

Proposal to establish a
Grand Challenges Scholars Program
Southern Methodist University

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SMU's Vision for a Grand Challenges Scholars Program

SMU is a nationally ranked private university located near the heart of Dallas, TX. SMU is a distinguished center for global research with a liberal arts tradition. SMU's 11,000 diverse, high-achieving students come from all 50 states and 90 countries to take advantage of the University's small classes, hands-on research opportunities, leadership development, community service, international study and innovative programs. The University offers a strong foundation in the humanities and sciences and undergraduate, graduate and professional degree programs through seven schools. Now in its second century of achievement, SMU is increasingly recognized for the ways it supports students, faculty and alumni as they become ethical leaders in their professions and communities. The University's entrepreneurial spirit lives in people from every academic discipline who see opportunities to create something new in the world – and work hard to bring their innovations to life. SMU's relationship with Dallas – the dynamic center of one of the nation's fastest-growing regions – offers unique learning, research, social and career opportunities that provide a launch pad for our students, faculty and alumni to make a global impact. SMU is home to the George W. Bush Presidential Center. The George W. Bush Institute focuses on programs and research resulting in action in the areas of education reform, global health, economic growth and human freedom. There are few college campuses that can provide students access to the resources and talents available in the Bush Presidential Center.

The Lyle School of Engineering offers undergraduate, master's and doctoral degrees, with many specializations, through five academic departments; Civil and Environment Engineering, Computer Science and Engineering, Electrical Engineering, Engineering Management, Information, and Systems, and Mechanical Engineering. More than 30% of our undergraduate students graduate with a second degree outside of engineering. The Lyle School of Engineering is also home to The Hart Center for Engineering Leadership (HCEL), which will host our Grand Challenges Scholars Program (GCSP). We believe the Hart Center for Engineering Leadership is the ideal home for the program because the HCEL provides resources for both leadership development and career development, both of which are central to the GCSP. Two other key components of the Lyle School which will be actively involved in our GCSP are the Caruth Institute for Engineering Education and the Hunt Institute for Engineering and Humanity.

We believe that SMU can provide a great setting for a Grand Challenges Scholars program. While many of our engineering students are already involved in some, if not all, of the required GCSP components, we believe the NAE GCSP will provide a framework for our best students to complete all of the components with the added benefit of focusing their efforts on a problem that has been determined to be one of the science and engineering challenges of the 21st century. For the hands-on research component of the GCSP, one of the unique advantages that SMU can provide for our Grand Challenges Scholars is access to great mentors from the local business community. Dallas has many high tech companies that are specifically addressing problems associated with the grand challenges, providing internships and co-op opportunities for projects directly related to the Grand Challenges Scholars research projects. We also have many faculty that are working on problems directly related to the grand challenges, providing mentoring and infrastructure for the students to carry out their research projects. We believe the GCSP will provide a unique experience for the participants because it allows the students to not only help solve a problem, but it allows them to take an active role in defining The problem. Many times

in undergraduate research projects, and even graduate research projects, the students are given a specific problem to solve based on the deliverables of the research grant or contract that is supporting the work. While problem solving is a necessary and important skill, it is even more important to be able to determine and define the problems that will have significant impact. Graduates from the Grand Challenges Scholars Program will be ideally positioned to define and solve the most pressing challenges. Entrepreneurship is part of the university as a whole. There are a wide range of courses dealing with entrepreneurship in 5 of the 7 schools on campus. The Grand Challenges Scholars will have a multitude of opportunities to both learn and practice entrepreneurship. Dallas is one of the most entrepreneurial cities in the country. Because of SMU's liberal arts history and tradition, there are many opportunities for students to study and be involved in public policy, ethics, human behavior, and business law, as well as be exposed to literature and the arts. We believe the GCSP will provide even more incentive and structure for the students to obtain as well rounded an educational experience as possible. We will work closely with the Hunt Institute for Engineering and Humanity in the Lyle School to meet the service learning and global dimension components of the GCSP. The mission of the Hunter & Stephanie Hunt Institute for Engineering & Humanity is to develop and scale sustainable and affordable technologies and solutions addressing the challenges of the global poor, in perfect alignment with several of the grand challenges. This Institute applies engineering problem solving in this context to challenges in refugee camps across the globe as well as prototyping and addressing problems in Dallas's own backyard. The Grand Challenges Scholars will bring much needed engineering expertise to these problems.

We recently briefed the Lyle School Executive Advisory Board about our plans to apply to establish a Grand Challenges Scholars program at SMU. The board enthusiastically endorsed the idea and is committed to helping make the program a success. We also recently presented our Grand Challenge Scholars proposal ideas to Mr. and Mrs. Mitch Hart, the benefactors for the Hart Center for Engineering Leadership. Mr. and Mrs. Hart are extremely enthusiastic about the possibility of SMU becoming a Grand Challenge Scholar school and promised to help in any way possible to make the program a success.

