

DRAFT

**A PROPOSAL FOR A MASTER OF ENGINEERING (MEng)  
DEGREE PROGRAM**

**HENRY SAMUELI SCHOOL OF ENGINEERING AND  
APPLIED SCIENCE**

**November 28, 2018**

## **OBJECTIVES OF THE PROPOSED PROGRAM**

This document is a proposal for establishing a Master of Engineering (MEng) degree in the Henry Samueli School of Engineering and Applied Science (HSSEAS). The new Master of Engineering program is a one-year, full-time, self-supporting professional degree program on campus. As compared to traditional research-oriented MS degree programs (that focus on developing advanced technical comprehension in a technical discipline) this program will include a specific interdisciplinary technology concentration and a substantial business/management component. It is designed to develop professional engineering leaders of the future who understand the technical, business, and management issues of technology.

The MEng degree requires 36 units of upper division and graduate courses, which equates to 9 courses: five courses in a technical depth area, three courses in business and management and one capstone project. The new Master of Engineering program is based on several existing cross-disciplinary areas of study within the HSSEAS. The programmatic technology concentration associated with the MEng program will be constructed from existing courses associated with the traditional MS program. The business-oriented courses are also available via the Engineering Management program offered through the current Engineering MS Online program.

Proposed tuition and fees for the 2020-21 academic year of the MEng program are \$50,000 + quarterly fees for all students. Tuition assistance from the program is available based on financial need and the availability of resources. It is anticipated that the MEng program will bring additional revenues for the School and the departments in HSSEAS. We have worked out a financial model with the Office of Academic Planning and Budget (APB) and Graduate Division to account for the cost of MEng students taking on-campus courses.

The MEng program will start with a small cohort of 50 high quality students, and an additional 50 students for each of the next three years, with an anticipated steady-state enrollment of 200 students. We do not anticipate that the MEng program will draw students away from the current MS program.

## **ACADEMIC JUSTIFICATION OF THE PROPOSED MEng PROGRAM**

Currently, our on-campus MS degree is modeled on our PhD program, and provides technical depth, but no management, financial or business training. It is intended for students who wish to pursue purely technical or research-oriented career paths. However, as outlined in the attached letters (Attachment A) from top executives in various high-tech sector industries (aerospace, information and communication), this type of technical training is inadequate for those aspiring to leadership positions in their industries. Increasingly, they are looking for a new breed of cross-disciplinary engineers who understand the technical, business, and management issues of technology. This demand from industry has been reflected in the introduction of management principles and cross-disciplinary projects into undergraduate engineering curricula to some degree, but is only now beginning to penetrate graduate programs. The strong demand from a wide variety of high-tech sectors give us a rare opportunity to design a new self-supporting Master of Engineering program which combines depth in chosen technology concentrations with breadth in business and engineering management. Accordingly, the MEng degree is designed to be a "Professional Master's degree," addressing the needs of students on an industrial career track, rather than a research track.

Our school continues to see extraordinary demand for our graduate degrees. HSSEAS currently has seven departments with over 3,900 undergraduate and over 2,300 graduate students. We have a total of about 1,150 full-time MS students currently enrolled among the seven departments, in addition to about 400 MS students in our MS Online program. The enrollment in our graduate program has nearly doubled over the last decade, from about 1500 in 2008 to about 2700 in 2018. It is noteworthy that the current undergraduate and graduate enrollments in HSSEAS have significantly exceeded the campus allocation.

The number of graduate applications has increased significantly to over 7,000 per year for the past three years. It has become very competitive to be admitted to graduate programs in HSSEAS. For instance, over the past three years, our Computer Science (CS) Department received over 2,000 applicants per year. However, due to limited faculty and resources available, the CS department can only enroll around 6% of its applicants. The Electrical and Computer Engineering (ECE) Department also had over 2,000 applicants over the past three years and enrolls only about 9%.

Applicants are highly qualified; for example, the average GPA of MS admits into our CS Department is 3.73. As a result, we have to turn away many highly-qualified applicants. If we are able to address this demand, we would be providing California and our nation much needed engineering manpower. We would also expand the footprint of UCLA and enhance our reputation nationally and internationally.

