

# Proposal for Implementation of the Grand Challenges Scholars Program at the



# University of Dayton

A handwritten signature in blue ink that reads "Eddy Rojas Molino".

---

Eddy M Rojas, Ph.D., M.A., P.E.  
Dean, School of Engineering  
University of Dayton

A handwritten signature in black ink that reads "M. Rumpfkeil".

---

Markus P. Rumpfkeil, Ph.D.  
Associate Professor; Hans von Ohain Endowed Chair  
Interim Director, Graduate Aerospace Program  
Department of Mechanical and Aerospace Engineering  
University of Dayton  
300 College Park, Dayton, Ohio 45469-0238

937-229-5380 (W)  
937-229-4766 (Fax)  
Markus.Rumpfkeil@udayton.edu

# GCSP Vision, Mission, and Goals

Since 1911, UD engineering alumni have generated advances and contributions to the world from the development of motion pictures, created by Joe Pesce '28, to the development of the overhead projector, created by Roman Shoenherr '56. Throughout the years, our faculty, staff, students and alumni have changed the world. In 2015, under Dean Eddy Rojas' leadership, the School of Engineering (SoE) established its current strategic plan. The uniquely devised plan follows the School's five core values: community, innovation, excellence, engagement, and service and has the following three goals:

- *Promote a Dynamic Educational Environment:* provide stakeholders with a forum to express diverse opinions in a safe environment of dialogue, debate, reflection, and strategic thinking. We learn through experience and experimentation, and we incorporate what we learn into our day-to-day operations. The School of Engineering seeks to constantly adapt to changing realities by embracing system thinking and holistic review.
- *Cultivate Transformational Learning Experiences:* committed to the pedagogy of experiential learning in which active engagement is intrinsic to our students' experience, and education integrates high-impact activities within an authentic, inclusive, and intercultural context. Experiential learning kindles curiosity, provides opportunities for interdisciplinary scholarship, develops leaders, promotes community engagement, stimulates social and global awareness, sparks entrepreneurship, and fosters a collaborative spirit. This situated learning - embedded in activities guided by faculty and staff - is a signature element of our students' educational experience. Such immersion in research, in industry, and in our domestic and global communities extends the classroom to the world.
- *Advance Programs and Research that Will Serve and Inspire the World:* committed to being an agent of change for our stakeholders, our community, and our world. We partner with external leaders to identify the skills, values, and vision that will best equip our students to address tomorrow's changing needs and to become the innovators of the future. Our programs and research continue to evolve to address the rapidly transforming challenges of the world and to develop adaptive, creative students who are owners of their educational experiences.

Comparing this vision and strategic plan of the SoE to the five competencies defined as essential elements of the GCSP one realizes that they are very congruent. Thus, the GCSP will add a new dimension to the curriculum, and tools for students who will solve next generation problems. We already employ many of the desirable aspects of GCSP in the education of our students through various programs and centers outlined later. Integrating and leveraging these with emphasis on global awareness will enrich the students overall understanding and professional preparation. Through the GCSP elements, the students will be trained to apply their knowledge and experience to meaningful solutions for 21<sup>st</sup> century challenges and they serve as a platform to educate the social entrepreneurs and innovators of the next century. These challenges cover the four cross-cutting themes: Sustainability, Health, Security, and Joy of Living. While students at UD through various programs and offerings could touch on all of these themes we see particular strength in Sustainability (e.g., through the Hanley Sustainability Institute, a Minor in Sustainability, Energy, and the Environment, and a Renewable and Clean Energy program) as well as Health (e.g., through the School of Education and Health Sciences with more than 35 academic programs, and biomechanical engineering as well as biology programs).

# Essential Elements of GCSP

## **(a) Grand Challenges Scholar Recruitment and Selection.**

The selection process consists of marketing to students, soliciting applications, and selecting participants from a diverse cohort of undergraduate students representing a variety of disciplines. Any University of Dayton undergraduate student in good standing, preferably at the freshman or sophomore level, though lateral entrance at a later stage might be considered as well, can apply for admission to the program. A GCSP website will be established with program requirements, the GCSP application form (see Appendix), model plans of study, contact information for the GCSP director, and up-to-date event information.

### Recruitment Plan

For the first year, we will focus our recruitment efforts on students who are already at UD. Our outreach strategy will include the following:

- Advertisement at freshman orientation and in freshman seminars where the GCSP Director will explain the benefits of the program to a diverse group of highly motivated first year students and encourage application to the program.
- Honors program office
- Academic advising centers
- ETHOS center
- Student clubs
- Website and emails

In subsequent years, the plan is to add the following recruitment strategies to the ones above:

- Include GCSP program flyers and brochures in high school recruitment efforts
- Link GCSP website to student application page
- Involve current GCSP scholars in outreach and marketing activities

### Application and Selection Plan

The application process will require students to submit a plan of study showing how they will complete the components of the program, as well as a statement of purpose. Students may apply at any time during their academic career but we anticipate that most students will apply in their sophomore year in order to show a viable plan of study and to satisfy a minimum of three semesters of participation in the program. In special circumstances, some students in their junior year may show strong interest, especially if they have already been engaged in meaningful activities that are relevant for GCSP. Such students may be accepted on a case-by-case basis, if the Steering Committee determines that some of the prior experiences can be counted in GCSP. Applications will be accepted on a rolling basis and reviewed once each semester for admission. Deadlines and announcements will be established to facilitate student's academic planning schedule. The GCSP Steering Committee, under direction of the GCSP Director, will review all applications. An application (see Appendix II+III) consists of a plan of study along with an essay in which students describe their desired outcomes from participation in the GCSP program. Review criteria will include:

- A coherent plan of study that supports the student's Grand Challenge theme.
- A plan of activity that addresses all required GCSP framework components.
- Feasibility that the plan will be completed successfully.
- A required minimum of three semester participation in the program.
- The student's motivation as evidenced by their essay.

