

Grand Challenge Scholars Program Manual

The Grand Challenge Scholars Program in the Ira A. Fulton Schools of Engineering will attract, engage, and graduate leaders that are ready to solve the grand challenges facing our world today. Students admitted to the Grand Challenge Scholars Program have the opportunity to enhance their educational experience in Engineering by exploring a grand challenge theme through curricular and co-curricular experiences. Students may choose to explore one of the National Academy of Engineering's fourteen grand challenges shown below:

1. Provide energy from fusion
2. Make solar energy economical
3. Manage the nitrogen cycle
4. Restore and improve urban infrastructure
5. Develop carbon sequestration methods
6. Provide access to clean drinking water
7. Prevent nuclear terror
8. Engineering better medicines
9. Enhance virtual reality
10. Secure cyberspace
11. Reverse-engineer the brain
12. Advance health informatics
13. Advance personalized learning
14. Engineer the tools of scientific discovery

Alternatively, GCSP students can choose to expand their exploration by focusing their GCSP work on one of the five Engineering research themes:

1. Health
2. Energy
3. Sustainability
4. Security
5. Education

In order to complete the Grand Challenge Scholars Program, students will complete requirements in obtaining research experience, interdisciplinary coursework and/or experience, entrepreneurship coursework and/or experience, global coursework and/or experience, and service learning work. The component coursework and/or experiences must relate to a student's chosen Grand Challenge theme area.

This program manual describes the requirements for completing the five program components, including lists of courses that have been pre-approved for each component, and outlines the requirements for the GCSP portfolio that is the culminating project for consideration towards graduation.

Procedure for Approvals

In order to receive approval for courses and experiences, students will submit the [Grand Challenge Scholars Program Approval form](#) and upload documentation on the online approval system. The GCSP Coordinator Senior will submit the request to the GCSP Director and/or the Faculty Advisor for approval. Students will be notified of the decision within 2-3 weeks after submission. Students enrolling in a pre-approved course should email the Coordinator Senior at gcsp@asu.edu

Students should submit appropriate documentation with the Component Approval form to help the committee to make a determination if the component will meet the GCSP requirements. In each component description below, there will be directions on what is required for documentation for approval for various requirements. For course approvals, if the syllabus is not available on the class schedule, please request one from the faculty teaching the course and submit it with the Component Approval form. Please note that courses can only count toward one required component (i.e. a course that meets global and interdisciplinary can only meet one or the other requirement, but not both). Courses that are already listed in this manual are 'pre-approved' courses and do not require the student to submit the Component Approval form. If a student wishes to have a pre-approved course that is currently only pre-approved for a certain theme satisfy another theme area, the student then must submit the course for approval for that specific theme. It is highly encouraged to submit the Component Approval form prior to beginning the research, course or experience.

Component 1: Research Experience

Students will conduct research related to their chosen Grand Challenge theme in order to gain hands-on experience and more in-depth knowledge of work in their chosen focus area. To complete this component, students must complete at least two semesters of an approved research experience on their selected Grand Challenge theme. The research project must be approved by the student's GCSP Faculty Advisor or the GCSP Director. Opportunities to complete this component include:

- [Fulton Undergraduate Research Initiative](#)
- Research with a faculty member
- Honors research and thesis (for example CSE 492 & CSE 493)
- Senior design/capstone project
- Independent Study (for example, CSE 499 course)
- [Research Experience for Undergraduates](#) (REU)

Submit a Component Approval form in order to receive approval from your GCSP Faculty Advisor and the GCSP Director for research experiences. Check with your academic advisor to see if honor research/thesis or independent study coursework will meet a degree requirement.

Component 2: Interdisciplinary Curriculum

Students will complete coursework in other fields (outside of engineering) that complements their technical engineering work in order to prepare them to work at the overlap with public policy, business, law, ethics, human behavior, risk, the arts, and medicine. There are two requirements for the interdisciplinary component with the second requirement having two different options. The first requirement is that students are required to complete FSE 150: Perspectives on Grand Challenges for Engineering with a completion grade of "B" or higher. The second requirement entails completing one upper division interdisciplinary course (with a completion grade of "B" or higher) that aligns with the selected Grand Challenge theme **OR** completing an interdisciplinary experience that aligns with the selected Grand Challenge theme.

FSE 150: Perspectives on Grand Challenges for Engineering is highly recommended to be completed within the first two years of the program. The course meets a Social/Behavioral Sciences (SB) requirement and is designated as automatic honors credit.

Should a student choose to participate in an interdisciplinary experience, the experience must be outside of engineering duties and align with the student's Grand Challenge theme. Experiences may include internship experiences (outside of engineering), long term intensive program participation, etc... Students are encouraged to submit the experience for pre-approval. The documentation should include what the program entails, how it relates to the interdisciplinary component of the program and the students' chosen theme, and include a letter from a professional/supervisor of the experience detailing the work being conducted and how long the experience lasts.