Under the current campus funding constraints, it is highly unlikely that we will be able to obtain all the resources needed to expand enrollment in our regular state-supported graduate programs. There is acute need for teaching faculty, support staff, teaching assistants and graders, but there is insufficient state support to provide these. A new funding model is needed that can bring resources to the school to support this expansion and to fully capitalize on the opportunity. The professional MEng program will allow us to obtain the necessary resources, not only to support the MEng program, but also to support the regular graduate program offerings in HSSEAS.

## **PROGRAM DESCRIPTION**

Degree requirements as well as the administration of this program are described herein.

### **1. Curriculum Requirements**

Students must be in residence for one full year and complete a minimum of 36 quarters units of graduate and upper division undergraduate courses (in or related to the major subject area). The MEng degree requires 9 courses, including 5 courses in technical depth areas, three courses in business and management and one capstone project with a faculty member and/or an industrial sponsor. The total number of units required for completion is the same as those for our MS students.

#### Proposed MEng Degree Requirements

*Core Requirement (20 units).* Five courses with a minimum of four graduate courses from the list of core courses in each technology concentration, requiring a grade no lower than a B-.

*Business/Management Electives (12 units).* Three courses from the list of business/management/leadership courses. The courses are currently offered to the students in the MS Online program.

*Capstone Project (4 units).* All students must complete a capstone experience that synthesizes and integrates the knowledge and skills obtained throughout the master's program. The intent is that the capstone project will be a 2-3 student team project. The project topic will be selected with the assistance of the instructor for the course. At the end of the summer quarter, a final project report must be turned in. Satisfactory completion of the capstone team project is required for award of the MEng degree. Evaluation of the completed capstone project will serve as the final examination for the capstone project.

## **2. Proposed Areas of Study**

The MEng program is built on the historic strengths of HSSEAS. The following cross-disciplinary areas of technology concentration are proposed. Additional areas may be proposed in the future if there is demand from industry.

- i. Master of Engineering in Artificial Intelligence
- ii. Master of Engineering in Data Science
- iii. Master of Engineering in Software Systems
- iv. Master of Engineering in Autonomous Systems
- v. Master of Engineering in Translational Medicine
- vi. Mater of Engineering in Green Energy Systems

## **3. Admission Requirements and Undergraduate Preparation**

All applicants must have completed a Bachelor's degree (or its approved equivalent) from an accredited institution and must attain an undergraduate record that satisfies the standards established by the UCLA Graduate Division. Applicants should have at least an undergraduate major in various engineering disciplines, mathematics, physics, or a closely related field with a scholastic average of B (3.0 on a 4.0 scale) or better (or its equivalent if the

letter grade system is not used for the last 60 semester units or last 90 quarter units of undergraduate study in any post-baccalaureate study).

All applicants must submit scores from the Graduate Record Exam, General Test (GRE). Applicants whose first language is not English are required to submit acceptable scores from the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS) unless they have a degree from an institution where English is the exclusive language of instruction. Additionally, each applicant must submit three letters of recommendation, two of which must be academic references. All other application requirements are specified in the graduate application. A faculty committee will be responsible for making admission decisions.

#### **4. Program Tuitions and Fees**

Proposed tuition and fees for the MEng program are \$50,000 plus quarterly fees for all students. The fee structure is based on the fact that most on campus MS students in HSSEAS spend 4 to 5 quarters to complete their MS degree. Thus, the tuitions for on-campus MS programs ranges from \$48,000 to \$60,000 for non-resident students. Therefore, the proposed tuition is similar to the tuition costs paid by on-campus students. In addition, the MEng program will provide additional academic, career advising, and placement services for students. Financial support will be available to qualified students based on their financial need and availability of the resources. The proposed tuition is comparable to other self-supporting degree programs at UCLA including LLM (~52,000) and MPH for Health Professionals.

The students enrolled in the MEng program will take classes in their technology concentrations alongside on-campus graduate students in HSSEAS. As a result, some state-support resources will be used for instruction. We have worked out a financial model with the Office of Academic Planning and Budget (APB) and Graduate Division to account for the cost of MEng students taking on-campus courses and the usage of state-supported instructional resources.