The selection process will strive for an academically strong and diverse cohort of students of both STEM and non-STEM majors. Non-STEM applicants' plans of study must show viable engagement with their chosen grand challenge. For example, a viable way to fulfill the research requirement is to participate in an interdisciplinary capstone or research team of STEM and non-STEM majors working on their chosen grand challenge. The selection process and ongoing advising will assure that non-STEM majors are fully engaged in the GCSP experience. There is no minimum GPA requirement as some of the most passionate and best contributing students are not necessarily the ones with a high GPA. However, the Steering committee will make sure to not admit students who may be in danger of failing since a dismissal would obviously also lead to the termination in their GCSP.

We are targeting to recruit 10-15 students per year in the first two years, with the cohort increasing to 20 students per year in subsequent years thereby trying to get to about 60 GCSP students at any given time.

#### **(b) GCSP Experiences.**

The Grand Challenge Scholars Program has five pillars that students must pursue in order to be well-prepared to tackle the Grand Challenges upon graduation. Students must participate in each of the five pillars, however, the depth of immersion in each component can vary. **It is required for students to have a high level of immersion in at least two of the five components (one of which has to be the talent competency) and a medium level of engagement in at least two other of the five components. The last component may be pursued at a low level.** Levels of immersion will be described individually for each component. Overlap amongst the components is valid and recommended to get the most out of the program. This does not mean that students can double count activities but rather that they are encouraged to seek activities with deep exposure which may contain multiple aspects to demonstrate multiple competencies, for example, participating in ETHOS (Engineers in Technical Humanitarian Opportunities of Service Learning). The five components of the GCSP are:

1. Talent Competency: Mentored research or creative experience on a Grand Challenge-like topic. *This is required to be a high level of immersion.*
2. Multicultural Competency: Understanding different cultures, preferably through multicultural experiences, to ensure cultural acceptance of proposed engineering solutions.
3. Multidisciplinary Competency: Understanding of multidisciplinary engineering systems solutions developed through personal engagement. *This component is required to be at least a medium level of immersion.*
4. Viable Business/Entrepreneurship Competency: Understanding, preferably developed through experience, of the necessity of a viable business model for solution implementation.

5. Social Consciousness Competency: Understanding that the engineering solutions should primarily serve people and society reflecting social consciousness.

These five GCSP experiences will be offered through the UD-specific program criteria outlined next, and summarized in Table 1. For the application the students will be expected to develop a plan of activities that they will use to satisfy the five competencies. This plan will be reviewed by the mentor [see Section (f)] and approved by the steering committee and will be consolidated within the first semester of starting the GCSP program. The options available to the student for addressing the five required competencies are described below. These are just examples and students can propose their own unique ways to achieve the desired immersion levels.

### **1. Talent Competency (high level of immersion):**

The technical creativity of the GCSP student will be developed through this competency. This will be closely mentored by the faculty advisor(s), who is either the GCSP mentor, or a close collaborator of the mentor. This activity will involve either a research project or design development related to the student's selected Grand Challenge topic. It is expected to be at least a two-semester effort to ensure substantial output. Existing opportunities that can be leveraged to satisfy the talent competency include the following:

- Air Force Research Laboratory (AFRL) and University of Dayton Research Institute (UDRI): UD's ties to the largest US-Department of Defense research complex is leveraged through the Southwestern Ohio Council of Higher Education (SOCHE) program and UDRI research contracts.
- Undergraduate research experiences sponsored by the Dean's offices, the Honors Program, and the Integrative Science and Engineering (ISE) Center Summer Collaborative Research Projects (CoRPS).
- Corporate Partnerships: Several companies that sponsor projects for our students through cooperative and internship employment, as well as sponsorship of capstone design projects.

Students will need to satisfy this criteria through the following:

1. Involvement in a two-semester long research or creative design project directed or co-directed by the GCSP faculty mentor. Examples include:
  - a. Faculty-led research (e.g., NSF Research Experience for Undergraduates program or similar projects).
  - b. Honors project or honors thesis: This can be an option for honors student who join the GCSP program.
  - c. 2-semester capstone design project with heavy research component or substantial added background analysis. A 2-semester capstone project is a required element of all engineering bachelor of science programs, so if students pick any of the grand challenges topics as their project, they can potentially use this as their talent competency.
  - d. 2-semester marketing project with the goal of increasing awareness of a specific Grand Challenge or promoting a potential intervention or solution developed by a GCSP team.
  - e. Cooperative/internship-based research-like project mentored jointly by faculty,

- and federal or industry collaborators.
2. Periodic presentations at GCSP meetings and inclusion of the results in their GCSP portfolio before graduation.
  3. At least one of the following additional experiences:
    - a. Research showcased in a campus event like the Stander Symposium
    - b. Research included in a peer-reviewed publication
    - c. Research presented in a professional meeting
    - d. Research showcase at local chapters of professional societies
    - e. Applying for invention disclosure or patent

Research experience and outcomes, along with accomplishments in the four other competencies, will be clearly described in the GCSP portfolio that the students submit on a regular basis.

## **2. Multicultural Competency:**

After completing this competency, the student will demonstrate in their portfolio their understanding and sensitivity to cultural issues among different communities (within the United States and across the globe), and how that is essential for viable Grand Challenge solutions. Here are some examples how students can satisfy different levels of immersion.

### *Low:*

This will require a 3-credit hour course related to multicultural studies and connected to at least one of the Grand Challenges themes. This course could be a required common academic program (CAP, see Appendix I) course in social science, faith traditions or practical ethical action depending on the actual content.

