course requirements.

Either option will require prior approval by the Director and student deliverables will be included in their GCSP portfolio and evaluated using a rubric (to be developed). For example, consider the challenge of *Advancing Health Informatics*. A student could explore ethical dilemmas such as patient privacy versus the benefits of increased efficiency in medical care. This same challenge could also be explored through the lens of another core elective such as “Introduction to United States Politics” where the student could address the implementation of a systematic approach to health informatics within a particular political system.

3. **Entrepreneurship and innovation experience** such as the start-up of a new venture, dissemination of technology, or coursework in entrepreneurship (Either component 3 or 4 must be completed at the expertise level).

Expertise Level

- Completion of the **E-Scholars Program** which is a 3-course sequence for students focused on entrepreneurship that requires students to select a venture to explore in detail over one to two years. The program includes an international component and culminates with participation in a 100K Venture Competition. All GCSP students who use the E-Scholars Program to fulfill component #3 must select a venture that is focused on a single Grand Challenge and invite the Director to the 100K Venture Competition where the project will be evaluated using a rubric (to be developed). Participation in the E-Scholars Program is by application only, though selection has not been competitive to date. In addition, students are charged a participation fee. For students in the GCSP Program, a 50% need-based scholarship will be granted by the Shiley School to offset the fee.
- Participation in the **University Innovation Fellows Program**. Once again, acceptance to this Program is by application and the fees are paid by UP. Students who want to use this option for component #3 must apply this experience to a single Grand Challenge and write an extensive reflective paper or provide an oral presentation in a public forum for their GCSP portfolio. The Director, with help from the Steering Committee, will evaluate this reflective paper/presentation using a rubric (to be developed).

Exposure Level

- An undergraduate course that focus on entrepreneurship and/or innovation, i.e., courses with ENT or INV designations, or relevant Business courses (a pre-determined list will be developed).

- Participation in the annual Franz Center 24-hour Create-a-Thon (a maker thon) that will focus on a Grand Challenge theme.

In either option, the student will be required to write a reflection paper addressing the connection to a single grand challenge.

4. **Global and cross-cultural perspectives** gained through experiences that promote involvement with globally complex issues in unfamiliar environments, such as a semester abroad (Either component 3 or 4 must be completed at the expertise level).

Expertise Level. Students must write a reflective paper for their GCSP portfolio that applies one of the experiences below to examine a single Grand Challenge. The Director with help from the Steering Committee will evaluate this reflective paper using a rubric (to be developed). Small need-based scholarships will be available for GCSP students who select one of the below.

- 10-week international summer research engineering project
- Engineering semester abroad
- Engineering summer term abroad
- International engineering internship

Exposure Level

- Global Engineering or International Structures (EGR430 or CE 456), both elective courses.
- E-Scholars Program (described above and includes a one-week global immersion as part of one of the required courses)
- Moreau Center Service plunge (1-week to 3-week service projects in communities that are very different culturally from UP)
- Service club international immersion projects with travel e.g., Engineering World Health, Engineers Without Borders, Bridges to Prosperity
- Other study abroad experiences not connected to engineering

All GCSP students who use the E-Scholars Program to fulfill component #4 at the exposure level must select a venture that is focused on a single Grand Challenge and invite the Director to the 100K Venture Competition where the project will be evaluated using a rubric (to be developed). For other options, the student will be required to write a reflection paper addressing the connection to a single grand challenge.

5. Development of **social consciousness through service-learning**, such as problem-based community projects that foster an appreciation of the impact of engineering and its role in serving human welfare and the needs of society

Exposure Level only

- A semester-long or other significant engineering service club project. There are many options to choose from including some that also meet the exposure level of component 4.

The student will be required to write a reflection paper addressing the connection to a single grand challenge.

Two of the GCSP components may be combined for curricular connectivity, e.g., E-Scholars meets the expertise level for component #3 and the exposure level for component #4. Similarly, the service-learning experience can be associated with an international community, meeting both components #4 and #5 at the exposure level. As the GCSP Program matures, we expect to add additional options for each component.

Student Application, Selection and Matriculation: When accepted to the Shiley School, the Dean's letter will include an invitation to apply to the GCSP. An invitation to apply to the GCSP will also be sent by the Associate Dean's Office to all freshman and sophomore students during each fall semester. Students accepted to the program will be required to maintain a minimum GPA of 2.75. If a student drops below that GPA, he/she will be given a probation semester to improve their GPA to at least the minimum level. Students will be required to submit the following as part of the application:

- A short essay demonstrating their understanding of the program and why they want to participate and how the program will impact them after graduation.
- A preliminary plan for completing the pre-approved components of the program (at both the expertise and exposure levels), or proposed alternative components with accompanying rationale. Pre-approved, or proposed alternative components selected by the applicants should align with expected outcomes stated in the essay. There will be a designated form to help students complete this preliminary plan. It is expected that the plan will change over the course of four years since it will be difficult for the student to anticipate senior design projects, research experiences, etc., however the preliminary plan will provide a baseline for subsequent advising.