## **5. Sample Program for MEng Students in Artificial Intelligence and Data Science**

Students will take two technical courses and one business/management course in Fall and Winter quarter, and one technical, one business/management course and one capstone project course in Spring. They will continue to complete the capstone project by the end of summer.

The following is a sample program for a MEng degree in Artificial Intelligence:

Fall: CS161 Fundamentals of Artificial Intelligence; CS 188 Introduction to Machine Learning; Business/Management elective

Winter: CS262 Reasoning and Learning with Bayesian Networks; CS 260 Machine Learning Algorithms; Business/Management elective

Spring: CS 264A Automatic Reasoning: Theory and Applications; Business/Management elective; Capstone project

Summer: Capstone project

Sample program for MEng in Translational Medicine:

Fall: BE176 Principles of Biocompatibility, BE C283 Targeted Drug Delivery and Controlled Drug Release; Business/Management elective

Winter: BE C285 Introduction to Tissue Engineering; BE M260 Neuroengineering; Business/Management elective

Spring: BE CM286 Computational Systems Biology: Modeling and Simulation of Biological Systems; Business/management elective; Capstone project

Summer: Capstone project and presentation

Sample program for MEng in Data Science:

Fall: CS 143 Data Base Systems; CS 249 Basic Data Science; Business/Management elective

Winter: EC ENGR 219 Large Scale Data Mining; CS 260 Machine Learning Algorithms; Business/Management elective

Spring: CS 245 Big Data Analytics; Business/management elective; Capstone project

Summer: Capstone project and presentation

Sample courses for Business/Management:

1. E215 Engineering Entrepreneurship
2. E200 Technical Project Management
3. E213 Data and Business Analytics
4. E211 Financial Management
5. E214 Management Communications

## **PROJECTED NEEDS AND RELATIONS TO ON-CAMPUS PROGRAMS**

### **1. Administration of the MEng Program**

HSSEAS will create a program office to administer the recruiting, admission and advising of students in the program. The administration structure will consist of a faculty director, a faculty governing committee, student affairs officer (SAO), capstone project coordinator, administrative specialists, and additional staff as needed.

HSSEAS will be responsible for covering all expenses associated with establishing and operating the MEng program. No additional resources will be requested from the campus. We have extensive experience in running a highly profitable self-supporting MS Online degree program. The Engineering MS Online program established in 2007 is one of the top-ranked programs in the United States. Currently, there are over 400 students enrolled in the Engineering MS Online program.



## **2. Enrollment Projection and Impact on Class Size for On-campus Program:**

The MEng program will start with a small cohort of high quality students. The target enrollment is 50 for year 1, and an additional 50 students for each of the next three years, with an anticipated steady-state enrollment of 200 students. All students will take classes in their cross-disciplinary technology concentrations alongside on-campus graduate students in HSSEAS. (We note that this is the same structure for students enrolled in the LLM program in the UCLA School of Law, and has existed for 10 years). However, all MEng students will take the business/management elective courses together. We have devised a plan to manage enrollment and to minimize the impact on class size for our on-campus program, as shown in Table 1 below.

In year 1, we anticipate that we will enroll a total of 50 students in five technology concentrations. Therefore, each technology concentration will have about 10 students. All 10 students will enroll in the same section with the on-campus MS students. We will not add an additional section of the course. Instead, an additional TA will be provided to assist the instructor and students. The on-campus MS students will also benefit from the additional TA support.

During years 2 to 4, an additional 10 students will be added to each technology concentration each year. As a result, we plan to offer an additional section for each course to reduce the impact on class size and faculty workload. Funding will be provided to each department to hire instructors and TAs to offer the additional section for each course impacted. Students from the on-campus MS program and the MEng program will be encouraged to mingle in each section. In fact, as shown in Table 1, the class size for the on-campus program will be reduced thru the offering of an additional section.

For the business/management courses, all students in the MEng program will enroll in the same course each quarter. For year 1, the enrollment will be kept at 50 students. Additional sections will be added from years 2-4, so the class size will be kept at 50 students.

\* Enrollment estimation is based on the enrollment of CS260 Machine Learning Algorithms of 60 students

Year	Total # of Students In Artificial Intelligence	Actions Planned		Total # of Students In each Section*
		New Sections	TA	
1	10	N/A	Yes	70
2	20	1	Yes	40
3	30	1	Yes	45
4	40	1	Yes	50

Table 1 Enrollment projection and actions planned to reduce the impact of MEng program on class size and faculty workload. The enrollment estimate is based on the average enrollment of CS260: Machine Learning Algorithms of 60 students.