### *Medium and high:*

These levels of immersion require foreign travel for international program participation, study abroad programs, international outreach initiatives, or a deep immersion into local collaborations for international initiatives. For students unwilling or unable to participate in these kinds of activities, only a low level of immersion is possible. Some international programs currently offered are listed below, and several others are available through NAE, local nonprofits and private foundations. Existing UD programs are:

- ETHOS (Engineers in Technical Humanitarian Opportunities of Service Learning) which provides service-learning experiences through technical immersions, student activities, research and hands-on projects.
- BWISE (Business Wisdom through International, Service and Experiential Education) program
- Study Abroad
  - Exchange Programs allow students to travel to UD partner institutions. While many of the programs require the student to take classes in the foreign language of their host country, there are some programs that are conducted in English. Students have the option of studying abroad in the summer, for a semester, or a full year.
  - External Partner Programs offered by professional organizations which allow students to study for a summer, semester or an academic year.

The duration, type and intensity of these activities will be the principal determinant for which level of immersion it qualifies for.

### **3. Multidisciplinary Competency (at least medium level of immersion):**

Students will experience and document multidisciplinary character through coursework outside their major and through documented collaboration with students and mentors from other disciplines. As part of CAP, which is mandatory for all students, UD offers an extensive choice of multidisciplinary courses. In addition to coursework, it is very likely that the student's technical project (discussed in the Talent Competency) will involve non-engineering and non-academic mentors or peers from different backgrounds. In their portfolio, the student will clarify their understanding of interdisciplinary team work, and discuss how they expect different disciplines to address their selected Grand Challenge topic. Next are some examples how students can satisfy different levels of immersion.

#### *Medium:*

This will require two or three 3-credit hour multidisciplinary courses connected to at least one of the Grand Challenges themes. These courses could be required CAP course in inquiry, integrative or capstone depending on the actual content. The Creative Analytics Mini-Series can be counted as a multidisciplinary course as well. A completed Sustainability, Energy and Environment (SEE) minor satisfies the multidisciplinary competency at a medium level.

#### *High:*

In addition to coursework explained in the medium level, a high level of immersion would require a multidisciplinary co-op experience, or engagement with activities offered by the Office of Experiential Learning, Hanley Sustainability Institute, Fitz center or similar all of which must be included and explained in the portfolio.

### **4. Viable Business / Entrepreneurship:**

Students will develop an understanding of business and entrepreneurship areas through participation in coursework and/or mentored exercises to generate viable business model(s) for successful implementation of Grand Challenge solutions. GCSP students will demonstrate that they have an understanding of how to implement innovative ideas. Here are some examples of how students can satisfy different levels of immersion.

#### *Low:*

This will require a 3-credit hour course related to business / entrepreneurship and connected to at least one of the Grand Challenges themes. This course could be one of the open electives many students at UD have to take.

#### *Medium:*

The first criteria to satisfy is for the student to take at least one course in the area of business and entrepreneurship and connected to at least one of the Grand Challenges themes. Additionally, the student will choose one more activity such as: taking 1-2 additional courses offered by the School of Business related to entrepreneurship or innovation, taking part in the flyer pitch or similar events, or active participation (equivalent of 40 hours) in one of the many local area innovation hubs, immersion in an enterprise or startup activity or Leonardo Enterprises and KEEN events. The capstone experience could also count if a significant component of it is related to developing a viable business model.

*High:*

This will also require at least one 3-credit hour course related to business / entrepreneurship and connected to at least one of the Grand Challenges themes. For the high level the scholar must also participate in experiences that involve some aspect of translating an invention/innovation into a viable business model. This may range from risk-taking commercial ventures to implementing beneficial solutions for nonprofits. This could be demonstrated by being ranked highly in the flyer pitch or similar event, deep immersion in an enterprise or startup activity, or active participation in one of the many local area innovation hubs (equivalent of 80 hours), or application for invention disclosure, patent or other form of intellectual property. Alternatively, completing a minor (or major) offered by the School of Business will satisfy this requirement.

**5. Social Consciousness:**

Students will deepen their social consciousness and motivation to address 21st century issues which they will describe in detail in their portfolio. Here are some examples how students can satisfy different levels of immersion.

*Low:*

This will require a 3-credit hour course related to social consciousness and connected to at least one of the Grand Challenges themes. This course could be a required CAP course in social science, faith traditions or practical ethical action depending on the actual content.

*Medium and high:*

These levels of immersion require a 3-credit hour course related to social consciousness and outreach activities which may include service learning, volunteerism, mentoring K-12 students, or equivalent. Completing a major in human rights is a high level of immersion. Completing the SEE minor will count as a medium level and can be promoted to a high level through additional outreach activities such as

- Service learning options
- Volunteerism
- K-12 outreach in STEM
- Leadership role at community-centered organization
- ETHOS
- Fitz Center
- Hanley Sustainability Institute
- Office of Experiential Learning
- GEMnasium
- Living Learning Community
- Special Interest Housing

The duration and intensity of these activities will be the principal determinant for which level of immersion it qualifies for.

