

**Proposal to Establish a Grand Challenge Scholars Program**  
**Within the Faculty of Engineering at University of New South Wales**

Dr Ang Liu, Ph.D.  
Proposed UNSW Director of GCSP  
Lecturer, School of Mechanical and Manufacturing Engineering  
University of New South Wales  
+61 (0) 2 9385 54080  
[ang.liu@unsw.edu.au](mailto:ang.liu@unsw.edu.au)

Professor Maurice Pagnucco, Ph.D.  
Deputy Dean (Education), Faculty of Engineering  
Head of School, School of Computer Science & Engineering  
University of New South Wales  
+61 (0) 2 9385 5518  
[m.pagnucco@unsw.edu.au](mailto:m.pagnucco@unsw.edu.au)

## **1. Introduction**

The Faculty of Engineering at the University of New South Wales (hereafter referred to as UNSW Engineering) proposes to establish a local Grand Challenge Scholars Program (GCSP) in Sydney, Australia. UNSW Engineering is the largest and most prestigious faculty of engineering in Australia. Since 2016, made possible by the PLoS Alliance ([www.plusalliance.org](http://www.plusalliance.org))—a formal alliance among UNSW, Arizona State University (ASU), and Kings College London (KCL)—UNSW Engineering has been collaborating with the GCSP program at ASU to offer a technology-enabled international joint course, ENGG1200: Introduction to NAE Grand Challenges for Engineering that has participation by engineering freshmen from both institutions. To date, this course has been continuously iterated for four semesters, and 60 UNSW students have successfully completed this course. Based on this solid foundation, we propose to launch a full-scale Grand Challenge Scholars Program (GCSP) in order to educate GC scholars for the 21<sup>st</sup> Century at UNSW.

## **2. UNSW Vision and Goals for GCSP**

UNSW launched its 2025 Strategic Plan ([www.2025.unsw.edu.au](http://www.2025.unsw.edu.au)) that prioritizes academic excellence, social engagement, and global impact. The plan explicitly outlines UNSW's aspiration "*to be Australia's global university, improving and transforming lives through excellence in research, outstanding education, and a commitment to advancing a just society*". On the global scale, UNSW is playing a leading role in initiating

reflections, discussions, and actions on addressing the grand challenges facing contemporary society in Australia and worldwide. UNSW Engineering is widely recognized as the leading engineering faculty in Australia and a renowned leader in the world. UNSW Engineering consists of 8 academic schools, all of which will be engaged in the GCSP program. UNSW Engineering is in a globally leading position, with respect to both research and education, in the areas of solar energy, cyber security, access to clean water but also in most, if not all, of the other grand challenges for engineering.

In light of the UNSW 2025 Strategic Plan, we are committed to offering students a *signature education experience* through the GCSP program that will empower our students to think big, take risk, and make it happen (Dream, Dare, Do!). Together with other signature experiences, we aim to graduate at least 15-20 GC scholars every year, who are equipped with diversified background, global competence, solid engineering skill, cross-disciplinary knowledge, in-depth contextual understanding, and strong motivation to tackle grand challenges in the 21<sup>st</sup> Century. We envision that the GCSP program will become a strategic complement to other successful programs at UNSW Engineering, such as the student-led projects and women in engineering. With a significant increase in undergraduate student enrolment, we are looking to create more learning opportunities and deliver quality engineering education at scale.

### **3. Steering Committee**

The UNSW Dean of Engineering will appoint an experienced faculty member to serve as the GCSP Director. A local GCSP Steering Committee will be established to be responsible for all aspects of the program, such as student admission, collaboration with other programs, budget approval, etc. The Steering Committee will consist of the GCSP Director, UNSW Engineering Deputy Dean (Education), multiple faculty members from different academic schools within UNSW Engineering (currently there are 8 schools in UNSW Engineering, so it would be advisable to seek one representative from each school). In addition, the Dean of Engineering will appoint a senior faculty member, preferably a member of the Australian Academy of Technology and Engineering, to serve as Chair of the Steering Committee. The GCSP Director and Chair of the Steering Committee will jointly select and invite members of the Steering Committee, in consultation with the Heads of UNSW Engineering schools.

The GCSP Director will oversee the development, management, evaluation, and promotion of the GCSP program. In particular, they are responsible for teaching ENGG1200: Introduction to NAE Grand Challenges for Engineering, reporting to NAE, collaborating with other GCSP programs at partner institutions, managing program budget, securing additional funds, and promoting the program to a broader audience. Members of the Steering Committee are responsible for reviewing student applications, tracking student progress, creating learning opportunities, engaging other faculty

members, etc. A professional staff at UNSW Engineering (i.e., Manager of Signature Education Experience) will commit 20% of her time to daily operations of the GCSP program and will advise students on courses and opportunities that satisfy program requirements, coordinate opportunities for students to be involved in a variety of related programs, and recruit students into the program.

#### **4. Student Recruitment, Application, and Selection**

GC scholars will be recruited through two main channels. Firstly, the top-performing students, who achieve a grade of distinction (DN) or high distinction (HD) in <ENGG1000: Introduction to Engineering Design and Innovation> (the cornerstone design course at UNSW Engineering) will be invited to join by the GCSP Director and Deputy Dean (Education). This will be our primary channel of recruiting top students. The effectiveness of this approach has been validated during the past two years. Secondly, students who do not achieve a satisfactory grade in ENGG1000 will still be considered once they submit an application that will be reviewed by the GCSP Steering Committee. A complete application should include the following documents:

- a) A completed application form;
- b) One essay that outlines the student's interest in the NAE Grand Challenges;
- c) One reference letter from a faculty member at UNSW;
- d) An official transcript of courses completed and grades received at UNSW.