### 3. Facilities and Resources

The proposed degree program will leverage the facilities existing in the HSSEAS. The faculty affiliated with this program will be primarily from the seven departments within the School and the MS Online program. HSSEAS is adding 50 new faculty members and will grow to 226 faculty members over the next 5 years. These additional faculty members will help provide teaching resources to both the MS and MEng program. Additional lecturers and adjunct professors will be hired as needed to support the program. Revenues generated by the MEng program will also support the hiring of adequate staff to support the program.

The program relies on engineering courses already being offered in our academic departments. The proposed business and management courses are already being offered in our MS Online program, and on-campus versions of these courses will be developed.

In terms of physical resources, in the first year of the program, the small increase in class size is easily accommodated in existing classrooms in which engineering classes are normally scheduled. For situations in which additional sections must be created (years 2-4 in Table 1) we propose to use

new classroom capacity available in the new HSSEAS building, Engineering IV. This building has two large classrooms, one with a 250-person capacity, and another with an 80-person capacity. In addition, we are in the process of converting 4760 Boelter Hall into a classroom with a capacity of 80-100 students.

#### **4. Impact to Current On-campus MS Program:**

We anticipate that the proposed MEng program will have a positive effect on the current on-campus MS program. As described above, the MEng program will create resources that the school and the departments can use, both in the courses shared by the two programs, and also to support graduate education in HSSEAS more generally. We have demonstrated in Table 1 that the MEng program will result in a decrease in class size for the MS program in steady state. Furthermore, the closer connection to industry forged through the MEng program will help not only MEng students, but all our graduate and undergraduate students and faculty.

We do not anticipate that the MEng program will draw students away from the MS program. The applicant pool is very deep, as discussed above. Currently, there are approximately 1,150 students enrolled in the on-campus Master of Science degree program. Departments will continue to recruit top students from these very competitive application pools. Furthermore, the fee structure proposed here prices the MEng program higher than the MS program, and therefore will not provide any incentives for students to choose the MEng program for cost reasons.

## Attachment A: Letters of Support



November 9, 2018

Jayathi Murthy  
Ronald and Valerie Sugar Dean  
Henry Samueli School of Engineering and Applied Science  
420 Westwood Plaza  
7256 Boelter Hall, Box 951600  
Los Angeles, CA 90095

Dear Dean Murthy,

I am writing you in support of your proposed Masters in Engineering (MEng) degree at the UCLA Henry Samueli School of Engineering and Applied Science. As a UCLA graduate myself (BSc. Chemistry / Materials Science and Engineering), and a current employer of 8 UCLA Engineering graduates, I am keenly aware of the skills required and challenges placed upon today's young engineers in order for them to strive for successful careers.

In addition to the supporting the blended curriculum, I look forward to collaborating with the program to develop cross-disciplinary capstone projects that will address current industry challenges. This hands-on experience will be a critical component to help participants thrive in today's high-tech corporate environment.

Respectfully,

A handwritten signature in black ink, appearing to read "Ken Vallens", written over a horizontal line.

Ken Vallens

President and CEO

***NORTHROP GRUMMAN***

**Northrop Grumman Corporation  
Aerospace Systems**

One Space Park  
Redondo Beach, CA 90278

Jayathi Murthy  
Ronald and Valerie Sugar Dean  
Henry Samueli School of Engineering and Applied Science  
420 Westwood Plaza  
7256 Boelter Hall  
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Los Angeles, CA 90095

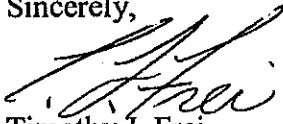
9 November 2018

Dear Jayathi,

I am writing on behalf of the Northrop Grumman Corporation in support of your proposed Master of Engineering (MEng) degree in the Henry Samueli School of Engineering and Applied Science. It is well understood in the engineering community that engineers today are dealing with a complex business culture driven by fast-paced innovation and bottom lines. The proposed degree will help fill a gap for engineers in the Aerospace industry who are technically sound and business savvy.