**Table 1: Some resources that are already available at UD for the GCSP**

<b>Resource</b>	<b>Can be applied to which component number (at what immersion level) with what activity</b>
Capstone experiences in many majors	1 (high) two semesters of project Potential for 3 and 4 at a (low or medium) level
Stander Symposium	1 (high) presentation or poster
University Honors Program	1 (high) honors thesis
SURE program in SoE Dean's summer fellowship in College ISE CoRPS program	1 (high)
CAP (Common Academic Program)	2-5 (low) taking a course 2-5 (medium) taking a sequence of courses
GEMnasium	Provides opportunities for 2-5
IACT at Art Street	Provides opportunities for 2-5
Study Abroad programs in many units	2 (high) being abroad for at least one semester 2 (medium) being away for a few weeks
ETHOS	2 (high) one or more semesters, provides opportunities for 5
Co-op Program	Provides opportunities for 2-5 (especially 3 and 4)
Office of Experiential Learning	Provides opportunities for 2-5 (especially 3 and 5)
Hanley Sustainability Institute (HSI)	Provides opportunities for 1-5 (especially 3 and 5)
Fitz Center	Provides opportunities for 2-5 (especially 3 and 5)
Creative Analytics Mini-Series	3 (medium) if combined with other multidisciplinary experience
SEE Minor	3 (medium) and 5 (medium) if completed
Leonardo Enterprises (Incubator)	Provides opportunities for 4
KEEN	Provides opportunities for 2-5 (especially 4)
Flyer Pitch	4 (high) give pitch and be ranked highly or 4 (medium) give pitch
Various business minors	4 (high) if completed
Major in human rights	5 (high) if completed; (medium) if partially taken
Living Learning Community	5 (low or medium) depending on involvement and scope
Special Interest Housing	5 (low or medium) depending on involvement and scope

### **(c) Thematic Continuity and Connectivity.**

For ensuring connectivity among the five pillars for an individual scholar, a portfolio (likely e-portfolio through Isidore which is UD's Learning Management System) based learning approach will be adopted. Every scholar will have a faculty mentor who will monitor progress, discuss the emerging connections, make deliberate curricular choices, give career advice, etc.

For making connections among the diverse cohort of scholars and networking regular mandatory activities will be offered (at least once or twice a semester). Some potential examples include:

- Workshops, seminars and mini-conferences where the scholars inform each other about progress, insights, research findings, plans, etc.
- Participate in community outreach (river clean-up, soup kitchen, etc.)
- Attend invited speaker series events that fit the GCSP theme with a reflective discussion among GCSP scholars afterwards
- Participate in GEMnasiums (Growth - Education – Mindset a collaborative hands-on ‘test lab’ at UD)
- Social outings

The student’s mentor, in consultation with the Steering Committee, will ensure that the selected Grand Challenge problem is consciously embedded within each of the five GCSP competency pathways that the student chooses. It will be highly advantageous to the student if development of a single competency is explicitly linked to development of one or more of the other competencies. The student will discuss with his or her mentor(s) to define a “Statement of thematic continuity and connectivity”, where they indicate how their thematic experiences are specifically linked to the Grand Challenge problem they are developing their talent in. Some of the basic ethics and integrity aspects of a professional are addressed in mandatory CAP courses every UD student has to take. This will give GCSP students a clear understanding of these issues and they can address in their portfolio how they come into play in all the GCSP competency sections as well.

Students in the program will submit their portfolio including a reflection at the end of each academic year to the GCSP Director. The Director with the help of the Steering Committee will review the portfolios and provide feedback or intervention as needed to keep students on track to complete the program. The reflection is meant to create greater connectivity between the scholar’s Grand Challenge theme and the other program components such as coursework and other experiences. An updated plan of study showing completed requirements, issues that are blocking progress, and requests for changes has to be submitted to the GCSP Director at the end of each semester or when required. Any problem areas will be discussed with the Steering Committee in order to help identify solutions to keep scholars on a successful path toward completion of the program. All changes to the plan of study must be approved by the GCSP Steering Committee.

### **(d) Programmatic and Individual Student Assessment.**

The GCSP scholar will work with his/her faculty mentor throughout the program. A student can either propose their own mentor or the Director with support of Steering Committee members can help to identify a suitable mentor. The mentor can reach out to the Steering Committee

members or the Director for advice/feedback, and the office staff for logistical support at any time. At the beginning of the program, the student will meet their mentor and fine-tune their plan of study. This, along with student updates, will be reviewed semesterly by the Steering Committee, and feedback will be provided to the mentor-scholar team.

The mentor will continue to oversee the student’s progress and ensure the successful completion of the requirements. Each mentor will serve as a counselor to guide the student through the program while being a motivational force to achieve the best results and meet all the required competencies. Figure 1 provides a suggested timeline for the student to follow which is flexible, and can be modified by students in consultation with the mentor.

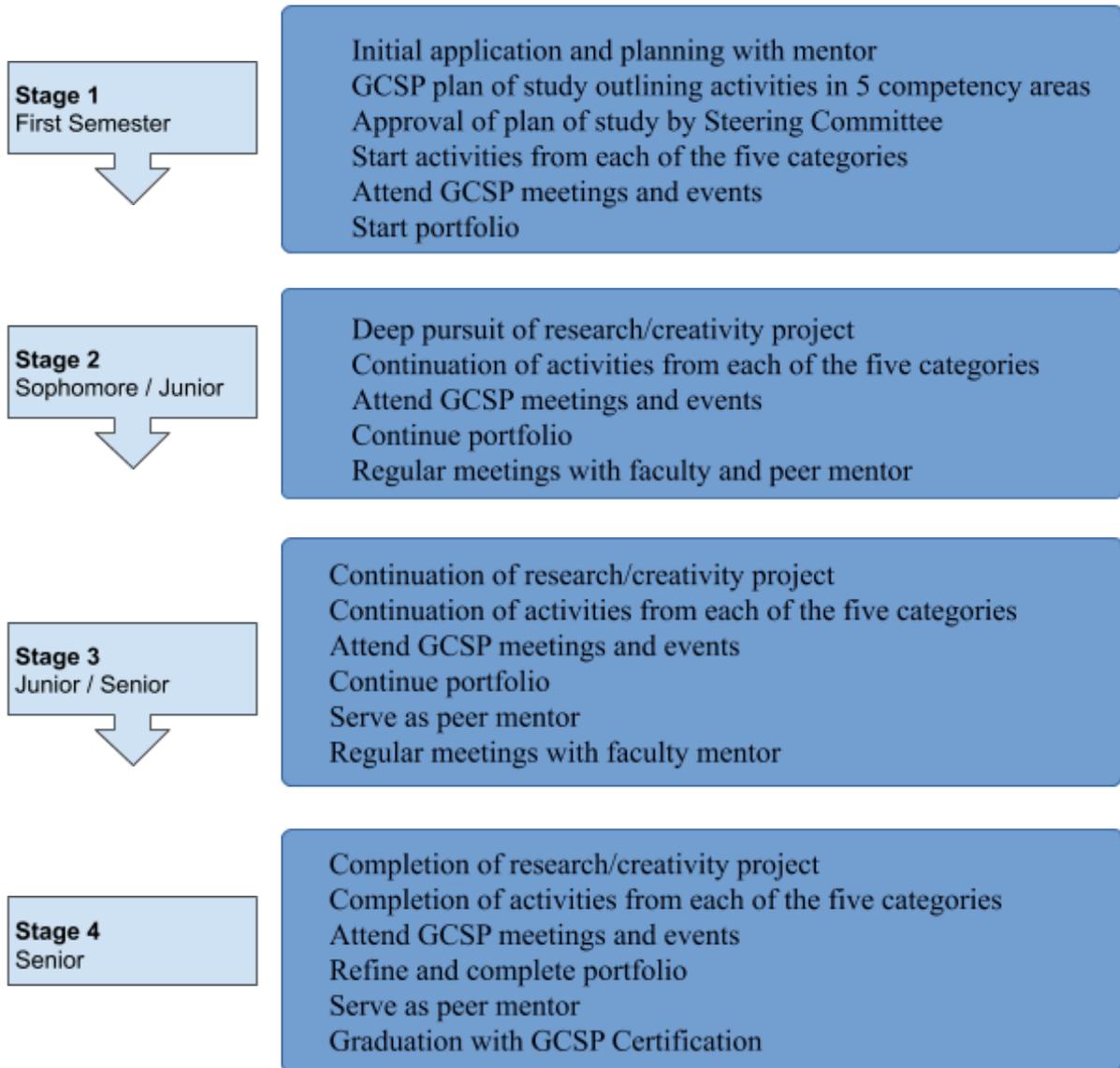


Figure 1: Suggested GCSP Progress Timeline

**(e) Institutional GCSP Governance and Sustainability.**

The program will be administered by the GCSP Director and the GCSP Steering Committee. The Dean of the School of Engineering will appoint the GCSP Director and Steering Committee

members. The GCSP Director is responsible for overall administration, operation, assessment, advertisement and advocacy, as well as reporting. Operational duties will include program logistics, budget management, scholar selection, and progress monitoring.

The Steering Committee will have representatives of all involved units on campus as well as staff and student representatives. The steering committee establishes criteria and mechanisms for assuring that all Grand Challenges Scholars comply with the goals and spirit of the program and selects the scholars. The Steering Committee will be comprised of:

- GCSP Program Director (serves as chair)
- Dean, School of Engineering (ex officio)
- Director of the University Honors Program (ex officio)
- Representatives from other units: College of Arts and Science, School of Business Administration
- Undergraduate student representatives (initially nominated by the dean's office, subsequently elected by all GCSP students)
- Undergraduate Faculty Advisors (from participating degree programs)
- Representative from the Learning Teaching Center to help advise how learning opportunities are created and assessed

Committee members will have three year terms with staggered rotation, so that only 1/3 of the non-standing steering committee can turn over in a given year. Members can serve multiple consecutive terms. The committee will meet every semester to perform the following regular tasks:

- a) Serve as a catalyst in connecting GCSP scholars to research
- b) Identify and select students into the program
- c) Solicit guest speakers (or serve as speakers)
- d) Provide guidance/feedback to mentors and GCSP scholars or serve as mentors
- e) Assess scholar's portfolios and approve plans of study

The entire committee will meet at least once a year for self-assessment of the program and to provide recommendations for further improvements. To further aid in the assessment of the program, the GCSP Director will solicit feedback from students, capstone and research faculty mentors, peer mentors, and other stakeholders. Using data from these sources, the GCSP Director will prepare an annual report for review by the Steering Committee and the Dean of the School of Engineering.

### Financial Sustainability

Since the major aspects of this program are going to leverage already existing and funded programs at UD, up-front costs and funding needs are relatively small. Some of these existing programs and centers are:

- ETHOS center which provides service-learning experiences through technical immersions, student activities, research and hands-on projects.
- Annual Stander Symposium to recognize and celebrate academic excellence in undergraduate and graduate education.
- Hanley Sustainability Institute (HSI)
- Sustainability Studies Program (SSP)

- University Honors Program
- Summer Undergraduate Research Experience (SURE) in the School of Engineering and Dean's summer fellowship in the College of Arts and Science
- Fitz Center for Leadership in Community by cultivating servant leaders
- GEMnasium (Growth - Education – Mindset) which is a collaborative hands-on 'test lab' that provides spaces for UD students, faculty, staff and regional partners to prototype new teaching and learning models for servant-leadership and social innovation.
- Business Wisdom through International, Service and Experiential Education (BWISE) program in School of Business Administration
- Flyer Pitch
- UD is a very active member in the Kern Entrepreneurial Engineering Network (KEEN)
- UD speaker series for inviting high visibility speakers to campus
- Office of Experiential Learning
- Institute of Applied Creativity for Transformation (IACT) at Art Street
- Capstone experiences in many majors
- Major in human rights
- Study Abroad programs in many units
- Learning teaching center (LTC)
- Chaminade Scholars Cohort
- Extensive and very popular co-op program administered through the Cooperative Education office
- Leonardo Enterprises (Incubator)
- Local student chapters of professional organizations
- Living Learning Communities
- Special Interest Housing

Once the program is in place, funds that will eventually be base budgeted in subsequent fiscal years include the following:

- a) Course release and/or summer stipends for the GCSP Director as well as summer stipends for steering committee members.
- b) Part time staff assistant or student helper to help in recruitment, applications, advertisement, event planning, and organization.
- c) Marketing expenses.
- d) Travel expenses for the GCSP Director and perhaps faculty and students to attend a national GCSP event each year.
- e) Food cost for GCSP meetings and events.
- f) Guest speaker travel expenses and honoraria.
- g) Funds to enable GCSP scholars to participate in research.

The University's Advancement Office will seek additional philanthropic support. However, the above funding is not dependent on donor support as it will be supported by the Dean of the School of Engineering. Initially, the Dean's office pledges \$25k per year and an estimated budget for the first years of the program is shown in Table 2.

**Table 2: Budget for the first years of the UD GCSP**

<b>Line Item</b>	<b>USD</b>
Up to one-month summer salary for GCSP director	6,000
Summer salary/stipend for GCSP committee members (\$1500 per member)	9,000
Admin support through a TA (5 hours per week at \$10 per hour)	2,200
Funding for workshops, events or an invited speaker	3,000
Travel cost to participate in NAE GCSP events	2,000
Miscellaneous (Marketing, Medallion as part of scholar's regalia at graduation, etc.)	2,800
<b>Total</b>	<b>25,000</b>

**(f) Mentorship for GCSP Faculty and Students.**

Scholars' primary source of mentorship and advising throughout their GCSP experience will be the GCSP Director and Steering Committee. Each semester, the Steering Committee will review scholars' progress reports and updated plans of study to monitor progress toward completion of the program and will provide advice as needed to guide students toward successful completion of the program. Also, faculty mentors will help to guide students through the GCSP and the director will assure that these faculty mentors are very familiar with the requirements of the program.

In addition, once the GCSP is more matured, experienced GCSP students will peer mentor new students. Peer mentors will have participated in the program for at least two previous semesters and mentees will be mentored for at least two semesters. The goal of this peer mentor program is to act as a source of networking and support to new GCSP students and to provide feedback to the GCSP Director to help identify problems or roadblocks early. The GCSP Director will meet with the peer mentors once per semester to help prepare them for their role and to solicit feedback to help identify potential problems and improve the program. Peer mentors may also assist with several of the marketing and advertising efforts.

**(g) Student Recognition.**

After the students submit their final portfolio to the GCSP Steering committee and it is approved, the student will be certified to have completed the University of Dayton GCSP program. Students who successfully complete the GCSP will receive a Certificate of Distinction of Grand Challenge Scholar and be recognized at graduation. In addition, the following distinguishing features will be provided:

- The GCSP designation will be added to the student's transcript if approved by registrar's office
- Students will wear a medallion as part of their regalia at graduation.
- The scholars will be invited to a special reception with Steering Committee members, faculty mentors and fellow GCSP scholars.
- Selected students may receive funds to attend the annual NAE-GCSP meeting.

After the certified completion of the GCSP the student's package and information will be forwarded by the Director to the National Academy of Engineering to be eligible for inclusion in the annual NAE Grand Challenges Scholar press release and web listing of all scholars.

## Unique Aspects

The University of Dayton President, Dr. Eric F. Spina, in his strategic vision calls for UD to become the "University for the Common Good". As such, we are called to serve others through our work, teaching, scholarship, service, creative endeavors, and partnerships. Therefore, UD embraced the **United Nations Global Goals** (also known as the Sustainable Development Goals, or SDGs) since they offer both a frame of reference and a plan for action that links our own efforts with an international movement to end poverty, protect the planet, and ensure prosperity for all - without compromising the ability of future generations to meet their own needs. The UN Global Goals are a set of 17 broad goals to transform the human experience and the health of the planet by 2030. The emphasis on global is not a call to action on the other side of the world. Instead, it is an invitation to work locally for global change where global means everyone, everywhere.

We live in a global society that is constantly changing. As tomorrow's leaders, UD students must understand its complexities and how to respond thoughtfully to its challenges and opportunities. The **Common Academic Program** (CAP) introduces key questions and topics across a wide range of academic disciplines (see Appendix I). Students learn to value and synthesize diverse points of view and to examine issues critically, yet with an open mind. Our students, through the CAP, are ready to pursue their life aspirations and be lifelong learners.

The **Sustainability Studies Program** (SSP) is a multidisciplinary effort to encourage students to explore complex societal sustainability issues that do not fit easily into one traditional academic discipline. The genesis of this program lies in the realization that a scientific and technical knowledge of environmental, ecological, and energy system challenges will not be sufficient to develop viable answers. Many disciplines at the University of Dayton make contributions to these issues, ranging from ethical, spiritual, and artistic, to economic, political, and sociological approaches. Students will take interdisciplinary courses and will participate in interdisciplinary research. The Minor in Sustainability, Energy, and the Environment (SEE) offered by SSP is one of the largest minors at the University of Dayton with majors from all units at UD, including Accounting, Biology, Communications, Dietetics, Education, Engineering, Finance, Geology, Entrepreneurship, History, Human Rights Studies, International Studies, Marketing, Pre-medicine and more.

In summary, UD's long history of being involved in these kind of transformative questions has attracted a student body uniquely qualified and motivated to work on the Grand Challenges. In addition, UD's mission and past efforts imply that we already have a lot of the resources and - more importantly - mindset both of which our implementation of the GCSP can rely on heavily.

## Other

In general, aspirations of the GCSP and the Strategic Vision of the University of Dayton (<https://udayton.edu/vision/>) align very well and have a lot of overlap. Therefore, it is very likely that the GCSP program, once introduced at the unit level, will get university-wide attention, and has a high probability of university-wide growth in the coming years.

# Appendices

## Appendix I: Common Academic Program (CAP)

CAP is an innovative curriculum that is the foundation of a UD education. It is a learning experience that is shared in common among all undergraduate students, regardless of their major. The CAP's distinctive structure is built on the notion that, while students have unique experiences at UD, all academic programs and learning encounters are informed by the seven institutional learning goals articulated in the *Habits of Inquiry and Reflection* ([HIR](#)):

1. Scholarship
2. Faith Traditions
3. Diversity
4. Community
5. Practical Wisdom
6. Critical Evaluation of Our Times
7. Vocation

We are a community of learners pursuing learning from myriad perspectives and with a wide range of interests, yet we share commonality in our aspirations. The CAP is an evolving, flexible curriculum that is responsive to the changing times while remaining grounded in the HIR principles and Catholic and Marianist intellectual traditions. Students begin with a set of courses that all UD undergraduate students complete and then put together a program that suits their own interests and goals as they progress throughout our developmental model. Both curricular and co-curricular aspects of students' lives at UD resonate with the seven learning goals.

Unlike many other institutions, the CAP is not a general education model in which students pick from lists of courses and check boxes of requirements that are disparate. Rather, the CAP is an integrated approach that builds and demonstrates connections across various aspects of student learning. The CAP intentionally sequences courses so that over time students build knowledge of and expertise in understanding, analyzing, and demonstrating the seven central learning goals and outcomes. The CAP calls on students to integrate what they learn by requiring them to take courses which intentionally cross disciplinary boundaries and incorporate non-classroom experiences. It emphasizes assessment of student learning to guide continual course improvement. Students are engaged through application of knowledge in learning-centered tasks. Professional and vocational learning opportunities are expansive and include skills valued by employers: communication, decision-making, and critical thinking. It has the following components:

- First-Year Humanities Courses – 12 total credit hours; Introductory courses in Religious Studies, Philosophy and History as well as a First-Year Writing Seminar.

- Second- Year Writing Seminar – 3 credit hours
- Oral Communication – 3 credit hours
- Mathematics 3 credit hours
- Social Science – 3 credit hours
- Arts – 3 credit hours
- Natural Sciences – 7 total credit hours
- Faith Traditions (Crossing Boundaries) –3 credit hours
- Practical Ethical Action (Crossing Boundaries) – 3 credit hours
- Inquiry Course (Crossing Boundaries) – 3 credit hours
- Integrative Course (Crossing Boundaries) – 3 credit hours
- Major Capstone Course or Experience – hours determined by department

In addition, one of these components must satisfy a diversity and social justice requirement. In the following some of these components, as they are particularly relevant to GCSP, will be discussed in more detail.

### Social Science

Essential to life in the 21st century is an understanding of the relationship between individuals, groups and institutions. The Social Science course (SSC 200) is a theme-based mandatory course that varies across sections but shares common learning outcomes. The course uses social science methods and social theory to critically examine a human issue or problem from at least three social science disciplinary perspectives (anthropology, economics, political science, psychology, and sociology). The course emphasizes learning outcomes related to the institutional learning goals of scholarship, diversity, and critical evaluation of our times

### Practical Ethical Action (Crossing Boundaries)

The Practical Ethical Action course is designed to cross the boundaries between the theoretical and the practical and between the liberal arts and the applied fields. Courses satisfying the Practical Ethical Action component may be offered by any department provided that the courses engage students in thick description and analysis of ethical issues using concepts central to the study of ethics such as justice, rights, natural law, conscience or forgiveness and that the courses provide sufficient normative content that allow students to reflect on value judgments and ethical reasoning and practical application. These courses draw from relevant interdisciplinary knowledge as well as an understanding of the professions and social institutions.

### Inquiry Course (Crossing Boundaries)

The Inquiry component requires that students select a course outside their own division to better understand the ways of knowing found in other academic disciplines. The Inquiry course serves as an introduction to key methods of investigation, interpretation, exploration, and ways of knowing. Taking a course outside one's major can broaden awareness of differing philosophies or analytic approaches, and it can offer new ways of conceiving of and resolving problems. The Inquiry course provides students an opportunity to contrast inquiry in their own field with a

different discipline's methods of inquiry. Some modes of inquiry engage experimentation and creative practice; other modes employ cognitive systems or analytical frameworks. Still other modes of inquiry investigate the complexity of systems, languages, or cultures. Exposure to modes of inquiry not typically used in the students' major prepares them to think critically about ways of acquiring, evaluating, and applying knowledge claims within their own discipline. For this reason, the Inquiry course includes a reflective and comparative component in which a student examines methods in his or her major field with those in the field of the Inquiry course.

#### Integrative Course (Crossing Boundaries)

The integration of knowledge has a long-standing position within the Catholic intellectual tradition and an increasingly important role in understanding contemporary social issues and problems. The Integrative course requires that faculty develop, and students select, a course that transcends disciplinary boundaries and explicitly examines significant social issues or problems in a multidisciplinary or interdisciplinary framework. Collaborative, interdisciplinary efforts by faculty are encouraged but not required.

#### Diversity and Social Justice Requirement

As a Marianist university, the University has a special concern for the poor and marginalized and a responsibility to promote the dignity, rights and responsibilities of all persons and peoples. The University curriculum is responsible for contributing to this effort and does so throughout the CAP, but in a more focused way through a Diversity and Social Justice component. Every student investigates human diversity issues within a sustained academic context by taking at least three credit hours of coursework that has a central focus on one or more dimensions of diversity that are relevant to social justice. The course must have a central focus on one or more dimensions of human diversity on the basis of which systems, institutions, or practices that obstruct social justice have functioned. The dimensions may include, but are not limited to, race, gender, socioeconomic class, and sexual orientation. Courses may address diversity within the United States, in a global context, or both. Since the course uses a social justice framework, it considers constructive responses to such injustice.

#### Major Capstone Course or Experience

The ability of students to integrate the knowledge acquired in the undergraduate career, both within the major and in the CAP, is greatly enhanced by a capstone experience. All students have a capstone course or experience in their major. The capstone provides students the opportunity to engage, integrate, practice, and demonstrate the knowledge and skills they have developed in their major courses and which reflect the University's institutional learning goals, particularly vocation. The capstone provides students the opportunity to engage in the scholarship, activity and/or practice of their major field and further the students' understanding of their chosen vocation, career or profession. Students present their work in a forum appropriate to their major.

## Appendix II: Application Form

Name and Student ID:

Major(s):

Intended semester and year of graduation:

**Part I** – Proposed Plan of Study: A minimum of three semesters of participation is required.

Grand Challenge Problem:					
Immersion level	Talent	Multicultural	Multidisciplinary	Business / Entrepreneurship	Social Consciousness
High (pick one more)	x				
Medium (pick two)					
Low (pick one)					
Explain briefly how you will satisfy the selected level of immersion for each competency. Please elaborate more in Part II (b).					
<b>Talent:</b>					
<b>Multicultural:</b>					
<b>Multidisciplinary:</b>					
<b>Business/Entrepreneurship:</b>					
<b>Social Consciousness:</b>					
<b>Connectivity:</b> Participation in Grand Challenge Scholar events, peer mentor program and portfolio					

**Part II** – Explain in two pages (a) what you hope to accomplish through participation in the Grand Challenge Scholars Program and (b) how your plan of study relates to your specific Grand Challenge theme and fulfills the student learning outcomes listed below.

1. **Talent Competency:** Mentored research or creative experience on a Grand Challenge-like topic
2. **Multidisciplinary Competency:** Understanding of multidisciplinary of engineering systems solutions developed through personal engagement
3. **Multicultural Competency:** Understanding different cultures, preferably through multicultural experiences, to ensure cultural acceptance of proposed engineering solutions
4. **Viable Business/Entrepreneurship Competency:** Understanding, preferably developed through experience, of the necessity of a viable business model for solution implementation
5. **Social Consciousness Competency:** Understanding that the engineering solutions should primarily serve people and society reflecting social consciousness

### Appendix III: Example Application Form

Name and Student ID: Joe Miller 424242

Major(s): Mechanical Engineering

Intended semester and year of graduation: Spring 2021

**Part I** – Proposed Plan of Study: A minimum of three semesters of participation is required.

Grand Challenge Problem: Improve Efficiency of Solar Cookers					
Immersion level	Talent	Multicultural	Multidisciplinary	Business / Entrepreneurship	Social Consciousness
High (pick one more)	x		X		
Medium (pick two)		X			X
Low (pick one)				X	
Explain briefly how you will satisfy the selected level of immersion for each competency. Please elaborate more in Part II (b).					
<b>Talent:</b> Complete SURE program (summer of 2020), independent research on exploring various solar cooker designs with Dr. Heyne and present results at Stander Symposium (spring 2021). In my senior year I plan to complete my capstone (MEE 431L and 432L, 5 credit hours) requirement by building a few prototypes.					
<b>Multicultural:</b> I spent the summer of 2019 with the ETHOS program in Columbia working on the installation of solar panels					
<b>Multidisciplinary:</b> Creative Analytics Mini-Series, SEE 301 Global Change and Earth Systems (3), Capstone project will be highly multidisciplinary					
<b>Business/Entrepreneurship:</b> ECO 204 Principles of Macroeconomics (3)					
<b>Social Consciousness:</b> SSC 200 (3), ETHOS, Volunteer in K-12 STEM outreach					
<b>Connectivity:</b> Participation in Grand Challenge Scholar events, peer mentor program and portfolio					

**Part II**

My goal for participation in the Grand Challenge Scholars Program is to gain skills and insight into how to use my major in Mechanical Engineering to help transition society to renewable energy and away from dependence on fossil fuels. Specifically I hope to learn how to overcome technical, economic, and social barriers to the widespread adoption of solar energy.

1. Talent (high): I will work with Dr. Heyne to explore various solar cooker designs. Dr. Heyne has

agreed to support my application to the Summer Undergraduate Research Experience (SURE) program to begin this research topic with the goal of completing my capstone requirement by building a few prototypes.

2. Multicultural (medium): I spent the summer of 2019 with the ETHOS program in Columbia working on the installation of solar panels. I believe that an individual person's state of well-being, as well as a society or culture as a whole's well-being, is tied to the availability of affordable and clean energy and I saw that first-hand in this project.

3. Multidisciplinary (high): I am planning on taking the Creative Analytics Mini-Series as well as the 3-credit hour course SEE 301 Global Change and Earth Systems both of which are highly multidisciplinary. In addition, my capstone project will also be highly multidisciplinary.

4. Entrepreneurship (low): I propose to complete ECO 204 Principles of Macroeconomics to help me to learn concepts and vocabulary associated with business and economics. I believe a basic understanding of Economics will help me to better understand and quantify the value proposition of renewable energy over fossil fuels. This course will also give me a basic prerequisite in business if I decide to pursue additional business courses, either at UD or for a graduate degree.

5. Social Consciousness (medium): I will be taking a section of SSC 200 which has a high focus on social consciousness. In addition, my ETHOS experience had a large aspect of social justice and empowering people. Lastly, through the local student chapter of ASME I am often involved (2-3 times a year) with K-12 STEM outreach activities.