Courses can only count toward one required component (i.e. a course that meets global and interdisciplinary can only meet one or the other requirement, but not both).

**Honors students have the option to utilize [Project Excellence](#) courses which are reviewed on a semester by semester basis and would require prior approval.

Pre-approved courses:

The courses below are approved to meet the interdisciplinary requirement for the following Grand Challenges themes and do not require documentation to be submitted:

Health

- ASB 443 Cross-Cultural Studies in Global Health [(L or SB) & G]
- ASB 462 Medical Anthropology: Culture and Health (SB & C)
- BIO 312: Bioethics (HU)

Energy

- GCU 364 Energy in the Global Arena (SB & G)
- SOS 324 Sustainable Energy, Material and Technology (No general studies credits)
- SOS 315/SOS 394 Energy Policy (No general studies credits)
- HST 306 Energy Transitions: Historical Perspectives [(HU or SB) & H]

Education

- TCL 360 Inequality & Diversity in Education

Security

- STS 364: National Security and International Terrorism (SB)
- BIO 312: Bioethics (HU)

Sustainability

- HST 306 Energy Transitions: Historical Perspectives [(HU or SB) & H]
- Fall 2015 and Prior ONLY: BIO 312: Bioethics (HU)

Below are general courses that are approved to meet the interdisciplinary requirement for all GCSP students and do not require documentation to be submitted:

- HON 494 Nanotechnology and the Law (No general studies credits)
- MSE 301/394 Materials and Civilization (No general studies credits)
- OMT/SOS/IND/EGR/HON 494 Design for the Developing World (No general studies credits)
- POS 394 Introduction to Science & Technology Policy (No general studies credits)
- SOC 334 Technology and Society (L or SB)

- STS 332 Global Issues in Science and Technology (Global or Interdisciplinary) (SB & G)
- PUP 301: Introduction to Urban Planning (L)
- SGS 394: Global Governance for Sustainability (No general studies credits)
- SOS 494: Sustainability and Social and Family Welfare (No general studies credits)
- STS 304: Science, Technology, and Society (SB)
- HON 494: Genetics and the Law (No general studies credits)
- ASB 362: People and Plants (H)
- SGS 394: Global Negotiation
- SOS 300: Advanced Concepts & Integrated Approaches in Sustainability
- SGS 394: Global Geopolitics
- POS 468: Asian Foreign Policies – The International Politics of the Asia Pacific

Students will submit a Component Approval form in order to receive approval for courses not included on the lists above in order to receive approval from the program committee. A course syllabus must be submitted in order for a course to be approved.

Check with your academic advisor with any questions on how interdisciplinary coursework will meet a degree requirement.

Component 3: Entrepreneurship

Students will complete entrepreneurship courses and/or experiences to learn how to translate invention to innovation, and to learn about how they can develop market ventures that scale to global solutions in the public interest. There are two requirements for the entrepreneurial component with the second requirement having two different options. The first requirement is that students are required to complete FSE 301: Entrepreneur and Value Creation during the junior or senior year with a completion grade of “B” or higher. The second requirement entails selecting one additional entrepreneurship course (with a completion grade of “B” or higher) **OR** completing an entrepreneurship experience that aligns with the selected Grand Challenges theme.

Students that participate in an entrepreneurial experience must submit the experience for approval. The documentation should include what the program entails, how it relates to the entrepreneurship component of the program and the students’ chosen theme, and a letter from the project lead or mentor outlining the student’s participation in the project and for how long.

Pre-approved courses:

Below are courses that are approved to meet the second entrepreneurship course requirement for all students and do not require documentation to be submitted:

- AIS 394 Innovation & Entrepreneurship Sustainability (No general studies credits)
- NLM 410 Social Entrepreneurship (No general studies credits)
- SOS/HON 494 Global Impact Entrepreneurship (Entrepreneurship or Global) (No general studies credits)
- MGT 494/594 Lean Launch (No general studies credits)
- FSE 294 Introduction to Systematic Innovation (No general studies credits)
- MGT 290 My Life Venture (No general studies credits)
- IEE 220: Business & Industrial Engineering (No general studies credits)
- CTI 294: MAKE Your Ideas Happen (No general studies credits)
- AIS/SOS 394: Innovation for American Indian Sustainability (No general studies credits)

Students will submit a Component Approval form in order to receive approval from the program committee for additional entrepreneurial courses (not listed above) and experiences to count toward the GCSP entrepreneurship requirement. A course syllabus must be submitted in order for a course to be approved. An entrepreneurial experience should be accompanied by a description of the experience and letter of support from the project lead or mentor.