Students recruited through both channels will be required to enroll in the special course, <ENGG1200: Introduction to NAE Grand Challenges>, which is offered exclusively by the UNSW GCSP program. ENGG1200 serves as the gateway into the GCSP program. At the conclusion of this course, the participating students who receive a grade of CR (i.e., good performance within the mark range of 65-74) and above will be formally accepted into the GCSP program. The students who fail to achieve an above-CR grade will not be able to continue in the program.

We aim to recruit, select, and admit 60-80 new students into the GCSP program every year. We aim to graduate 15-20 GC scholars every year, based on the assumption that 20-25% of the participants will retain and fulfill all the program requirements. At UNSW Engineering, we believe that diversity is the most effective catalyst for breakthrough innovations. Therefore, we aim to build a highly diversified cohort that will consist of, preferably, at least 30% female students and 20% international students. At present, UNSW Engineering has female enrollment at 22% that is above the national average in Australia. In light of our goal to promote diversity and embrace inclusion, the above-mentioned admission criteria may be adjusted for underrepresented students on a case-by-case basis. Finally, we aim to target primarily honours students. The GC scholars will be supported to conduct a GC-related project for their undergraduate thesis, which will

afford them adequate time, resource, and guidance from academic schools and faculty members to produce a high-quality work to conclude their GC portfolio.

We will actively promote the GCSP program during the major student events at UNSW, such as the Engineering Education Showcase and UNSW Open Day for future students. A professional program website will be created under the homepage of UNSW Engineering ([www.engineering.unsw.edu.au](http://www.engineering.unsw.edu.au)). All the incoming UNSW Engineering students will receive a brochure, as a part of their orientation package, which will describe the GCSP program and explain how to join the program.

## 5. Funding/Support

The GCSP program will be fully funded by UNSW Engineering. The Dean of Engineering has pledged his full support for this initiative. An annual budget will be allocated by the Dean's Office, the breakdown of which is summarized in Table 1. Moreover, we will actively seek external funds, especially alumni donation, in order to create additional learning opportunities and supports for the GC scholars. For example, Dr. Ang Liu has received a small grant of \$14,000 from the James N Kirby Foundation, which has been used to support GC scholars to conduct research projects.

**Table 1.** The annual budget for the UNSW GCSP program

Category	Budget Item	Cost
Travel	Support GCSP Director or Vice Dean to attend the Global Grand Challenge Summit or a major international conference	4,000
	Support one faculty mentor to attend the annual GCSP workshop	4,000
	Support GCSP Director to travel to Washington DC to report to the National GCSP Steering Committee	5,000
	Invite 2 GCSP Directors or Deans of the partner institutions to visit UNSW for one week	10,000
	Support 2 GC scholars to attend the Global Grand Challenge Summit that is organized every two years	8,000
	Support 2 GC scholars to attend the GCSP annual meeting	6,000
	Support 2 GC scholars to attend the GCSP annual meeting	6,000
Honoraria	Compensate 4-5 speakers for guest lectures in ENGG1200	1,000
	Compensate 2-3 speakers for GC seminars	2,000
Supports for GC Scholars	Support 3-5 GC scholars to participate in a service learning or entrepreneurial activity	5,000
	Support 5 GC scholars, through research stipend, to conduct GC-related research projects	5,000
	Support 3 GC scholars to attend international conference	9,000
	Support the student-led GCSP Society	5,000
	Support the peer-to-peer mentoring	3,000
Course	Hire one teaching assistant for ENGG-1200 for term 1	2,000
	Hire one teaching assistant for ENGG-1200 for term 3	2,000
Training	Organize a one-day workshop to train faculty mentors	2,000
Award	One Grand Challenge Scholar Award	1,000

	Organize the annual GCSP Showcase	5,000
	Organize a hackathon event on one of the 14 Grand Challenges	8,000
PR and Marketing	Design and print program brochures	2,000
	Design a professional GCSP program webpage	1,000
	Host a professional website to display student portfolios	3,000
	Produce two professional program promotion videos	2,000
On Cost	Course release for GCSP Director	/
	20% workload of the Signature Experience Manager	/
<b>Total Amount of Annual Budget (excluding on-cost) in AUD</b>		<b>95,000</b>

## 6. Faculty Mentors

We plan to recruit 10-15 faculty members, whose research and teaching are relevant to any of the 14 GCs, to serve as the GCSP faculty mentors. In the interest of transdisciplinary research and education, mentor recruitment will not be limited to UNSW Engineering. Faculty mentors will guide GC scholars to formulate a unique engineering problem, identify enabling technologies and design constraints, acquire necessary knowledge and skill, develop a viable research plan, and complete the project in time. Each faculty mentor is expected to advise no more than 5 GC scholars at the same time, and meet every GC scholar at least once a semester to keep track of the student's latest progress.

We will organize a one-day workshop per year for all the faculty mentors to meet, discuss, and share their best practices of mentoring GC scholars. Several motivated GC scholars will be invited to participate in the workshop to share their feedback on the mentorship from the student perspective. Moreover, some senior GC scholars will be engaged in serving as student mentors, who will be designated to guide those newly admitted GCSP students on the right track.

## 7. Unique Aspects

We aim to offer multiple technology-enabled international courses on a variety of GC topics through collaboration with other GCSP programs of the partner institutions such as Arizona State University, University of Southern California, and Peking University. By doing so, UNSW GC scholars will be enabled to learn together with their international counterparts without leaving the home campus. We have been collaborating with the GCSP program at ASU since 2016, from which, we have received tremendous support. This approach is proven effective, efficient, and scalable, leading to some very positive student feedback.