We have included Appendix A to summarize the program requirements for the Grand Challenge Scholars program at SMU. We have also included Appendix B to provide an example of a program plan that would allow a Grand Challenge Scholar to meet all of the requirements and graduate in 4 years. The sequence of the program plan is flexible and Appendix B is just one possible option.

Research Experience

All Grand Challenges Scholars will be required to complete a substantial research project related to one of the Grand Challenges. We believe one of the great aspects of the program is the opportunity for the student to define a research project related to one of the Grand Challenges. We will provide a format for the project proposal. The student will write a research proposal detailing how their specific proposed project will address one or more of the grand challenges. The proposal will include their research objectives, how their research objectives address a Grand Challenge, a research plan, a timeline and milestones. This proposal process will not only better define the link between the proposed project and the Grand Challenge, it will also be good

training for the students on how to present their ideas. Once the student has completed their research proposal, they will identify a potential faculty advisor. The GCSP Director will also be available to help identify a faculty advisor with expertise and infrastructure to help support the proposed research activity. Once a faculty advisor is selected and agrees to the scope of the proposed research project, the GCSP steering committee will review and approve the proposed project before the student starts the research. The steering committee will work with the student to find a mentor in industry with relevant experience in the field of research chosen by the student. The HCEL already runs a mentoring program for Juniors and Seniors, with approximately 75 participants each year, so we have an established network of mentors that are anxious to help with the Grand Challenges Scholars mentoring.

Because the research component of the GCSP is such an integral piece of the overall program we plan to provide as many options as possible for the GC scholars. Ideally the research project will contain both design and hands-on experience, but we will work with the students on an individual basis to provide the mentoring and infrastructure they need to carry out their proposed research project. There are several programs already in place at SMU that can provide support for the Grand Challenges Scholars research activities. One such opportunity is the Lyle Summer Undergraduate Research Fellowship program, which offers students the opportunity to spend up to 8 weeks during the summer working with a faculty mentor in his/her research lab. Selected participants are expected to complete 20 hours of research work each week and must be willing to devote themselves fully to the program during the summer. In addition to their time working in the lab, participants must attend regular meetings, leadership assessment and skills training conducted by the Hart Center for Engineering Leadership. The stipends are up to \$4000 for the summer plus up to \$1000 for incidental research related expenditures. There are also University wide Undergraduate and Summer Research Assistantships that are available through the Office of Undergraduate Research. The Undergraduate Research Assistantship (URA) program at SMU provides an opportunity to students to pursue research across all disciplines. By providing matching funds to another source of research funding, such as a department's, school's or individual faculty member's existing research funding, this program facilitates undergraduate involvement in the university's leading edge research. Full time Summer Research Assistantships are awarded via a competitive process and can support students ready to focus more deeply on a research project. These assistantships are meant to accomplish research while also providing mentoring for students. The 50% funding match required for these assistantships will be provided by the GCSP program. Participants in the Summer Research Assistantship program are expected to present at the University Research Day. These will be additional sources of support for the Grand Challenges scholars. The Director of the Undergraduate Research Office will be on the GCSP steering committee to help coordinate activities between the programs. The SMU Honors Research Association recently launched the SMU Journal of Undergraduate Research. This will provide an opportunity for the Grand Challenges scholars to share their research results with the rest of the SMU community. When appropriate we will encourage the students to submit their findings to a peer reviewed journal, in collaboration with their faculty research advisor.

Engineering Plus/Interdisciplinary Curriculum

All SMU undergraduates are required to complete the University Curriculum (UC), which emphasizes the values of a traditional liberal arts education, thus developing students as critical thinkers and good citizens. The UC's broad curriculum requirement complements the depth of study within the student's discipline. Hence, GCSP Scholars will leverage the UC as the primary means to bridge engineering/technology with non-engineering through the general prerequisites of the degree plan. Under advisement of Hart Center Staff and the Lyle School's Advising Center, GCSP Scholars will coordinate 9 UC credit hours that align with the student's chosen Grand Challenge. Recently the Hart Center for Engineering Leadership and the Lyle School's Advising Center both physically moved so the two groups are now co-located. Part of the motivation for the move was to make sure there was close coordination between the GCS program and advising to ensure students could fulfill all GCSP requirements and still graduate on time. The other part of the motivation was to provide additional space to house the Grand Challenge Scholars program. Six of the 9 UC credit hours must be in the humanities or social sciences. We will generate a list of classes that specifically target preparation for tracking the grand challenges to guide the GCSP Scholars' to select the most useful UC classes. SMU students benefit from centers and institutes that support fellowships and host events of an interdisciplinary nature. The John Goodwin Tower Center seeks to bridge the gap between the world of ideas, scholarship and teaching, and the practice of politics. The Tower Center seminars will be a strong aid for the GCSP Scholars. Moreover, when possible, students will enroll in advanced and discipline level electives that further their knowledge of aspects of their chosen Grand Challenge.

