GRAND CHALLENGES SCHOLARS PROGRAM

OKLAHOMA STATE UNIVERSITY

COLLEGE OF
Engineering, Architecture and Technology

GRAND CHALLENGES
AT OKLAHOMA STATE

The College of Engineering, Architecture and Technology (CEAT) Grand Challenge Scholars Program (GCSP) is a combined curricular and extra-curricular program with five key components that are designed to prepare students to be the generation that solves the grand challenges facing society in this century.

In 2008, the National Academy of Engineering (NAE) identified 14 Grand Challenges for Engineering in the 21st Century. The challenges address opportunities and challenges affecting quality of life.

In a letter of commitment presented to President Barack Obama in spring 2016, the College of Engineering, Architecture and Technology announced plans to educate a new generation of engineers expressly equipped to tackle these 14 most pressing issues facing society today.

CEAT is already actively engaged in the curricular components represented by the program; however, GCSP students, in cooperation with faculty mentors, industry, and government, will begin leading the expansion of the tenets of the Grand Challenges through industry backed design projects, GCSP focused research efforts, scholarly publications, and enhanced leadership training that recognizes the diversity of both our nation and the global community.

With the formal implementation of the GCSP, CEAT will focus one of its scholars programs on an educational target that integrates research, interdisciplinary curriculum, entrepreneurship, global understanding and service learning, attracting a diverse cohort of students who will embrace innovation and collaboration through sustainable and affordable solutions to global issues like those outlined below.

NAE 14 GRAND CHALLENGES IN ENGINEERING	UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS
ENERGY AND THE ENVIRONMENT	
- Make solar energy economical - Provide energy from fusion - Manage the nitrogen cycle - Provide access to clean water - Develop methods for carbon sequestration	- Ensure access to water and sanitation for all - Ensure access to affordable, reliable and sustainable energy for all - Ensure sustainable consumption and production of natural resources - Take action to combat the impacts of climate change
HEALTH	
- Advance health informatics - Engineer better medicines	- End Poverty in all forms - End Hunger, achieve food security - Improve nutrition & sustainable agriculture
SECURITY AND SOCIETY	
- Restore urban infrastructure - Prevent nuclear terror - Secure cyberspace	- Build resilient infrastructure and promote sustainable industrialization - Participate in global partnerships for sustainable development
LEARNING AND COMPUTATION	
- Reverse engineer the brain - Enhance virtual reality - Advance personalized learning - Engineer the tools of scientific discovery	Ensure inclusive and quality education for all

BECOMING A GRAND
CHALLENGE SCHOLAR

This operational plan sets forth the principles by which students are selected and mentored in the program, as well as the requirements they must meet to be designated a Grand Challenge Scholar. The plan also addresses the funding of the program.

Students interested in the Grand Challenge Scholars Program must have demonstrated academic excellence within the college (minimum college GPA of 3.2 with at least 18 CEAT credit hours) to apply, as academic achievement is an important component of success in any of our scholars programs. However, the student's response on the proposed GCSP portfolio and evidence of a commitment to the program will be major factors in considering prospective applicants. To apply for the Grand Challenge Scholars Program, each student must meet the following requirements:

1 **Have professional school standing in the College of Engineering, Architecture and Technology with a least 30 semester credit hours remaining until graduation.**

2 **Complete an application form by October 1 and have a valid passport at the time of submission.**

3 **Submit a commitment form from the student's GCSP Mentor.**

4 **Propose a GCSP portfolio described below encompassing the five required components in the NAE Grand Challenge Scholars Declaration of Principles.**

APPLICATION PROCESS

The online application and proposed portfolio can be submitted in either the students Sophomore or Junior year and must be submitted by October 1, prior to the start of their final 30 credits and the start of a senior design course or Honors Thesis. The GCSP portfolio (see appendix on page. 11) must address the 5 key components of the program.

<div align="center">

Research
Interdisciplinary Curriculum
Entrepreneurship
Global Awareness
Service Learning

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The GCSP Oversight Committee will review all applications and recommend students for admission to the program based on portfolio submission, faculty mentor's recommendation, and scholastic standing. Successful candidates will be notified of their acceptance to the program within 30 days of submission. Based on the initial $1 million endowment, the GCSP expects to maintain 20-50 students per year and graduate ~20 GCSP Scholars per year.