UNSW Engineering has a longstanding reputation for supporting student-led projects, for example, Sunswift Solar Car (<https://www.sunswift.com/>), Redback Racing Car, BLUEsat, etc. Therefore, we will support a cohort of motivated GC scholars to build an inclusive GCSP Student Society, which functions to transfer knowledge, skill, and

wisdom from senior GC scholars to new GC scholars. Furthermore, we will create networking opportunities (e.g., GCSP Student Forum) to connect UNSW GC scholars with their counterparts at the partner institutions, towards a global network.

## **8. GCSP Program Components**

This section of the proposal details the specific requirements that must be fulfilled by every GC scholar for the five components of the GCSP program.

### **8.1 Research Experience**

Generally speaking, each GC scholar is expected to identify a specific GC topic that intrigues him/her in the freshmen year, then gain relevant knowledge towards in-depth understanding of the topic in the sophomore year, then formulate a unique engineering design problem in the junior year, and finally conduct a rigorous research to propose a feasible engineering solution in the senior year. A variety of learning opportunities will be created for GC scholars to gain such a substantial research experience.

Firstly, since we will primarily target honours students, GC scholars will be encouraged to complete their undergraduate thesis on a GC-related research project, preferably under the supervision of one GCSP faculty mentor. At UNSW, a honours student is required to complete an individual thesis through two semesters, namely Thesis A and Thesis B. Most of the faculty members are highly enthusiastic to supervise motivated thesis students. GC scholars will be encouraged to propose their own thesis topic and then find a suitable supervisor. Alternatively, they can pursue a thesis topic supplied by a faculty member, which will need to be approved by the GCSP Director.

Secondly, the academic schools within UNSW Engineering all run its own version of senior capstone design courses, such as <MECH4100: Mechanical Design 2> by the School of Mechanical and Manufacturing Engineering, <CVEN4002: Design Practice> by the School of Civil and Environmental Engineering, and so forth. GC scholars can choose to complete a GC-related design project based on the capstone design courses.

Thirdly, UNSW Engineering runs a successful Taste of Research Summer Program that enables undergraduate students to spend summer time working with a research group in one of the academic schools to understand what real research is about at university and in industry. The program offers junior and sophomore students a valuable opportunity to conduct research for 12 weeks and receive a tax-exempt allowance of \$500 per week. GC scholars will be strongly encouraged to apply for this scholarship. GC scholars will be highly regarded during the selection process.

Finally, GC scholars will be encouraged, supported to publish their research findings in international journal and/or conference. Moreover, the senior GC scholars will be

required to present their research findings, through the format of poster presentation, during the annual GCSP Showcase at UNSW

In summary, the applicable research experiences include the following:

1. Complete an undergraduate thesis that focuses on a GC-related research project.
2. Complete a GC-related research project based on a senior capstone design course.
3. Participate in the UNSW “Taste of Research” program on a GC-related project.
4. Publish scientific/technical papers in an approved international journal or conference.
5. Present research findings during the annual UNSW GCSP Showcase.

GC scholars can propose other extracurricular research projects that are not included above. The proposal must be sponsored by a faculty member at UNSW. It will be reviewed, approved by the GCSP Steering Committee.

## **8.2 Interdisciplinary Curriculum**

A unique “Engineering Plus” curriculum will be designed for GC scholars to develop transdisciplinary knowledge and skill. This curriculum consists of one special GCSP course (i.e., ENGG1200), a set of non-engineering courses in science, social science, and humanities, a set of engineering technical/professional elective courses, as well as a set of none-credit GC seminars. Specifically, every GC scholar is required to complete at least ENGG1200, two approved non-engineering elective courses, one approved engineering technical/professional elective course that is related to the GC topic chosen by the student, as well as six GC-related seminars. For any of the above-mentioned courses, an above CR (Credit or 65/100) grade is required for the course to be included in the final portfolio.

At UNSW Engineering, every student is allowed to freely select two first-year elective courses, two general education elective courses, and up to six technical/professional elective courses. Such a flexible structure enables GC scholars to smoothly incorporate the “Engineering-Plus” curriculum into their existing degree programs, without causing any significant delay to graduation. There are a number of readily available courses that are suitable for GC scholars to select in the current UNSW Engineering curriculum. GC scholars will be advised by the GCSP Director in terms of course selection.

During the freshmen year, GC scholars will be required to complete one mandatory course, <ENGG1200: Introduction to NAE Grand Challenges for Engineering>, which is managed by the GCSP program. This course may be jointly offered with other partner institutions of UNSW such as Arizona State University and University of Southern California. To date, this course has been iterated for four semesters since 2016. Student feedback has been very positive. Since 2019, the course will be offered twice a year (i.e., term 1 and term 3). It is counted as one of the 1<sup>st</sup> year electives.

During the sophomore and junior years, firstly, GC scholars will be advised by the GCSP Director and faculty mentors to choose one non-engineering course in the areas such as international relationship, public policy, medicine, ethics, human behavior, social science, etc. Secondly, GC scholars will be advised to choose one engineering technical/professional elective course that is relevant to their chosen GC topic. Moreover, GC scholars will be encouraged to study abroad for one semester at a partner institution. They will be advised by the GCSP Director in terms of the country, institution, and scholarship of study abroad. Finally, GC scholars will be supported to secure a summer internship that is related to their chosen GC topic in a research group, entrepreneurial organization, or non-governmental organization.

During the senior year, GC scholars will be encouraged to conduct their undergraduate thesis on a GC-related research project. Faculty mentors will be motivated to supervise GC scholars. If a GC-related thesis is not possible, GC scholars will be guided to conduct a GC-related research project based on the capstone design courses.