Undergraduates are also required to take a 3-credit hour "Ways of Knowing" (KNW) course to develop interdisciplinary approaches to problem solving. KNW courses allow students to explore how a topic or issue changes when viewed through a different disciplinary lens. GC Scholars will enroll in the Lyle School's KNW2300, Introduction to Design course. In addition to learning interdisciplinary problem solving, KNW2300 uses an experiential learning methodology to enable students to practice systems thinking, engineering design, project management and team-building skills via the design and construction of an autonomous robot, which was motivated by one of our faculty's work in water testing and remediation in camps monitored by the UNHCR (the United Nations High Commissioner for Refugees). KNW2300 is typically taken in the student's first year of their undergraduate tenure, thus enabling GC Scholars to develop important skills helpful for embarking upon their chosen grand challenge.

While GCSP Scholars will engage in interdisciplinary learning via the UC and discipline level electives, the students will participate in the Grand Challenges Seminar Series that specifically highlight the various historical, political, financial, business, psychological and sociological contexts of a past engineering challenge, such as The Manhattan Project. The seminar series will enable the GCSP Director and subject matter experts from representative grand challenge fields to introduce the 14 Challenges and GCS program components. Starting in Fall 2018, students will enroll in a 0-credit Special Studies Grand Challenges Course, replacing the seminar series.

GCSP Scholars curricular program requirement will culminate with the student’s enrollment in a radically multidisciplinary senior capstone experience designed and supported through the Dean’s office. While the capstone project will be designed by a GCSP scholar, they will be able to recruit non-GC scholars to their team. Students will engage in a hands-on Grand Challenge project. Students will lead a team or work independently over the course of the Senior Design two-semester class to demonstrate their cap-stone level understanding of the challenge and to present their proposal to address the Grand Challenge. The Senior Design experience will provide the opportunity to work closely with their Faculty Mentor as well as industry professionals and entrepreneurs. Students will present various artifacts such as research papers/presentations, reflection journals, photos, video logs, prototypes, etc.

Finally, the courses that fulfill the interdisciplinary requirements will be tagged for Grand Challenges recognition.

The following summarizes the interdisciplinary curricular path for GC Scholars.

University Curriculum (Broadening & Depth Requirements)	9 Credit Hours from <ul style="list-style-type: none"> • Philosophical and Religious Inquiry and Ethics • Historical Contexts • Creativity and Aesthetics • Individuals, Institutions and Cultures • Human Diversity • Community Engagement • Global Engagement
Engineering/Discipline Curriculum	KNW2300 – 3 credit hours Discipline Level Elective – 3 credit hours Senior Design Course – 3 credit hours
Co-Curricular Offering	Grand Challenges Seminar Series

Possible courses to fulfill interdisciplinary course requirements

Environment

KNW2313 Science and Politics in the Nuclear Age CEE1301 Environment and Technology
CEE1326 Introduction to Global Development CEE3323 Water Resources Engineering
CEE3325 Groundwater Hydrology CEE3331 Fundamentals of Air Quality I
CEE3327 Principles of Surface Water Hydrology and Water Quality Modeling
CEE3351 Industrial Hygiene and Occupational Health
CEE3353 Introduction to Environmental Toxicology
CEE2321 Aquatic Chemistry CEE5328 Introduction to Sustainability
CEE5331 Air Pollution Management and Engineering
ME1303 Energy, Technology, and the Environment

ME1304 Green Engineering: Designing Tomorrow Today
EE5313 Solar Cells and Applications
GEOL1315 Introduction to Environmental Science
GEOL5384 Hydrogeology
ECO4355 Environmental Economics
BUSE 3331 From Prospect to Production to Kilowatts: The Business of Energy
EE5353 Power System Planning
GEOL3330 Resources and the Environment
GEOL1100 Earth Sciences Abroad
BUSE4332 Energy and Environmental Law

Security

CSE5338 Security Economics
CSE5369 Hardware Security and Trojan Detection
CSE5349 Data and Network Security
EMIS2375 Cultural and Ethical Implication of Technology
PLSC4381 National Security Policy
CSE5339 Computer System Security
CSE5359 Software Security
EMIS3150 Ethics in Computing