In addition to the supporting the blended curriculum, we look forward to collaborating with the program to develop cross-disciplinary capstone projects that will address an industrial challenge. This hands-on experience will be a critical component to help participants thrive in a corporate, high tech environment.

Sincerely,



Timothy J. Frei  
Sector Vice President  
Aerospace Systems Sector  
Northrop Grumman Corporation



Wayne H. Goodman, Ph.D.  
Executive Vice President

THE AEROSPACE CORPORATION  
2310 E. El Segundo Blvd.  
El Segundo, CA 90245-4609  
310.336.5356

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P.O. Box 92957-M1/007  
Los Angeles, CA 90009-2957

[www.aerospace.org](http://www.aerospace.org)

16 November 2018

Jayathi Murthy  
Ronald and Valerie Sugar Dean  
Henry Samueli School of Engineering and Applied Science  
420 Westwood Plaza  
7256 Boelter Hall  
Box 951600  
Los Angeles, CA 90095

Dear Jayathi,

I am writing on behalf of The Aerospace Corporation in support of your proposed Master of Engineering (MEng) degree in the Henry Samueli School of Engineering and Applied Science. At Aerospace, we have developed a strong relationship with the professors and students at UCLA, and we actively seek your students for employment. It is well understood in the engineering community that engineers today are dealing with a complex business culture driven by fast-paced innovation and where the commercial market is driving new technologies that are being integrated into government space systems. The proposed degree will help fill a gap for engineers in the aerospace industry who are technically sound, business savvy, and know how to seek innovative solutions in the growing entrepreneurial market place.

In addition to the supporting the blended curriculum, we look forward to collaborating with the program to develop cross-disciplinary capstone projects that will address an industrial challenge. This hands-on experience will be a critical component to help participants thrive in a corporate, high tech environment.

Sincerely,

A handwritten signature in black ink that reads 'Wayne H. Goodman'.

Wayne H. Goodman, Ph.D.



Jayathi Murthy  
Ronald and Valerie Sugar Dean  
Henry Samueli School of Engineering and Applied Science  
420 Westwood Plaza  
7256 Boelter Hall  
Box 951600  
Los Angeles, CA 90095

November 2, 2018

Dear Jayathi,

I am writing on behalf of HRL Laboratories in support of your proposed Master of Engineering (MEng) degree in the Henry Samueli School of Engineering and Applied Science. In today's dynamic research and development community, engineers are driven by a fast paced culture that requires a broad set of technical, business, and interpersonal skills. The proposed degree will help fill a gap for engineers in the aerospace and defense industry who combine technical excellence with superior project management abilities and business savvy.

We believe the blended curriculum will prepare our staff to succeed in challenging assignments involving complex teams and objectives. We look forward to collaborating with the program to develop cross-disciplinary capstone projects that examine critical engineering needs. This hands-on experience will be an important component to help participants thrive in a corporate, high tech environment.

Sincerely,

A handwritten signature in cursive script that reads 'Leslie Momoda'.

Leslie Momoda  
Vice President





November 27, 2018

Arnold Hackett  
Vice President, Alliance &  
Partnership Management  
WHSC

Xerox Corporation  
6701 Center Drive West  
Los Angeles, CA 90045

Arnold.Hackett@xerox.com  
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Jayathi Murthy  
Ronald and Valerie Sugar Dean  
Henry Samueli School of Engineering and Applied Science  
420 Westwood Plaza  
7256 Boelter Hall  
Box 951600  
Los Angeles, CA 90095

Dear Jayathi:

I am writing on behalf of Xerox Corporation in support of your proposed Master of Engineering (MEng) degree in the Henry Samueli School of Engineering and Applied Science. The proposed MEng degree is well comprehended in the engineering community that engineers today are dealing with a complex business culture driven by fast-paced innovation and bottom lines. The proposed degree will help fill a gap for engineers in the industry who are technically sound and business savvy.

In addition to supporting the blended curriculum, we look forward to collaborating with the program to develop cross-disciplinary capstone projects that will address industrial challenges. This hands-on experience will be a very critical component to help participants thrive in a corporate, high tech environment.

Sincerely,

*Arnold Hackett*

Arnold Hackett

AH:fet