Last but not least, the GCSP Program will organize 2-3 GC seminars every semester. Each GC scholar is required to attend at least 2 GC seminars per year in order to maintain good standing in the program. The GCSP program will join forces with other programs at UNSW, such as the Institute for Global Development and Michael Crouch Innovation Centre, to jointly organize GC seminars. These seminars will be open to not only GC scholars but also a broader audience of students and academics. Moreover, GC scholars will be encouraged to participate in relevant seminars organized by the UNSW Grand Challenge Program (<http://grandchallenges.unsw.edu.au/>). By the time they graduate, every GC scholar is required to attend no less than 6 GC seminars.

Every GC scholar must fulfill EACH of the following requirements in accordance with the UNSW version of the “Engineering Plus” curriculum.

1. Complete “ENGG1200: Introduction to NAE Grand Challenges for Engineering”.
2. Complete one non-engineering elective course.
3. Complete one engineering technical/professional elective course that is relevant to the particular GC topic chosen by the scholar.
4. Attend at least six GC seminars within four years.

### **8.3 Entrepreneurship**

UNSW produces the most entrepreneurs in Australia. There exist a number of readily available entrepreneurial opportunities that will be leveraged by the GCSP program. Firstly, GC scholars will be advised to enroll one of the entrepreneurship courses offered at UNSW, such as <ELEC4445: Entrepreneurial Engineering>, <GSOE9220: Launching a Startup>, and <MGMT2100: Innovation & Entrepreneurship>. Made possible by the PLS Alliance, UNSW students are allowed to sign up <FSE301: Entrepreneurship & Value Creation> that is an entirely online course managed by the

GCSP program at ASU. Moreover, GC scholars will be encouraged to attend various entrepreneurship-oriented conference and competition, such as the iGLOBAL Sino-Australia Innovation and Entrepreneurship Competition, Global Student Forum Conference, iCAN International Innovation Contest, UNSW Maker Game, James Dyson Award, etc. Last but not least, we will join forces with other entrepreneurship programs at UNSW, such as the Startup Launch Program and Centre for Innovation & Entrepreneurship, to create additional learning opportunities for GC scholars.

The applicable entrepreneurial activities include the following:

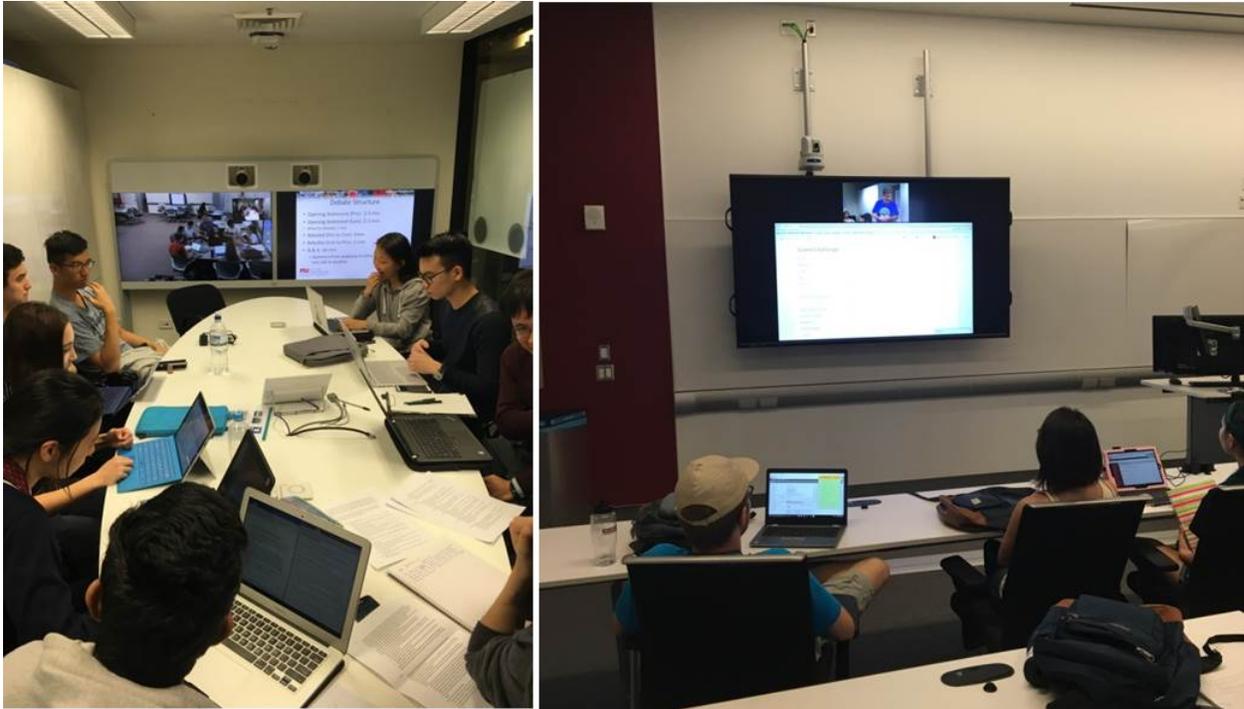
1. Complete an approved course in entrepreneurship offered by UNSW or another partner institution.
2. Play a leadership role in one of the major student-led projects at UNSW, such as the rUNSWift Robot Soccer, Sunswift Solar Car, Redback Racing Car, BLUEsat, etc.
3. Participate in an entrepreneurship-centered conference or competition.
4. Found or co-found a new venture that is largely initiated by college students.
5. Complete an approved internship in a start-up company.

Additional entrepreneurial activities may be added to the formal program based on the recommendation of the GCSP Director and approved by the GCSP Steering Committee.