GCSP MENTOR

Each applicant must select a GCSP Mentor (i.e., engineering faculty member) who will guide the student through the entire GCSP Scholars program. The mentor will review the student's initial portfolio and submit a letter of commitment with the student's application to the Oversight Committee. Scholars are required to meet with their mentors every semester to provide progress updates on their present program and to plan for the next semester's goals. Upon conclusion of the program, the GCSP Mentor must write a letter of completion to the GCSP Oversight Committee in support of the GCSP application to be named an Oklahoma State University Grand Challenge Scholar. Once identified, all prospective GCSP Mentors will be given guidance on the Grand Challenges, select UN Sustainable Development Goals and the GCSP prior to submitting the letter of commitment.

To remain in the program GCSP Scholars must:

1 Meet at least twice a semester with their GCSP Mentor

2 Submit a progress report (once a semester) to their GCSP Mentor, to be signed and forwarded to the GCSP Director, outlining their accomplishments for the past academic semester and detailing their plan for the upcoming academic semester

3 Attend GCSP Seminars/Presentations at least twice a semester, organize one before graduation

4 Present their research project at a summit, symposium or at the National GCSP Summit during their senior year of school

Before or during the final semester of study, GCSP students must:

1 Submit a final report (10-20 pages) or Honors thesis to the GCSP Committee verifying the completion of the Plan

2 Forward a signed letter of completion from their GCSP Mentor to the GCSP Director

3 Conduct a capstone or Honors presentation to share their experiences and information about the Grand Challenge Scholars Program

4 Submit a GCSP exit interview form on the program's impact and potential changes in the program

The final report should define the means of the completion of each of the five curricular requirements of their plan and the overall focus of their work, describe the breadth and depth of their specific program. The GCSP capstone presentation must be completed within the last two semesters of the student's remaining time in school. This presentation should summarize the completion of the requirements, the research/project component. It is expected that students in the GCSP will present their work and network with other GCSP scholars at one of the local or regional GCSP Summits or research symposia in order to connect with students in the GCSP from other engineering schools. The final GCSP portfolio or completion checklist must be completed by the close of the semester in which the student graduates.

PROGRAM SEQUENCE

The GCSP allows students to choose the path most desirable to their academic needs. There is no specific sequence for completing the program; however, they will be encouraged to complete components of it before they officially apply for the GCSP designation.

A typical model for successfully carrying out all the requirements is shown below:

First Year:

1 **Learn more about the 14 Grand Challenges: introduced during the freshman course ENGR 1111 and through other College specific marketing efforts**

2 **Participate in the Freshman Research Scholars Program or other undergraduate research https://scholardevelopment.okstate.edu/undergraduate-research/**

3 **Start earning the CORD for service learning at OSU or participate in other service learning activities**

Second Year:

1 **Select one of the 14 Grand Challenges or UN that will be your area of focus**

2 **Find a faculty professor who will serve as your mentor**

3 **Working with your mentor and academic advisor, identify the classes, experiences, or activities that you have done since your first year at OSU, are doing presently, or plan before graduation to do as part of your portfolio.**
Examples include:
- Being active in Engineers without Borders or enrolling in a study abroad course
- Seeking an internship or CO-OP rotation
- Exploring research projects in the Niblack or Wentz Research programs
- Participating in an entrepreneurial project

Third Year:

1 **Finish your Grand Challenge Scholar Portfolio and Submit your application by October 1**

2 **If selected as a Grand Challenge Scholar or planning to submit your application the following year, continue to work on your portfolio.**
Examples include:
- Complete research projects, study abroad assignments, or entrepreneurial experience
- Take appropriate class(s) in the Interdisciplinary Curriculum
- Perform second summer internship rotation

3 **Attend a local or GCSP regional summit**

Fourth Year:

1 **Complete research project and present findings**

2 **Attend National Summit**

3 **Complete appropriate class(s) in the Interdisciplinary Curriculum**

4 **Submit final report(s) Grand Challenge Senior Thesis/ Honors thesis**

5 **Prepare and present capstone presentation**

REQUIRED GCSP PORTFOLIO COMPONENTS

The importance of a student's experience in the Grand Challenges Scholars Program is based upon the completion of the 5 curricular components, tied either specifically or thematically to Grand Challenge or select UN Sustainable Development Goal focus topics.

