NAE Grand Challenges for Engineering

In 2008, the National Academy of Engineering issued a list of 14 “Grand Challenges for Engineering in the 21st Century”

- Make solar energy affordable
- Provide energy from fusion
- Develop carbon sequestration methods
- Manage the nitrogen cycle
- Provide access to clean water
- Restore and improve urban infrastructure
- Advance health informatics
- Engineer better medicines
- Reverse-engineer the brain
- Prevent nuclear terror
- Secure cyberspace
- Enhance virtual reality
- Advance personalized learning
- Engineer the tools for scientific discovery
The NAE Grand Challenge Scholars Program is a combined curricular and extra-curricular program with five components that are designed to prepare students to be the generation that solves these 14 grand challenges.

Over 120 US engineering schools have signed a letter of commitment to create GCSPs on their own campuses.

Students who complete the requirements from an approved program will be designated as a Grand Challenge Scholar and certified by UND and the National Academy of Engineering.
GCSP Portfolio

Students will develop a portfolio in which they demonstrate that they have met the requirements in each of 5 areas.

1. **Hands-on Project or Research Experience:** Related to a Grand Challenge

2. **Interdisciplinary Curriculum:** A curriculum that complements engineering fundamentals with courses in other fields, preparing engineering students to work at the overlap with public policy, business, law, ethics, human behavior, risk, and the arts, as well as medicine and the sciences

3. **Entrepreneurship:** Preparing students to translate invention to innovation; to develop market ventures that scale to global solutions in the public interest

4. **Global Dimension:** Global Dimension: Developing the students’ global perspective necessary to address challenges that are inherently global as well as to lead innovation in a global economy

5. **Service Learning:** Developing and deepening students’ social consciousness and their motivation to bring their technical expertise to bear on societal problems through mentored experiential learning with real clients
Program Requirements

Hands-on Project OR Research Experience related to a Grand Challenge

- To satisfy the research component of the GCSP, students must complete a research experience under the direction of a faculty member on one particular element of the selected Grand Challenge. This can consist of either one summer (10 weeks) of full time (40 hrs/wk) or two semesters of part time (10-15 hrs/wk). At the end of this experience, the student must present his or her work through either a poster or oral presentation at the UND Scholarly Forum, CEM Design Expo, REU poster session, or other similar venue. Research opportunities include:
  - UND Research Experience for Undergraduates (REU) Program
  - Advance Undergraduate Research Awards (AURA) program
  - International Research Experience for Students (IRES)
  - Other equivalent research or significant hands-on project experience conducted for credit or pay under the direction of a faculty member
Program Requirements

**Interdisciplinary Curriculum:** A curriculum that complements engineering fundamentals with courses in other fields, preparing engineering students to work at the overlap with public policy, business, law, ethics, human behavior, risk, and the arts, as well as medicine and the sciences.

- Requirement (one of the following):
  - Two courses outside of CEM that are related to the selected Grand Challenge, or
  - One course outside of CEM plus a significant interdisciplinary experience through an internship, independent study project, research project, service learning activity. This must be approved by the Jodsaas Center director and should consist of at least 100 hrs. of experience.
Entrepreneurship: Preparing students to translate invention to innovation; to develop market ventures that scale to global solutions in the public interest

Requirements:

- Complete 3 credits of coursework in entrepreneurship, including ENGR410 or courses taught by the ENTR program, and work on a GC related project as part of the class

AND one of the following

- Participate in an extracurricular activity related to entrepreneurship, such as the Dakota Venture Group, Innovation Fellows, etc.
- Develop a business model or marketing plan related to their Grand Challenge research experience
- Other activities as approved by the GCSP director
Program Requirements

Global Dimension: Global Dimension: Developing the students’ global perspective necessary to address challenges that are inherently global as well as to lead innovation in a global economy

Requirement (one of the following):

- Study abroad or other student exchange experience
- Internship or Co-op experience with a significant global dimension
- Significant participation in international service organizations such as Engineers Without Borders
- Significant participation in a project sponsored by a global partner company through the Jodsaas Center
Program Requirements

Service Learning: Developing and deepening students’ social consciousness and their motivation to bring their technical expertise to bear on societal problems through mentored experiential learning with real clients

Requirement (one of the following):

- Participate in at least 40 hours of service related to a Grand Challenge
  - Tutoring and mentoring other students
  - Participation in projects through EWB, Habitat for Humanity, etc.
- Participation in outreach activities such as the Lego League, Power On, Young Scientists and Engineers Academy, etc.
- Other activities as approved
GCSP Portfolio

• By the time they graduate, students will assemble a portfolio documenting their activities in each of the five GCSP components.

• The portfolio will be reviewed by the GCSP Operating Committee before certificates are awarded.
Support for Students

- $500/semester stipend for up to 6 semesters.
- Students can apply for additional support of up to $6000/student
  - Research grants
  - Business development
  - Work/study abroad
  - Service learning projects

- Funding for the program
  - Initial funding will come from the Larson Foundation
  - Additional fundraising activities (e.g. corporate/individual sponsorships)
Roles

• Students
  – Responsible for identifying opportunities to meet the program’s requirements and making steady progress in the program

• Advisers
  – Faculty members from each department in the college who will serve as advisers to the GCSP students
  – Advisers will review student’s progress each semester and make recommendation for continued funding
  – Advisers will work with the Director to approve special cases

• Operating Committee
  – Consists of the advisers, the GCSP Director, and 2 student representatives
  – Will meet each semester to approve new students and review portfolios
Advising Process

• Students will meet with the GCSP adviser each semester (may be combined with academic advising)
  – Civil Eng.: Howe Lim, Frank Xiao
  – Chemical Eng.: Edward Kolodka
  – Mechanical Eng.: Surojit Gupta
  – Electrical Eng.: Prakash Ranganathan,
  – Biomedical Eng.: Reza Fazel-Rezai
  – Petroleum Eng.: Mehdi Ostadhassan
  – Geological Eng.: I-Hsuan Ho
  – Computer Science: Ron Marsh

• Prior to the meeting, students update their portfolios to describe the following
  – Those components which have been met
  – Ongoing activities
  – Planned activities, with timeline
  – A template will be provided