#### **8.4 Global Dimension**

GC scholar must be a global citizen who has international perspectives, contextual awareness, and cross-cultural competence. UNSW is one of the most globalized universities worldwide. More than 30% of UNSW engineering students choose to study abroad. We will work closely with the UNSW Global Education Office to design personalized study abroad plans for GC scholars. There are some readily available scholarships for study abroad that can be applied by GC scholars. Every year, a large number of UNSW Engineering students will be funded by the New Colombo Plan, which is a signature initiative of the Australian Government, to study abroad and undertake internships in the Indo-Pacific region.

In addition to the conventional approaches such as study abroad and summer school, we will develop more technology-enabled international courses for GC scholars to gain a unique global learning experience right on the home campus. Figure 1 illustrates the interconnected UNSW and ASU classrooms through video-conferencing technology. The PLuS Alliance has pledged its strategic support for this component of the GCSP program. Moreover, we will support GC scholars to attend various international conferences and competitions, such as the Global Grand Challenges Summit, Humanitarian Design Summit, Global Student Forum, etc.



**Figure 1.** Illustration of the technical-enabled UNSW-ASU joint course.

The applicable global learning experiences include the following:

1. Study abroad at a partner institution for more than one semester.
2. Complete one approved summer course abroad.
3. Complete one approved internship abroad.
4. Participate in one approved international conference.
5. Complete one technology-enabled global course together with their counterparts at a partner institution.
6. Conduct one field research abroad as a part of an approved research project.

Additional global experiences may be added to the formal program based on the recommendation of the GCSP Director and approved by the GCSP Steering Committee.

### **8.5 Service Learning**

Every GC scholar is required to complete at least one curricular or extracurricular service learning activity. At UNSW, we value the irreplaceable role played by the university in serving our society. UNSW Engineering maintains a long-term partnership with organizations such as Engineers Without Borders (EWB) and Engineering World Health (EWH). Many faculty members are currently supervising students who conduct their thesis based on projects supplied by EWB or EWH. Moreover, UNSW Engineering recently launched a Humanitarian Engineering Program that consists of two core courses: <ENGG3001: Fundamentals of Humanitarian Engineering> and <ENGG4102: Humanitarian Engineering Project>. Both courses carry a heavy service learning

component. Finally, the senior GC scholars will be engaged in mentoring the new scholars during their freshman and sophomore years. Such a peer-to-peer mentorship will be counted as a particular kind of service learning experience.

The applicable service learning activities include:

1. Participate in an approved community service for at least 40 hours.
2. Complete an approved course that involves a significant service learning component.
3. Complete a EWB or EWH project that has a significant service learning component.
4. Complete a thesis that has a substantial service learning component.
5. Mentor at least three incoming GC scholars.

Additional service learning activities may be added to the formal program based on the recommendation of the GCSP Director and approved by the GCSP Steering Committee.

## **9. Support, Tracking, and Assessment**

GC scholars will be mentored, supported through three main channels. Firstly, they will be mentored by the GCSP Director and members of the Steering Committee with respect to the choice of GC topic, personalized pathway of fulfilling the program requirements, and pursuit for new learning opportunities. Secondly, GC scholars will be mentored by faculty mentors in terms of their project progress, academic performance, and career development. Lastly, every newly admitted GC scholar will be mentored by a senior GC scholar during his/her freshmen and sophomore years in terms of course selection, knowledge transfer, and experience sharing.

We will support a cohort of motivated GC scholars to build a student-led society that focuses on Grand Challenges for Engineering. Several UNSW students who had complete ENGG1200 (e.g., Mr. Ainsley Sydun, Mr. Matthew Brener, Ms. Alli Murray, etc.) have expressed strong desire in leading this endeavor. UNSW Engineering has a longstanding reputation for supporting student-led projects and societies. The Manager of Student-led Activity will provide administrative support for this student-led society.

With respect to progress tracking, every GC scholar will be required to meet with a member of the Steering Committee at least once per semester in order to confirm the active participation and report the latest progress. Every GC scholar will be expected to attend at least one GC-related seminar per semester, which is organized by the GCSP program or recommended by the GCSP Director. All GC scholars will be expected to attend the annually organized GCSP Showcase.

Every GC scholar will be required to build, maintain, and update a digital portfolio that functions to document his/her continuous progresses in meeting the specific program requirements. An exclusive program page will be created on Moodle (i.e., the learning management system used at UNSW) for GC scholars to manage the portfolios. The digital portfolio will be evaluated once a year by the GCSP Steering Committee, based

on which, a GC scholar will be advised how and in what ways to proceed in the following year. The final portfolio will be evaluated by the GCSP Steering Committee and at least one external assessor.

## **10. Recognition**

In accordance with the NAE expectation, the GCSP Director will personally report program graduates to the National GCSP Steering Committee in May. The GC scholars who successfully fulfill all program requirements will receive a letter from the NAE President. Internally, we will recognize the representing GC scholars in multiple ways. Every year, one UNSW Grand Challenge Scholar Award will be offered to recognize the innovative work accomplished by one senior GC scholar. GC scholars will be highly regarded for positions in the UNSW Engineering Student Ambassador program. We will actively engage GC scholars in various outreach activities at UNSW. A GCSP Showcase will be organized on an annual basis for all senior GC scholars to present their research findings to a broader audience of UNSW students, faculty members, and industrial partners. Meanwhile, the GCSP Showcase functions as a general assembly of all the GC scholars, faculty mentors, and relevant stakeholders.

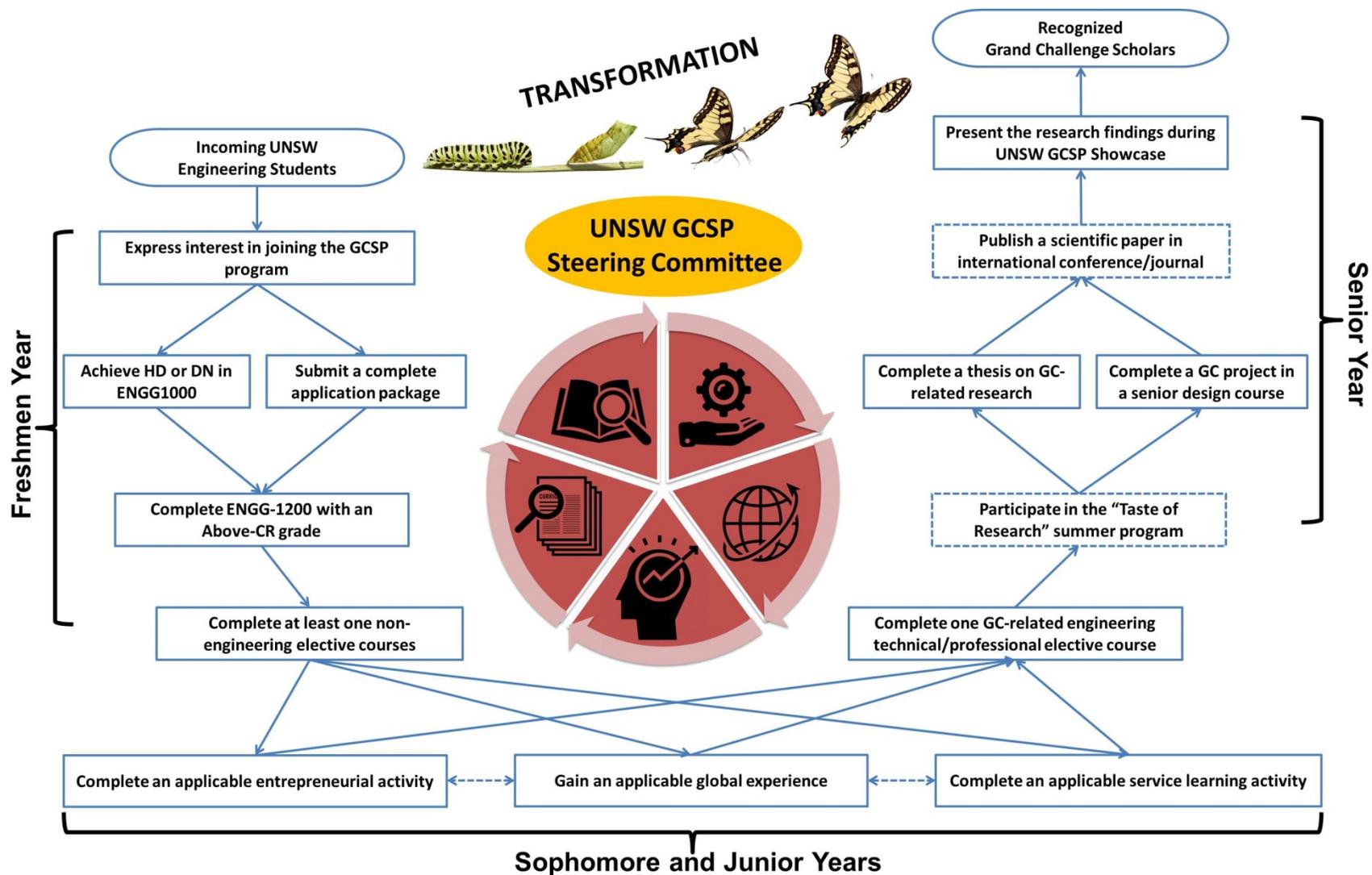
## **Closing Remarks**

In light of the UNSW 2025 Strategic Plan, we firmly believe that the NAE Grand Challenge Scholars Program is perfectly aligned with UNSW's strategic priorities on academic excellence, social engagement, and global impact. We are fully confident that UNSW Engineering possesses all the necessary expertise, resource, infrastructure, and commitment not only to launch a successful GCSP program in Australia but also to lead this global initiative outside the USA. We look forward to collaborating with NAE and other established GCSP programs at our partner institutions to educate more GC scholars for the 21<sup>st</sup> Century.

## Appendix A: Summary of Requirements for 5 Components of GCSP

Component	Requirements
<p><b>Research Experience</b></p> 	<p><u>Complete ONE of the following activities</u></p> <ol style="list-style-type: none"> <li>1. Complete an undergraduate thesis that focuses on a GC-related research project.</li> <li>2. Complete a GC-related research project based on a senior capstone design course.</li> <li>3. Participate in the UNSW “Taste of Research” program on a GC-related project.</li> <li>4. Publish scientific/technical papers in an approved international journal or conference.</li> <li>5. Present research findings during the annual UNSW GCSP Showcase.</li> </ol>
<p><b>Interdisciplinary Curriculum</b></p> 	<p><u>Complete EACH of the following activities</u></p> <ol style="list-style-type: none"> <li>1. Complete “ENGG1200: Introduction to NAE Grand Challenges for Engineering”.</li> <li>2. Complete one non-engineering elective course.</li> <li>3. Complete one engineering technical/professional elective course that is relevant to the particular GC topic chosen by the scholar.</li> <li>4. Attend at least six GC seminars within four years.</li> </ol>
<p><b>Entrepreneurship</b></p> 	<p><u>Complete ONE of the following activities:</u></p> <ol style="list-style-type: none"> <li>1. Complete an approved course in entrepreneurship offered by UNSW or another partner institution.</li> <li>2. Play a leadership role in one of the major student-led projects at UNSW, such as the rUNSWift Robot Soccer, Sunswift Solar Car, Redback Racing Car, BLUEsat, etc.</li> <li>3. Participate in an entrepreneurship-centered conference or competition.</li> <li>4. Found or co-found a new venture that is largely initiated by college students.</li> <li>5. Complete an approved internship in a start-up company.</li> </ol>
<p><b>Global Dimension</b></p> 	<p><u>Complete ONE of the following activities:</u></p> <ol style="list-style-type: none"> <li>1. Study abroad at a partner institution for more than one semester.</li> <li>2. Complete one approved summer course abroad.</li> <li>3. Complete one approved internship abroad.</li> <li>4. Participate in one approved international conference.</li> <li>5. Complete one technology-enabled global course together with their counterparts at a partner institution.</li> <li>6. Conduct one field research abroad as a part of an approved research project.</li> </ol>
<p><b>Service Learning</b></p> 	<p><u>Complete ONE of the following activities:</u></p> <ol style="list-style-type: none"> <li>1. Participate in an approved community service for at least 40 hours.</li> <li>2. Complete an approved course that involves a significant service learning component.</li> <li>3. Complete a EWB or EWH project that has a significant service learning component.</li> <li>4. Complete a thesis that has a substantial service learning component.</li> <li>5. Mentor at least three incoming GC scholars.</li> </ol>

## Appendix B: A typical development roadmap for GC scholars



## Appendix C: Syllabus of UNSW-ASU Joint Course “ENGG-1200: Introduction to NAE Grand Challenges for Engineering”

### 1. Contact Staff

#### 1.1 Contact details and consultation times for course convenor

UNSW Lecturer: Ang Liu

Office Location: Ainsworth Building (J17), Level 4, Room 408C

Email: [ang.liu@unsw.edu.au](mailto:ang.liu@unsw.edu.au)

ASU Lecturer: Amy Trowbridge, MS

Office: GWC424

Phone: 480-965-4830

Email: [amy.trowbridge@asu.edu](mailto:amy.trowbridge@asu.edu)

### 2. Course Details

#### 2.1 Credit points

This is a 6 unit-of-credit (UoC) course, which involves 4 hours per week (h/w) of face-to-face contact. The UNSW website states “The normal workload expectations of a student are approximately 25 hours per semester for each UoC, including class contact hours, other learning activities, preparation and time spent on all assessable work. You should aim to spend about 12 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

#### 1.2 Contact hours

	Day	Time	Location	Week
<b>Weekly Lectures</b>	Tuesday	09:30 – 11:00	K17 Room 103	1-9
	Thursday	09:30 – 11:00	K17 Room 103	1-9
	Tuesday	10:30 – 12:00	K17 Room 103	10-13
	Thursday	10:30 – 12:00	K17 Room 103	10-13

#### 2.3 Course summary

This course, centered on the theme of National Academy of Engineering’s (NAE) Grand Challenges for Engineering in the 21<sup>st</sup> century, will offer a unique opportunity for

students to develop an interdisciplinary appreciation for the Grand Challenges that can be addressed by engineers. This course will increase students' awareness of the social complexities of meeting the needs of local and global challenges through engineering and technology. Students will also learn more about the Grand Challenge Scholars program, begin their path towards making a Grand Challenge area their life's passion.

In this course, students from Arizona State University (ASU) and University of New South Wales (UNSW), will attend class simultaneously and learn together interactively through in-class discussions and activities based on the use of video conferencing technologies. Students in the course will also continue to work collaboratively in small teams across physical, institutional, and cultural boundaries outside of class time.

## 2.4 Learning outcomes

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. After successfully completing this course, you should be able to:

Learning Outcomes		EA Stage 1 Competencies
1	Understand a variety of emerging grand challenges for engineering	PE1.6 and 3.1
2	Formulate a unique engineering problem as a set of specific functional requirements	PE 1.5
3	Identify relevant enabling technologies to address a grand challenge for engineering	PE 2.1 and 3.2
4	Conceptualize novel and feasible engineering solutions to address a grand challenge for engineering	PE1.6
5	Develop an awareness of societal issues that influence and/or constrain engineering solutions	PE 3.3
6	Experience the dynamics of collaboration within a cross-cultural, multi-disciplinary, and virtual team	PE3.4 and 3.6

## 3. Teaching Strategies

Weekly lectures are the primary teaching and learning activities for this course. All/most of the in-class lectures (except guest lectures) will be interactive discussions & activities (i.e. active learning sessions) with minor lecture components, rather than a typical 'lecture'. There will often be materials for students to review/read before coming to class. The weekly lectures will be led by the ASU instructor. In addition, some global experts for different GC themes will be invited to deliver guest lectures. The importance

of lectures cannot be overstated. Unless otherwise approved, you are required to participate in every lecture and pay 100% of your attentions in class.

The best way to understand those Grand Challenges for Engineering is through practicing on a specific project, together with other engineers. Two kinds of cohorts will be formed for this class: project team and cultural group. For the former, the UNSW students will collaborate with their counterparts at ASU to jointly accomplish a team project to identify a particular GC and propose a preliminary Future Solutions. For the latter, the UNSW students will collaborate with each other to accomplish a cross-cultural activity, which is intended to explore the profound impacts of diversified cultural perspectives on the understanding of Grand Challenges for Engineering.

#### 4. Course Schedule

<b>Week</b>	<b>Dates</b>	<b>Lecture Topic</b>	<b>Assignments Due</b>
<b>4</b>	14 Aug – 20 Aug		
<b>5</b>	21 Aug – 27 Aug	Course Overview; Intro to Grand Challenges	Portfolio Intro
<b>6</b>	25 Aug – 03 Sep	Identify Interests: Specific Opportunities/Challenges; Technology & Society	
<b>7</b>	04 Sep – 10 Sep	Intro to FS project (form teams, ID focus, customers, Needs Analysis)	Team Formation
<b>8</b>	11 Sep – 17 Sep	FS Project: Needs Analysis; GC Theme A	
<b>9</b>	18 Sep – 24 Sep	GC Theme A; FS Project Solution Development	Project Needs Analysis;
	UNSW: Semester Break	ASU: ASU GCSP Requirements	Portfolio Entry 1 (GC Theme A)
<b>10</b>	02 Oct- 08 Oct	ASU: 'Human Element' of Future Solutions	'Human Element' of Future Solutions; GC Theme B
<b>11</b>	09 Oct – 15 Oct	ASU: FALL BREAK; GC Theme B	Project Solution & Tech
<b>12</b>	16 Oct – 22 Oct	GC Theme C; GC Theme D	Portfolio Entry 2 (GC Theme B)
<b>13</b>	23 Oct – 29 Oct	Final Project Presentations	Portfolio Entry 3 (GC Theme C); Final Project Presentation
<b>14</b>	30 Oct – 15 Nov	Study Week and Exam Period	Research Paper

## 6. Assessment Scheme

Participation and teamwork are critical to your success in this course. There will be no exams in this course; performance will be assessed based on class participation, a digital Portfolio, a research paper and presentation, a cross-cultural activity, and a team project. Assignment categories are briefly described below and additional materials that specifically outline the requirements for each assignment will be provided in class and/or on Blackboard.

Individual Assignments: **Participation** will include attendance to lectures, completing necessary preparation for in-class discussions and activities, and contributing during in-class sessions. You will maintain a **digital portfolio** of this course to record and reflect on the in-class experiences and your interests in the grand challenges throughout the course. Outside of class, you will be asked to individually do further research to explore your specific interests in the Grand Challenges and report on your findings by means of a **research paper** and an **individual presentation**.

Team Assignments: The **Future Solutions project** will require cross-campus student teams to work together, primarily outside of class, to complete a team project focused on developing a Future Solution to a specific problem related to one (or more) of the Grand Challenge areas.

There will be a total of 100 points available in this class. Every point is worth the same, but different assignments will have different point values. The table below provides details on how your performance will be assessed in this course and the points available for each category of assignments.

<b>Task</b>	<b>Contribution</b>	<b>Mark</b>	<b>Learning Outcome</b>	<b>Due</b>	<b>Marks Returned</b>
Participation/Contribution to in-class discussions	<i>Individual</i>	10%	1, 6	<i>Every week</i>	<i>1 week after each lecture</i>
Digital Portfolio (setup + 4 entries)	<i>Individual</i>	20%	2, 3, 4, and 5	<i>Week 9, 12, 13</i>	<i>Two weeks after submission</i>
Grand Challenge Research Paper	<i>Individual</i>	30%	1, 2, and 6	<i>Week 14</i>	<i>Upon release of final mark</i>
Future Solution Project	<i>Team</i>	40%	2, 3, 4, and 5	<i>Week 9, 11, 13</i>	<i>Two weeks after submission</i>

Individual project grades will be based on both the team's grade and the individual's contribution to the team. At the conclusion of the course, a confidential peer evaluation

will be conducted in order to evaluate the teamwork dimension of the design project. Each student will be asked to fill out a questionnaire, which evaluates every team member for his/her contribution to teamwork in different categories. The evaluations are averaged in order to find each student's contribution and the weighting factor is made proportional to the average. The peer evaluation result is intended to reward the active contributors and penalize the inactive ones.

All assignments must be turned in before the deadline stated on Blackboard and/or in class. An extension may only be granted in exceptional circumstances. Where an assessment task is worth less than 20% of the total course mark and you have a compelling reason for being unable to submit your work on time, you must seek approval for an extension from the course convenor **before the due date**. Special consideration for assessment tasks of 20% or greater must be processed through [student.unsw.edu.au/special-consideration](http://student.unsw.edu.au/special-consideration). On the other hand, it is always worth submitting late assessment tasks when possible. Completion of the work, even late, may be taken into account in cases of special consideration.

For details of applying for special consideration and conditions for the award of supplementary assessment, see the School [intranet](#), and the information on UNSW's [Special Consideration page](#).

## **7. Expected Resources**

There is no required textbook for this course. Selected readings will be provided from various sources each week and will be available on Blackboard. All materials, assignment details, and due dates will be available on Blackboard (the learning management system used in ASU, which is similar to Moodle). All UNSW students will be provided with a guest access to Blackboard. You will be expected to use Google Doc to complete Portfolio entries throughout the semester. You are expected to check Blackboard regularly. NOTE: Other online resources may be used to distribute course materials. Instructors will inform you about those resources in class, in Blackboard, and/or via email when they are identified.

## **8. Course Evaluation and Development**

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, and the School's Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

## 9. Classroom Policy

Students are expected to conduct themselves professionally in class. Any behavior that might cause hindrance to the progress of the class is not acceptable. Students are requested to refrain from using pagers, cell phones, or laptops during class (except for note taking or other class related purposes) so as not to disturb the other students. You should not be texting, surfing the web, or doing other non-class related activities on your computer, tablet, or cell phone during the lecture time. Students are allowed to use recording devices, but the commercial distribution of the recordings is not permitted.

## 10. Academic Honesty and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgment. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism: [student.unsw.edu.au/plagiarism](http://student.unsw.edu.au/plagiarism) The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

If plagiarism is found in your work when you are in the first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more serious instances in the first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.