Component 4: Global Dimension

Students must develop a global perspective in order for them to address the global Grand Challenges and to become leaders of innovation in a global economy. There are two requirements for the Global component with the second requirement having two different options. The first requirement is that students must complete one global course (lower or upper division), preferably related to their Grand Challenge theme. The second requirement states that students must either take an upper division global course (preferably related to their Grand challenge theme) **OR** participate in a global academic or work experience.

Students that want to participate in a global academic or work experience are highly recommended to receive prior approval. The experience can include an approved ASU [study abroad](#) or faculty directed study abroad program, an [internship](#) abroad or one with a significant global component, a global project through [Engineering Projects in Community Service](#), or a global project through [Engineers Without Borders](#).. The documentation should include what the program entails, how it relates to the global component of the program, and confirmation of acceptance into the study abroad experience or a letter from the work experience supervisor outlining the work that will be performed and for how long. Any other details regarding the experience are highly recommended to be submitted for approval.

Courses can only count toward one required component (i.e. a course that meets global and interdisciplinary can only meet one or the other requirement, but not both).

Pre-approved courses:

The courses below are approved to meet the global requirement for the following Grand Challenges themes and do not require documentation:

Health

- ASB/SSH 100 Introduction to Global Health (SB & B)
- ASB 443 Cross-Cultural Studies in Global Health [(L or SB) & G]

Energy

- ERM 428 International Environmental Management (G)

Security

- POS 467 International Security and Conflict (SB & G)

Sustainability

- GPH 210 Society and Environment (G)
- SGS 394 Global Governance for Sustainability (No general studies credits)

The courses below are approved to meet the global requirement for all students:

- GCU 364 Energy in the Global Arena (Global or Interdisciplinary) (SB & G)
- OMT/SOS/IND/EGR/HON 494 Design for the Developing World (Global or Interdisciplinary) (No general studies credits)

- SGS 203 Contemporary Global Trends (SB & G)
- SOS/HON 494 Global Impact Entrepreneurship (No general studies credits)
- SGS 494 China and Globalization (No general studies credits)
- STS 332 Global Issues in Science and Technology (Global or Interdisciplinary) (SB & G)
- GPH 314 Global Change (HU & G)
- COM 263 Elements of Intercultural Communication (SB & C & G)
- POS 300 Contemporary Global Controversies: Aid & Development (SB & G)
- FSE 294 Global Engineering (No general studies credits)
- POS 160 Global Politics (SB & G)
- SGS 394: Global Negotiation
- SGS 394: Global Geopolitics
- FSE 394: Engineering in a Global Context
- POS 468: Asian Foreign Policies – The International Politics of the Asia Pacific

Foreign language courses will not meet this requirement.

Students will submit a Component Approval form in order to receive approval for courses not included on the list in order to receive approval from the GCSP committee. The course syllabus must be submitted along with the approval form.

Check with your academic advisor with any questions on how global coursework will meet a degree requirement.

Component 5: Service Learning

Students will complete service learning to develop their social consciousness and motivation to use their technical expertise to help solve societal problems. To complete this component, students must demonstrate significant experience in a service learning project or projects to total 80 hours. It is preferred that the service learning experience is related to the student's Grand Challenge theme, however it must be related to one of the Fulton Schools major in some form of service. Students also have the option to enroll in the [Engineering Projects in Community Service Program \(EPICS\)](#) for three semesters. Student may combine the service learning projects with enrollment in the EPICS program.

Service learning benefits students by:

- Enhancing understanding of academic curriculum
- Providing diverse and practical “real-world” experiences
- Encouraging community involvement
- Fostering civic responsibility
- Raising awareness of social justice issues
- Providing career-exploration opportunities

Students are highly encouraged to join the [Engineering Projects in Community Service](#) Program. EPICS students will complete three semesters of coursework to meet the service learning requirement. Each EPICS course is offered for 1 credit hour. New EPICS students will enroll in FSE 104: EPICS Gold I. Continuing EPICS students will enroll in FSE 494: EPICS in Action for their second and third semesters. **EPICS courses do not need to be pre-approved for meeting the service learning requirement.** If a student completes less than three semesters of EPICS, each semester completed may count as 25 hours toward the service learning hours' requirement.

If you are not an EPICS student, you must receive approval for service learning activity by GCSP committee by submitting a Component Approval form. The documentation should include what the service learning will entail, how many hours you will be participating and a letter from the advisor or service learning lead detailing the student's role in the project and how many hours were completed. The following are other suggested service learning activities that could align with Grand Challenge themes and require prior approval.