Applications will be reviewed by the GCSP Steering Committee consisting of the following:

- Associate Dean who is the Director for the Program.
- One faculty member from each of the four degree programs.
- One member of Industry: A member of the University of Portland Engineering Advisory Council (UPEAC) will be identified who can provide feedback.

Acceptance to the program will be based on the merit of the essay and preliminary GCSP plan. By the mid-point of the final semester of their senior year (or the semester in which they graduate), students will submit a portfolio that demonstrates their successful completion of the GCSP requirements. It is up to the students to use the portfolio to articulate how each of their experiences meets the requirements. Any deviations from the preliminary plan must have prior approval by the Director (on the designated form). The Director (with input from the GCSP Steering Committee) will make the final decision designating the student as a Grand Challenge Scholar.

With the proposed recruiting plan, students will have two chances to apply, once in the freshman year and once in the sophomore year. We will not establish a minimum or maximum number of students in the pilot program.

Students will not be accepted to the program without an approved preliminary GCSP plan which includes pre-approved activities. That plan will serve as the contract while in the program and will be reviewed every semester. All elements of that plan must be completed to the satisfaction of the Director and GCSP Steering Committee in order for the student to be recognized as a Scholar. Students will be allowed to alter their plans, but only with the prior approval of the Director. In order to avoid review of the entire portfolio at the end of the senior year, students will be encouraged/required to seek official confirmation of specific components when curricular activities associated with that component are completed, so that at the end of the senior year, only the most recently completed activities need to be reviewed by the Director. At the end of the fall semester of the senior year, a letter will be sent to all potential GCSP candidates notifying them of the components of their plan that remain uncompleted and the deadline for their completion (hopefully avoiding last minute confusion). In the case of particular courses, the final GCSP designation may not be known until two days before commencement when the final grades are processed by the Registrar's office.

Program Management: The Associate Dean for the Shiley School of Engineering will serve as the Director for the program, and will advise those students who are accepted to the program. The GCSP Steering Committee will provide institutional oversight. The Director will track student progress and keep

records. The Director will be the point person for students in the Program. As that point person, the Director will facilitate all communications and outreach between students, faculty and mentors. Portfolios will be submitted to the Director.

The Dean's Office will host social events at least twice per semester to facilitate interaction and community building among the Scholars. As stated earlier, the Founders Day Showcase will be a time to celebrate the creative learning experiences by the seniors and will be highlighted for all students in the GCSP.

An integral member of the Associate Dean Staff is the Program Specialist. Her current responsibilities include marketing and outreach for admissions, student organizations, freshman orientation, etc. She will develop marketing strategies for the program to include, but not be limited to, informational meetings with pizza (always a big draw with students), visitations to the first-year student workshops taken by every engineering/computer science student, and staffing a booth at the Student Activities Fair held during the first week of classes.

Initially, mentorship for the students will be provided entirely from the GCSP Steering Committee. In future years, upper division students in the program as well as program alumni will be used as peer mentors. The Director with assistance from the Program Specialist will provide feedback on student portfolios at the end of each semester.

The Shiley School of Engineering has an endowment to support special student projects, including material costs, travel, etc. Some of these funds will be used to support GCSP students. The School of Engineering will work with the Office of Development to make GCSP a priority in fund raising activities.

Timeline: The following timeline has been developed for this program:

High school senior year:	Dean sends invitation letter to all students admitted to Shiley School of Engineering (November – March). Prospective students are also invited as part of the final UP recruiting event (Weekend on the Bluff) in mid-April.
Freshman fall semester:	First program application deadline on Friday of final exam week – students notified of decision on first Friday of spring semester.
Freshman spring semester:	Second program application deadline on Friday of final exam week – students notified of decision on May 31.
Sophomore/Junior years:	All portfolio products for the current academic year are submitted to GCSP Director by May 15 – feedback provided to students no later than August 15.
Senior year:	Final portfolio turned into Director by Friday before spring break Presentation of Creative Learning Experience products on Founder's Day (Early April).

Assessment and Expected Outcomes: Those who complete the GCSP will be able to:

1. Contribute solutions to the Grand Challenges as undergraduates;
2. Recognize the contributions from multiple fields to the development of solutions for complex problems;
3. Form networks with other GC Scholars at University of Portland, and within the national network of GC Scholars at other U.S. institutions; and
4. Interact with academic, public policy, health, and corporate leaders engaged with the NAE Grand Challenges.

One aspect of UP's assessment process will be to conduct a **focus group** with the GCSP participants during their senior year that directly addresses the four outcomes above. We will also use this focus group for evaluative information that we can use to improve the program over time. In other words, the focus group results will be both formative and summative.

The Shiley School of Engineering conducts an **annual survey** of the alumni who are five years past graduation. We will include several questions on the survey for alumni who participated in the GCSP to self identify. We will compare the alumni data for the GCSP cohort versus the complete results.

Transcripting: We will initiate the Program during academic year 2017-18. We will involve the faculty in an effort to formalize the Program as part of the University Bulletin with designation on a student's transcript.