Health

BIOL4370 Biotechnology and Nanotechnology
BIOL3323 Biology of the Brain
BIOL4325 The Biology of Aging
CHEM5398 Medicinal Chemistry
ECO5320 Health Economics
ANTH4343 Biomedicine, Culture, and Power
PSYC4320 Health Psychology
SOC13301 Health, Healing, and Ethics: Cross-Cultural Perspectives on Sickness and Society
BIOL3304 Genetics
BIOL3365 Cancer of the Brain
CHEM3371 Organic Chemistry
EE5340 Biomedical Instrumentation
ANTH4307 Global and Public Health
APSM4349 Health Care: From Policy to Practice
PHIL3376 Bioethics

Education

CSE5323 Mobile Application for Sensing and Learning
CSE5320 Artificial Intelligence
EDU2350 Educational Psychology
HIST1325 Doing Digital History
DSIN Human Centered Design
EDU2355 Literacy and Society

The Hart Center and Lyle School Advisory Center staff will work with the Grand Challenge Scholars to optimize the course work to support their Grand Challenge project. For instance, if the student's Grand Challenge is "Make Solar Energy Economical", the student can use the global engagement courses as part of the University Curriculum, as well as engineering electives such as ME1303 (Energy, Technology, and the Environment), ECO 4355 (Environmental Economics), BUSE4332 (Energy and Environmental Law) and EE5313 (Solar Cells and Applications). Because many of our students come to SMU with many semester credit hours already in place, there is significant flexibility in optimizing each of the undergraduate student's curriculum to meet the need of their chosen Grand Challenge.

Entrepreneurship

The real business of engineering is to make a positive difference in the world around us. Often, this means bringing new products to market. To an engineer, this requires developing technologies into successful business ventures. This is particularly true if a student wants to have an impact on problems at the scale of the Grand Challenges. Research alone will not have a global impact. All of the Grand Challenges Scholars will be required to engage in some form of entrepreneurial activity. SMU offers a broad selection of courses for aspiring entrepreneurs covering startups, business ethics, attracting capital, etc. The Lyle School of Engineering has an Office of Engineering Entrepreneurship directed by Dr. Duncan MacFarlane, Associate Dean for Engineering Entrepreneurship. There are many resources available on campus to support student entrepreneurial activities. Some examples are:

The Cube

The Cube is a dedicated space on campus for entrepreneurial students and faculty to meet and work on projects. It is designated specifically for students working on projects through the Engaged Learning Office, members of the SMU Entrepreneurship Club, Arts Management/Arts Entrepreneurship students, and Engineering Grand Challenges Scholars. The Cube is open on weekday afternoons and available outside that time window by request.

Engaged Learning

Managed under the Office of the Provost, Engaged Learning creates opportunities for students to find funding and other support for their ideas and projects that do not typically fit in traditional academic programs. Engaged Learning has three key programs:

- **Engaged Learning**: The Engaged Learning program, the original activity of the office, provides funding for students with ideas that exist outside the classroom. The Undergraduate and Summer Research Assistantships, described in the Research Experience section, are part of this program.
- **Big iDeas**: The Big iDeas program is designed for students to develop business plans into real businesses.
- **Clinton Global Initiative**: The Clinton Global Initiative (CGI U), a consortium of universities and colleges worldwide, offers funding for students who wish to explore ideas for alleviating global challenges in human rights, education, health, poverty, and the environment.

SMU Entrepreneurship Club

The SMU Entrepreneurship Club is open to undergraduate students from across campus who have an interest in entrepreneurship. It holds educational events, speakers, and social events and recently put on its first competition, the Flagpole Elevator Pitch.

Deason Innovation Gymnasium (DIG)

The DIG is best described as a facility that combines a design studio, a machine shop, and a garage. It is 1,200 ft. of space, tools, and computers dedicated to undergraduate design projects. The DIG currently houses a wide selection of hand and power tools as well as a 3 axis CNC machine, 3-D Printers, and a laser cutter. For things that cannot be fabricated in the Innovation Gymnasium, there is access to the Lyle School of Engineering Machine Shop as well as the Research Center for Advanced Manufacturing. In addition to fabrication tools, the Deason Innovation Gymnasium has several workstation computers loaded with a number of software packages chosen specifically to enhance the usefulness of the Gym; software such as Solid Edge for CAD, Matlab and Mathematica for computational analysis, LabView for instrumentation control and robotics, and multiple integrated development environments such as Microsoft's Visual Studio.

The Grand Challenges Scholars will be able to choose from a number of options to meet the entrepreneurial activity requirement for the program. We will work with the scholars to ensure their entrepreneurial activities are in line with their Grand Challenge. For instance, if the student's Grand Challenge is "Make Solar Energy Economical" we may encourage the student to intern with one of our spin-out companies, Fiddler. Fiddler is developing a small wind turbine based energy harvesting / storage system. Working in a small company such as Fiddler would provide the scholar insight into the competing technologies, as well as the economics of an energy harvesting start-up. Because this portion of the GCS program is so important, we will work with the scholars to formulate a plan that really meets their desires to pursue their Grand Challenge, hopefully beyond graduation. Options will include, but are not limited to:

- a) Completing one or more classes from the list of approved entrepreneurship courses. Approved courses will come from 5 different schools at SMU, so there is a wide variety of options.
- b) Participate in a business plan competition
- c) Start a new venture
- d) Complete an internship or Co-Op at a venture that is approved by the GCSP steering committee

Global Dimension

We recognize that students' experiences vary, some are well traveled while others have yet to fly on an airplane; therefore, it is important that GCSP Scholars gain exposure to new and unfamiliar environments and people. Moreover, SMU GCSP Scholars must be capable of exploring their chosen grand challenge beyond physical and cultural borders, i.e. scholars should develop a global mindset. Therefore, GCSP Scholars will participate in local and international experiences that enhance their ability to innovate in a global context. Students can gain a perspective shifting global experience by working in communities they never interact with in the Dallas area as much as by travelling abroad. While we would seek to send as many students globally as possible we will also leverage the rich cultural opportunities afforded by bringing engineering problem solving to the areas surrounding Dallas (both urban and rural) which would be far from familiar to our students. For instance the Hunt Institute and Hart Center are currently engaged in aquaponics systems in Vickery Meadow, a community consisting mostly of immigrants and

refugees. Additionally, our Lyle in the City Program directs students to service learning and community engagement to West and South Dallas, the city's most underserved areas. Among other projects, Lyle in the City students have renovated playgrounds, built retaining walls and conducted home energy audits.

GCSP Scholars will benefit from learning experiences that include racial/ethnic, socio-economic, religious, cultural and other forms of diversity when solving the most pressing societal problems. These encounters support the development of a global point of view that informs the scholar's thinking with respect to their chosen grand challenge. In consultation with the GCSP Scholar's Faculty Mentor, the GCSP Scholar will identify the aspects of their chosen grand challenge of global significance.

There exist curricular and co-curricular paths to global engagement at SMU. Thus, GC Scholars will work with the Hart Center for Engineering Leadership Office to identify the best activities and/or courses that support the development of a broad/global perspective connected to the Grand Challenges. We will work with the scholars to ensure the global dimension of their program, be it international or south Dallas, is directly related to their Grand Challenge problem or problems.

Globally focused courses will emphasize national and international topics, such as public health, security, human rights, world religion, trade, etc.

Some examples of courses that fulfill the Grand Challenges Global Dimension component include:

- PLSC1380 Intro to International Relations*
- SOCI 3305 Intro to Race and Ethnicity in the US*
- ANTH 4307 Global and Public Health**
- HRTS 3329 Contesting Development: Global/Local Impacts & Human Rights**
- EMIS 3309 Information Engineering and Global Perspectives
- EMIS 3375/CFB 3345 Cultural and Ethical Implications of Technology

(* - Fulfills the University Curriculum IIC requirement)

(** - Fulfills the University Curriculum HD requirement)

In addition to courses, GSC students will participate in at least one of the following globally focused activities, but we will encourage students to participate in as many activities as their schedules allow:

- Study Abroad
- Co-op or Intern Abroad
- Courses at SMU Taos Campus
- State side co-op or intern with a global focus
- Community Engagement with a global focus
- Lyle in the City Project in underserved and under-resourced areas
- Hunt Institute for Engineering and Humanity Projects

- Participate in an Engineers Without Borders Project
- Alternative Break with a global focus
- Engaged Learning Fellowship with a global focus

Service Learning

It is in the context of service to the public and in collaboration with organizations that students can best observe the societal impact of their chosen grand challenge; therefore, GCSP Scholars will participate in Service Learning projects. The Grand Challenges Scholars Program Steering Committee will evaluate and approve the Service Learning Plan to help align the community engagement component to the scholar's chosen grand challenge as much as reasonably possible.

All GCSP Scholars will complete a minimum of 30 hours of service experience. Scholars will work with the Hart Center for Engineering Leadership to identify community and/or industry partners, internships and other activities related to their challenge. The Service Learning experience will include a reflection component that captures the GCSP Scholar's understanding of the contextual complexities, especially the people aspects, of technical problem solving.

The GCSP Scholar's primary service learning objective is to gain social and civic competence with respect to their chosen grand challenge. The SMU general curriculum, co-curricular programs and extra-curricular activities provide ample opportunities for students to gain relevant Grand Challenges Service Learning experiences.

The following is an overview of the mechanisms for Service Learning at SMU.

Curricular

All students must fulfill a "Proficiency and Experience" graduation requirement; this may be met via participation in U.S. based community engagement. The Community Engagement learning objective to apply theoretical learning in the "real world" aligns with the Grand Challenges Service Learning goals.

Co-curricular

The Lyle School's three centers, Hart, Hunt and Caruth, whose missions are identified in the introduction section, provide opportunities for students to address issues directly related to several of the Grand Challenges addressing the environment, education and energy.