Scholars are required to undertake one (1) element in each of the following breadth components:

1 **Research**

2 **Interdisciplinary Curriculum**

3 **Entrepreneurship**

4 **Global Awareness**

5 **Service Learning**

In addition, scholars are required to undertake two (2) or more elements in each of the following depth components:

1 **Research**

2 **Interdisciplinary Curriculum**

3 **Choose one (1) element from the following**
   a. Entrepreneurship
   b. Global Awareness
   c. Service Learning

While not all inclusive, the following elements are typical elements in the GCSP:

Research Elements

1 **Approved team (or individual) research or senior design project related to GCSP topic**

2 **Research Experience for Undergraduates (REU) related to GCSP topic**

3 **Research work experience for a Summer or semester (e.g., Research Assistant)**

4 **University Honors Program - Undergraduate Research Symposium**

5 **Approved interdisciplinary research programs related to GCSP topic**

Interdisciplinary Curriculum Elements

1 **Research experience with an interdisciplinary focus**

2 **Course(s) relating to a Grand Challenge theme (e.g., non-engineering)**

3 **GCSP focused general education electives**

4 **Approved interdisciplinary degree, minor, or honors programs**

5 **Internship with an interdisciplinary focus**

Entrepreneurship Elements

1 **Riata Entrepreneurs Program**

2 **Entrepreneurship Internship**

3 **Entrepreneurial Research Program**

4 **Entrepreneurial Minor (2 Courses)**

Global Awareness Elements

1 **Approved international experiences**

2 **Co-op or internship with a significant global focus**

3 **Research experience with a significant global focus**

4 **Course(s) which focus on global issues**

Service Learning Elements

1 **Volunteer experience with a significant service-learning focus**

2 **Volunteer experience with a significant service-learning focus**

3 **Course(s) which focus on service and/or community-related issues**

4 **Center for Student Leadership, Ethics, and Public Service; SORC, etc.**

The curricular components and their individual requirements are addressed below:

Research

Each GCSP Scholar must prepare to help develop effective and economical solutions to one or more of the engineering grand challenges or select UN Sustainable Development Goals that this nation and the world face. Each GCSP Scholar must complete a GCSP Capstone experience or Honors thesis and take advantage of one or more of the following:

• Engage in a minimum of one semester of undergraduate research in an approved team or individual research or design project with a university faculty member, focusing the research on one of the grand challenge themes including a presentation of their findings/experience and an evaluation of their research by a faculty research supervisor. This may include any of the following programs:

Freshman Research Scholars
https://admissions.okstate.edu/academics/scholar-development-research

Wentz Research Scholars
https://admissions.okstate.edu/academics/scholar-development-research

Niblack Research Scholars
https://admissions.okstate.edu/academics/scholar-development-research

NSF REU
http://www.nsf.gov/crssprgm/reu/reu_search.jsp

Crowdfunded Undergraduate Research with PhilanthroPete
http://scholardevelopment.okstate.edu/undergraduate-research/crowdfunding-undergraduate-research

Extramurally Funded Directed Research
http://www.ceat.okstate.edu/research

- The students can register for an independent study research course, directed by a faculty member, or perform the research in an industry or government lab. Prior to conducting the research, the students will provide a written scope of the work to be performed during the semester(s). The prospective work must be approved by the instructor/researcher, the student, and the student's GCSP Mentor. In addition, the students will be required to present their findings in a poster exhibition at one of the university's undergraduate research symposiums or at a professional meeting.

- Completion of an entrepreneurial product or process development project approved by the instructor, the student, and the student's GCSP Mentor focusing on a grand challenge theme. The students will also be required to present their findings in a poster exhibition at one of the university's undergraduate research symposiums or at a professional meeting.

- Completion of an Independent Study research project approved by the instructor, the student, and the student's GCSP Mentor focusing on a grand challenge theme. The students will also be required to present their findings in a poster exhibition at one of the university's undergraduate research symposiums or at a professional meeting.

- Work experience, for a minimum of one summer or one semester, as a research or laboratory assistant under the direction of a university faculty member or industry research director. The students will also be required to present their findings in either a paper or poster exhibition approved by the faculty member or industry partner and the GCSP mentor.