- [All For Good](#)
- [ASU Service Learning coursework](#)
- [Engineers Without Borders](#)
- [Engineering World Health](#)
- [Fulton Ambassadors*](#)
- E2 Camp Counselor (2 sessions required in the same summer) *
- Leadership Launch Leader

*If a student has been selected to join the Fulton Ambassadors program or serve as an E2 Camp Counselor (2 sessions required in the same summer), up to 40 hours can meet the service learning component. A signed letter from the president and advisor must be submitted verifying the hours participated. Students are responsible for tracking their own hours and submitting a drafted letter to the president of the Fulton Ambassadors and E2 professional staff for approval.

Component 6: Grand Challenge Scholars Program Portfolio

GCSP program participants are required to write a GCSP Portfolio upon completion of the required components in the program. The portfolio must contain a representation of the work that the program participant has completed and must demonstrate how the components are interconnected and align with the chosen Grand Challenges theme. **Students must have a 3.00 grade point average or higher to be considered for completion.**

The portfolio is a written document, at least ten pages in length, single-spaced, with approximately two pages allotted to each of the five component areas. Including photos of experiences and/or other relevant figures in the document is encouraged. Supporting documentation (letters of support, course syllabi, etc.) should be included in Appendices and referred to in the appropriate section of the portfolio. All portfolios must contain the following sections in the noted order:

1. **Cover Page:** Include the University name, your name and major, selected grand challenges theme and the date of submission.
2. **Introduction:** Include a brief overview about what being a Grand Challenge Scholars Program student means to you in your academic and future professional career. Describe which grand challenge theme you pursued and why this theme is important to you.
3. **Research Experience:** Include a brief summary/overview of the research you did to complete this component, how it relates to your grand challenges theme, and the value of this experience to you (in terms of other GCSP work, academic and/or professional career, etc.). Include a research report that describes your project objective, methodology, and outcomes. At a minimum, your report must include the following sections: Introduction and Background, Methodology, Results, Discussion, Conclusions, Future Recommendations, and References. Students must also submit a letter of support from their research faculty mentor.

4. **Interdisciplinary Component:** Document and describe how you achieved the interdisciplinary component. Provide a summary of the courses and/or experience you completed, including FSE150, and what you learned. For each course (or experience) you should also describe how it relates to your grand challenges theme, and discuss the value of these interdisciplinary courses/experience to you (in terms of other GCSP work, academic and/or professional career, etc.). Include a syllabus (in an appendix) for the upper division course.
5. **Entrepreneurship Component:** Document and describe how you achieved the entrepreneurship component. Provide a summary of the courses (or experience) you completed, including FSE301, and what you learned. For each course (or experience) you should also describe how it relates to your grand challenges theme, and discuss the value of these entrepreneurship courses/experience to you (in terms of other GCSP work, academic and/or professional career, etc.). If you took a course to meet the second requirement, include a syllabus and example course materials (in an appendix). If you completed an entrepreneurship experience to meet your second requirement, include (in an appendix) a letter of support from your entrepreneurship mentor and any other relevant documentation (i.e. proposal, business plan, etc.).
6. **Global Dimension Component:** Document and describe how you achieved the global dimension component. Provide a summary of the courses (or experience) you completed and what you learned. For each course (or experience) you should also describe how it relates to your grand challenges theme, and discuss the value of these global courses/experience to you (in terms of other GCSP work, academic and/or professional career, etc.). For courses, include a syllabus (in an appendix). Include (in an appendix) a letter of support from your mentor and other relevant documentation for any other global experience, such as study abroad or a global internship.
7. **Service Learning Component:** Document and describe how you achieved the service learning component. Provide a summary of the experience(s) you completed and what you learned. For each experience you should also describe how it relates to your grand challenges theme, and discuss the value of these experiences to you (in terms of other GCSP work, academic and/or professional career, etc.). Include (in an appendix) a letter of support from your service learning mentor(s) and documentation of service learning hours completed (not required for EPICS courses).
8. **Conclusion (Overall GCSP Outcome Evaluation):** Reflect on your overall GCSP experience. Discuss how your coursework and experiences helped you achieve the GCSP goals in each of the five components. Discuss how these experiences helped you to become a well-rounded engineer and helped to prepare you for your future career plans. Cite specific examples and evidence included in your portfolio demonstrating your achievement of the GCSP goals. Discuss the connectivity across the five components addressing your Grand Challenge theme. Note any components not well achieved by your experience in the GCSP. Describe your overall opinion of your GCSP experience.

GCSP participants should submit their portfolio to Jade Silva in the Undergraduate Student Engagement Office in ECF 130 via email at, GCSP@exchange.asu.edu. The portfolio will be submitted to the GCSP committee. **The proposal must be submitted to the GCSP committee by October 1 for fall graduation and March 1 for spring graduation.**

The National Academy of Engineering and Arizona State University will endorse GCSP participants who complete all requirements in the program as a NAE Grand Challenge Scholar.

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