The programs include:

Lyle Engineering in the City - Initiatives that enable engineering students to apply their engineering knowledge and skills to real-life problems in the Dallas/Ft. Worth community. Students employ "user-centered" research and design practices to solve problems and meet needs that are genuinely valued by the community partner. These community-based engineering endeavors require students to identify and understand needs, assess and evaluate capabilities, propose potential solutions, implement designs, and reflect on outcomes.

Hart Center's Cooperative (Co-op) Education Program- A joint effort between SMU and the business community to give Lyle students an integrated engineering education, alternating classroom theory with real-world industry practice.

Kids Ahead - A larger national initiative being led by Southern Methodist University aiming to improve STEM skills in young people. By providing middle school children access to quality content, activities, projects, events and information, Kids Ahead will spark their interest and passion. Kids Ahead also seeks to provide parents, teachers, club leaders and STEM volunteers the resources they need to keep STEM activities a central part of young people's lives.

Lyle Engineering Camp at SMU - The Lyle School of Engineering at SMU offers summer camp programs for students in 6th through 12th grades. These summer camps are authentically Lyle, as the facilities, staff, and curriculum are all unique to the Lyle School of Engineering. Camps provide a creative environment for students to learn the fundamentals of engineering through hands-on, interactive team projects.

Extra-curricular

The Lyle School hosts over 20 student organizations that participate in community service projects. Many of the projects connect to Grand Challenges. For example, the SMU Chapter of Engineers Without Borders (EWB) partners with the professional chapter and developing communities to implement sustainable water, power, sanitation and infrastructure solutions. The SMU Society for Women Engineers (SWE) co-hosts the Annual Design Your World STEM Girls Conference. Students may engage in more independent pursuits of Service Learning through the University Community Engagement and Leadership Office and the Engaged Learning Program.

GC students may complete the Service Learning component by a combination of activities from the list below, as approved by the committee. Each GC scholar will complete at least one high and one medium effort activity to fulfill their service learning component. Suggested levels of effort are noted after each of the options.

1. Working with an approved Service Learning Community Partner (Medium)
2. Completing an Engaged Learning Project (High)
3. Participating in a Hunt Institute Service Learning Project (Medium)
4. Volunteering with the Caruth Institute's Summer Programs (Medium)
5. Participating in an EWB project abroad. (High)
6. Completing an approved "Alternative Spring Break" (Medium)
7. Completing a Senior Design project for a non-profit organization (High)

The GC scholar will be required to write a short reflection essay on each of the activities they participate in to describe how the activity supported their Grand Challenge program.

Selection and Program Management

Students can be selected to be Grand Challenges Scholars through two paths. Students can submit an application or they can be nominated by a faculty member during their first or second

year at SMU. While the emphasis for the program will be for students to join in their first or second year, we will also consider students in their third year if they are able to fulfill all of the program requirements and still graduate on time. The GCSP program office will hold an information session at the beginning of each Fall Semester for all incoming engineering students to explain the program and the application process. We will also work with student organizations on campus such as SWE (Society for Women Engineers) and NSBE (National Society of Black Engineers) to advertise the GCSP to maximize the diversity of applicants and accepted students. The HCEL is actively involved with these student organizations. We will accept applications throughout the school year. Students who are nominated by a faculty member will be notified by the GCSP program office of the nomination to determine their interest, and to help them through the application process. The application process will include the following documentation:

- a) A completed application form that includes; major, GPA, scheduled graduation date, and potential faculty advisors
- b) A short essay describing which Grand Challenge(s) the student is interested in, and what area of research they are interested in working on to help resolve that Grand Challenge
- c) Courses and grades at SMU to date
- d) A plan on how the student will fulfill all of the requirements of the GCSP program in order to graduate on time.
- e) Names of two SMU faculty references the selection committee may contact

Selections will be made by the steering committee based on the entire application.

Once selected for the GCSP, each student will meet at least once per year with a member of the GCSP steering committee to make sure the student is on schedule and making progress towards completing all of the GCSP requirements. The student will ultimately be responsible for making sure they have met all of the requirements for the program. Each student will also meet with the GCSP program director at least once during their tenure as a GC scholar to provide feedback on what is working well in the program and what can be done to continuously improve the program. One of the main goals of the GCSP is to make sure participating in the program does not delay the normal graduation date for the student. The student will also be expected to meet with their faculty research mentor on a regular basis to make sure the student is making adequate progress on their independent research. Each GC scholar will also meet with their outside / industrial mentor on a regular basis, preferably once per month. As mentioned in the research experience section, we currently have a mentor program for our juniors and seniors that includes approximately 75 mentor / mentee teams. In describing the Grand Challenge Scholars program to our mentors, we have had a tremendous show of enthusiasm from our mentors to participate with the program to serve as multi-year mentors to our GC scholars. We feel one of the real advantages of being in Dallas is that we will be able to find local mentors with direct experience with the Grand Challenges the students want to undertake. Local mentors will make it possible to have frequent face-to-face meetings. We plan to have several GCSP events each year which will include; lectures related to Grand Challenges, networking events with mentors, and special meals. Being in Dallas provides great access to local speakers and mentors to interact with

students. At least once per year we will have a lecture related to one of the grand challenges from an external speaker who is recognized as an expert in a field closely related to one of the Grand Challenges. The Grand Challenges Scholars will be expected to attend at least 2 of these events each semester.

Graduating seniors will be required to participate in the GCSP Showcase to be held in April, in conjunction with the SMU undergraduate research symposium. Each senior will present their overall experience as a Grand Challenges Scholar as well as their research findings in a formal presentation during the Showcase. Each Grand Challenges Scholar will write a formal Final Report describing how they fulfilled all of the requirements for the program, as well as their research findings. When appropriate we will encourage the students to submit their findings to a peer reviewed journal, in collaboration with their faculty research advisor. These reports will be reviewed by the faculty advisor and GCSP steering committee to make sure the students have fulfilled all of the requirements. The presentation at the Showcase and the Final Report will be required for the student to receive the designation as a Grand Challenges Scholar at Commencement and on their SMU Transcript. Each graduating Grand Challenges Scholar will be presented with a GCSP medallion at the Lyle School awards day at the end of their final semester. The final reports will be posted on the GCSP web site to advertise the success of the program and to help recruit new students into the program. We believe the GCSP will be a great recruiting tool to attract the best students into engineering at SMU.

Finally, the GCSP program office will maintain a database of the Grand Challenges Scholars after they graduate. We will track their career progress and report this on our program web site in order to provide evidence of the benefits of participating in the GCSP.

We currently envision that the Executive Director of the Hart Center for Engineering Leadership will be the GCSP Director. The GCSP Director will have responsibility for the day-to-day operations and the financial management of the program. In addition to Dr. Gnade, Kathy Hubbard, the Hart Center's Director responsible for leadership development, will develop and execute program content and assist in monitoring GCSP Scholar's successful progress. The GCSP Steering Committee will have oversight of the program and provide guidance to the Director. The Steering Committee will approve any changes to the program, such as addition or removal of courses that can fulfill program requirements. The steering committee will be made up of faculty members from across campus. Members of the steering committee will include the Executive Director and the Sr. Director for Leadership Development for the HCEL, the Associate Dean for Engineering Entrepreneurship, the Director of Undergraduate Research, the Associate Dean for Academic Affairs and a representative from each academic department with the Lyle School of Engineering. We will also invite representatives from the other schools that provide classes that our GC scholars take.

Resource Plan

SMU has dedicated the resources needed to launch and maintain the GCSP. Dean Christensen has appointed Bruce Gnade, the Executive Director of the Hart Center for Engineering Leadership, to be the GCSP Director. Space is designated in the HCEL for the program staff.

Initial funding for the program will be provided through the HCEL operating budget to cover costs such as matching funds for the Undergraduate and Summer Research Assistantships, salary for the program director and staff, GCSP Scholar dinners, travel to the annual meeting, etc. Costs for seminars, courses, etc. will be covered by the Lyle School of Engineering. Because we anticipate that the GCSP will attract the best students, we will work to target University scholarships towards students who are likely to become Grand Challenges scholars. We will also work with the Development Office in the Lyle School of Engineering to seek donors who are particularly interested in supporting the GCSP. Long term we will work to establish scholarships designated for Grand Challenges scholars and to secure funds to support research expenses for the scholars.

Summary

We believe the Grand Challenges Scholars Program will provide a great opportunity to engineering students at SMU. The Lyle School of Engineering is very excited about the possibility of establishing a Grand Challenges Scholars Program at SMU. We feel that we have the people and resources in place to make the Grand Challenges Scholars program at SMU an exemplar for educating the engineering students needed to solve the challenges of the 21st century. We are excited about starting the program and recruiting our first class of scholars.

Appendix A

Summary of Grand Challenges Program Requirements

Component	Requirement Options	Deliverable	Approval
Interdisciplinary Curriculum	<ul style="list-style-type: none"> • Attend the Grand Challenges Seminar Series, and • Enroll in the KNW2300 Introduction to Design class • 9 UC credit hours in perspective broadening courses • Senior capstone project related to GCS research topic • Major related courses 	<ul style="list-style-type: none"> • Degree Progress Report • GC Seminar Attendance Log 	Lyle Academic Advisor & GSC Steering Committee
Research	<ul style="list-style-type: none"> • Propose a GC Related Research Project, and • Secure a Faculty Advisor and Industry Mentor, and • Complete a comprehensive research project, as approved by GCS steering committee. 	<ul style="list-style-type: none"> • Presentation at Lyle and the University's Research Days and • Submission to the SMU Journal of Undergraduate Research, or • Submit manuscript to peer reviewed journal 	GSC Steering Committee
Global Dimension	<ul style="list-style-type: none"> • Enroll in at least one globally focused class, and • Study Abroad, or • Co-op or Intern Abroad, or • Globally focused community engagement, Service Learning or Alternative Break 	<ul style="list-style-type: none"> • Documentation of Completion of at least 30 hours of service experiences 	Hart Center
Service Learning or Internship/Co-op	<ul style="list-style-type: none"> • Enroll in a Community Engagement tagged 	<ul style="list-style-type: none"> • A 500 word reflection essay 	Hart Center

	<p>Proficiency and Experience UC class, and</p> <ul style="list-style-type: none"> • Complete at least one high and one medium effort activity as described in the Service Learning section. 	<ul style="list-style-type: none"> • Documentation of Completion 	
Entrepreneurship	<ul style="list-style-type: none"> • Enroll in one course based entrepreneurship class and • Attend at least one entrepreneurship seminar, and • Complete a 1 semester internship or Co-op at a start-up, or • Start a new venture 	<ul style="list-style-type: none"> • Participation in Big Ideas, or • Participation in the Business Plan Competition 	Lyle Engineering Entrepreneurship Office

Appendix B

Example Grand Challenges Scholars Program Plan that allows graduation in 4 years

	Fall	Spring	Summer
First Year	<ul style="list-style-type: none"> <input type="checkbox"/> 15 to 18 Credits* inclusive of KNW2300 and <input type="checkbox"/> Info Session and <input type="checkbox"/> GC Seminar (3)* 	<ul style="list-style-type: none"> <input type="checkbox"/> 15 to 18 Credits* inclusive of KNW2300 and <input type="checkbox"/> Info Session and <input type="checkbox"/> Grand Challenge Seminars & Workshops by Hart 	<ul style="list-style-type: none"> <input type="checkbox"/> GC Application, Grand Challenge Selection and Project Proposal
Sophomore	<ul style="list-style-type: none"> <input type="checkbox"/> 15 to 18 Credits* inclusive of interdisciplinary curriculum and <input type="checkbox"/> Faculty Mentor/Industry Mentor Assignment***and <input type="checkbox"/> GCSP degree plan and <input type="checkbox"/> Research and / or <input type="checkbox"/> Service Learning 	<ul style="list-style-type: none"> <input type="checkbox"/> 15 to 18 Credits* inclusive of interdisciplinary curriculum and <input type="checkbox"/> Meetings with Faculty/Industry Mentor*** and <input type="checkbox"/> Research or <input type="checkbox"/> Service Learning or <input type="checkbox"/> Global Dimension** 	<ul style="list-style-type: none"> <input type="checkbox"/> Research, or <input type="checkbox"/> Study Abroad/Global Dimension**, or <input type="checkbox"/> Internship/Service Learning
Junior	<ul style="list-style-type: none"> <input type="checkbox"/> 15 to 18 Credit hours and <input type="checkbox"/> Meetings with Faculty/Industry Mentor*** and <input type="checkbox"/> Research or <input type="checkbox"/> Global Dimension** 	<ul style="list-style-type: none"> <input type="checkbox"/> 15 to 18 Credit hours and <input type="checkbox"/> Meetings with Faculty/Industry Mentor*** and <input type="checkbox"/> Entrepreneurship or <input type="checkbox"/> Service Learning 	<ul style="list-style-type: none"> <input type="checkbox"/> Research, or <input type="checkbox"/> Internship /Service Learning or <input type="checkbox"/> Entrepreneurship or <input type="checkbox"/> Study Abroad/Global Dimension**

<p>Senior</p>	<ul style="list-style-type: none"> <input type="checkbox"/> 15 to 18 Credit hours, including Sr. Capstone project and <input type="checkbox"/> Meetings with Faculty/Industry Mentor*** and <input type="checkbox"/> Entrepreneurship or <input type="checkbox"/> Service Learning 	<ul style="list-style-type: none"> <input type="checkbox"/> 15 to 18 Credit hours including Sr. Capstone project and <input type="checkbox"/> Meetings with Faculty/Industry Mentor*** and <input type="checkbox"/> Entrepreneurship or <input type="checkbox"/> Service Learning <p style="text-align: center;">Graduation</p>	
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*9 credit hours should be complete within first four semester – fulfilled by core curriculum.

Interdisciplinary credit can be fulfilled with electives

**Global dimension can be fulfilled in curricular and co-curricular

***Monthly meetings with mentors