Interdisciplinary Curriculum

Each GCSP Scholars must prepare to work at the boundaries of public policy, business, law, ethics, human behavior, medicine, and risk as well as other sciences. Each GCSP Scholar MUST take advantage of one or more of the following:

1   Approved interdisciplinary program with a minor outside of engineering

2   3-month or more Internship with an interdisciplinary focus in one or more of the topics above (approved by GCSP Mentor)

3   1 academic year or 3-months summer research experience with an interdisciplinary focus that engages non-engineers

4   Non-Engineering General Education Course(s) relating to a Grand Challenge theme

Entrepreneurship

Each GCSP student must be capable of translating invention and innovation into market ventures and possibly global solutions required for the public's interest. Each GCSP Scholar must take advantage of one or more of the following:

1   Approved entrepreneurial experiences (approved by GCSP Mentor & program oversight committee) including startup activities with

Cowboy Technologies
http://www.cowboytechllc.com/about-us

OCAST
http://www.ok.gov/ocast/

The National Veterans Entrepreneurship Program
http://riata.okstate.edu/veterans/

Riata Center
http://riata.okstate.edu/veterans/
http://riata.okstate.edu/startup/incubator/

2 **Internship with a significant entrepreneurial focus (approved by GCSP Mentor & program oversight committee)**
http://www.cowboytechllc.com/about-us

3 **Research experience with a significant entrepreneurial focus (approved by GCSP Mentor & program oversight committee)**
https://cied.okstate.edu/CowboyTechnologies

4 **Approved Course(s) or Bootcamps which focus on entrepreneurship**

Global Awareness

Each GCSP Scholar must develop the perspective necessary to address challenges that are inherently global as well as to lead innovation in a global economy. Each GCSP Scholar MUST take advantage of one or more of the following:

1 **Approved international experiences with CEAT Scholars Programs**

2 **Research experience outside of continental US with a significant global focus**

3 **Course(s) which focus on global issues accompanied by study abroad course**
http://abroad.okstate.edu/

4 **Engineering Study Abroad Programs**
http://ceatde.okstate.edu/2016-schedule-study-abroad

Service Learning

GCSP Scholars must develop and deepen their social awareness and demonstrate motivation to bring technical expertise to bear on societal problems. Each GCSP Scholar must participate in the leadership of a service learning effort; examples are listed below:

1 **Volunteer with an approved service learning program**
http://volunteer.okstate.edu/service-learning

2 **Earn the CORD (Creating Opportunities for Responsible Development)**
http://volunteer.okstate.edu/cord-program

2 **Help lead a project with Engineers Without Borders at OSU**
http://www.ewb-osu.okstate.edu/node/24

Administration and Assessment

To maintain the high standards expected from a quality program, assessment and success of our Grand Challenge Scholars Program will be the responsibility of everyone involved. To lead this charge, the CEAT Scholars Director will serve as the Director of the GCSP. The Director will participate in the electronic community for the exchange of GCSP best practices, attend workshops and summits, and prepare an annual report of programmatic accomplishments for the GCSP. The Director will be responsible for the training of all mentors in the program requirements and connecting them to the university resources in entrepreneurship, service learning and undergraduate research to assist students in developing portfolios, and previously approved activities for program credit.

The administration and supervision of the program will be performed by an Oversight Committee comprised of faculty members selected from within the College of Engineering, Architecture and Technology. The GCSP Oversight Committee will be responsible for the following:

1 Select students and monitor their progress (along with the GCSP Mentor),

2 Verify and document the program objectives,

3 Approve portfolios that successfully integrate the GCSP Components,

4 Compile the names and accomplishments of GCSP Scholars

5 Convey all information to the Oversight Committee Chair and GCSP Director as part of the required annual report,

6 Assist with longitudinal tracking of GCSP Scholars Program in cooperation with the Grand Challenge Steering Committee and the NAE, and

7 Approved interdisciplinary research programs related to GCSP topic

APPENDIX:
GCSP PORTFOLIO OUTLINE

GCSP Student Name: _____ Signature: _____

CWID: _____ Major: _____ Date: _____

GC Focus Area: _____ GCSP Mentor: _____

Required Element	Description of **Breadth Component**	Description of **Depth Component**	Mentor Initials
Research	Required	Required	
Interdisciplinary Curriculum	Required	Required	
Entrepreneurship	Required	Choose 1	
Global Awareness	Required	Choose 1	
Service Learning	Required	Choose 1	
Capstone Project or Honors Thesis	Required		

Plan Approval - GCSP Mentor:

_____

Date: _____

GCSP Director on behalf of the Oversight Committee

_____

Date: _____

GCSP Capstone: