STATE OF THE SCHOOL OF ENGINEERING: 2014

Godfrey Mungal
Dean

• #10 U.S. News & World Report
• Undergrad and Grad Enrollments on the Rise
• A Movement Toward STEM Education
We are: *Engineering with a Mission*

Educating ethical leaders and innovators to make a difference in their communities and in the world
Who We Are

Our Enrollment

- 953 Undergraduate (57%)
- 727 Graduate (43%)

- 32% Female
- 17% F-1 International

18% u.g. population
23% Female
T-MODEL Of Engineering Education

Jesuit education of the “whole person”

Our model for undergraduate education

Communication – Ethics – Integrity – Global Perspective
Entrepreneurial Mindset - Creativity - Lifelong Learning

Engineering
Teamwork
Problem-Solving
Technical Skills
Analysis
Iterative Design
Math
Science

Deep Technical Core - Hard skills – left brain

Soft skills – right brain – liberal arts education...
Educating the left and right brain

Our Model for Graduate Education

- science
- math
- engineering
- design
- communication
- creativity
- global view
- ethics/integrity
A Unique Education

- Hands-on
- Project-based
- Unique Labs
- Inspiring Opportunities
- Silicon Valley Connections
- Global Engagement
- Entrepreneurial Mindset
- Service Mentality
- Relevant Programs
- Outstanding Faculty

Santa Clara University
School of Engineering
Engineering is not a spectator sport!

Hands-on

Solar Decathlon

Collaborative Study

ENGR 1 Final

Civil Engineering Lab
Solar Decathlon – unrivaled experience

Interdisciplinary 2-year project
13 sub-teams, 100+ students

countless decisions made and problems solved

1,000 sq. ft.
solar-powered home
designed and built
by undergrads

Student involvement: bamboo structural technologies, control systems, solar thermal system, PV maximization...
Senior Design: year-long capstone

research, design, teamwork, project management

2014:
87 teams, 272 students

BIOE: cancer research, 3D printing, genome editing ...
CENG: water systems, transportation, sustainable design ...
COEN: mobile apps, file sharing, robotic control system ...
ELEN: satellite power system, off-grid energy, GPS locator...
MECH: smart water heater, autonomous robots, nanosat testing ...
INTER: extreme environment exploration, audiometry testing...
Distinctive Laboratories

- Center for Nanostructures
- Frugal Innovation Lab
- Latimer Energy Lab
- Maker Lab
- Robotics Systems Lab
Center for Nanostructures

increases in collaborations, space, and use

# of students, TAs, faculty, and collaborators who currently have access to the CNS

57

New external partner collaborations lead to student internships

Furnace removal and lab renovation increases space

Refurbished Gaertner L116B ellipsometer adds to characterization capabilities
Frugal Innovation Lab

designing accessible, affordable, adaptable, and appropriate solutions for underserved markets

Instruction

Innovation

Immersion

Renewable Energy

Clean Water

Lab-on-a-Chip for Global Health

Design Innovation Process

Empathize | Ideate | Define | Prototype | Test
Frugal Innovation Lab Going Mainstream!

thought leadership and deepening expertise in programmatic initiatives

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Innovation</th>
<th>Immersion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Graduate Certificate in</strong></td>
<td><strong>Multi-Disciplinary Projects for Social Benefit</strong></td>
<td><strong>Partnerships with Social Enterprises and Non-Profits</strong></td>
</tr>
<tr>
<td>Frugal Innovation</td>
<td>Senior Design, In-Class Projects, 1+ Year Client-Based Projects</td>
<td>Catholic Relief Services, NetHope, salaUno, iMerit, SOKO, Community Technology Alliance, and 20+ more</td>
</tr>
<tr>
<td><strong>Global Academic Partners</strong></td>
<td><strong>Engagement w/Silicon Valley Projects &amp; Partnerships</strong></td>
<td><strong>Case Study Development</strong></td>
</tr>
<tr>
<td>Technische Universität Hamburg-Harburg (TUHH)</td>
<td>Cisco, HP, Vodafone, Samsung, Ricoh, etc.</td>
<td>Advancing ‘Mobile for Humanity’ industry, MOOC development with Cisco</td>
</tr>
<tr>
<td><strong>Undergraduate Design Innovation Courses</strong></td>
<td><strong>International Journal Publications and Conference Keynotes</strong></td>
<td><strong>Design Process Workshops</strong></td>
</tr>
<tr>
<td>Including ENGR 1 Lab (400+ Freshman/year)</td>
<td>Academy of Management, Xavier Earth Summit, ICT4D, State Department MOOC</td>
<td>Tech Museum of Innovation</td>
</tr>
</tbody>
</table>
Latimer Energy Laboratory
advancing the study of sustainable energy

4 Summer Projects:
- PV system for Radiant House (scored full 100 points)
- Hydrogen and alcohol fuel cell research
- Characterization of PV panels
- Optimization of power from thermoelectric generators

2 Senior Design Projects:
- “Supercapacitor Power Management Module”
- “Pb: Project Battery – A Portable In-Home Power System”

17 future projects identified
- Study of PV solar energy for charging batteries

New Course
ELEN 20:
Emerging Areas in Electrical Engineering

New initiative – study of DC energy storage and use: systems, supercapcitators, distributed microgrids

Outreach – LEL hosted 40 high school students for a summer “Intro to PV” workshop
Maker Lab

Easy-access, hands-on prototyping for everyone

- Supports courses, capstone teams, and personal projects

- Equipment:
  - Laser Cutter
  - Rapid Prototyping Machines
  - 3-D Scanning System
  - Traditional hand and power tools

- 150+ students certified

- Maker Club

- Maker Challenges

2012 SWAG Challenge winner

Chris Kitts
Maker Lab: Examples of student creativity

- SCU Coasters
- iPhone Covers
- Lasercut Gears
- ROV Control Box
- 3D Printed Quadcopter Model
- Inverted Pendulum
- Balancing Platform
- Montgomery Glider
- 3D Cube Gear
- 3D Ball Bearing

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Robotics Systems Laboratory

a world-class field robotics program for air, land, sea, and space

Student team is running mission operations for 3 new, recently launched NASA satellites

Underwater robot and autonomous marine mapping missions find further evidence of historic tsunami in Lake Tahoe (journal article submitted)

RSL is leading a new multi-university consortium on aerial drones (UAVs)
RSL performed a demonstration mission mapping a local winery

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Opportunities that inspire

Industry Field Trips
Study Abroad
Collaborative Research
Social Benefit

AIAA Student Chapter Visits NASA Wind Tunnel
Engagement with Silicon Valley

- Guest Speakers
- Field Trips
- Faculty Collaboration
- Student Research Projects
- Department Advisory Boards
- Career Fairs
- Networking
- Outreach

...and many more!
Promoting Global Understanding

For Faculty

Academic Exchange:
China, India, Japan, Singapore, S. Korea, Spain, Uruguay...

Collaborative Research:
Argentina, China, Greece, India, Mexico, Spain, Taiwan

Conferences, Presentations: 26 cities, 18 countries

Distance Learning: India, Uruguay

For Students

Immersion Trips:
China, Ecuador, India, Nepal, Rwanda

Research Projects:
Ghana, Haiti, Indonesia, Mexico, Nepal

Study Abroad:
Australia, England, Spain...

EWB:
Honduras

Frugal Innovation:
30+ projects in 20+ countries
Fostering entrepreneurial mindset

courses, contests, mentoring, networking

New Electives:
- ENGR 170 – Improv for Engineers
- ENGR 171 – Product Opportunity Assessment
- ENGR 172 – Product Prototype to Test
- ENGR 173 – Intro to Business Fundamentals
- ENGR 174 – Financial Reporting & Decision Making
- ENGR 175 – Intro to Business Models
- ENGR 177 – Cultures of Innovation

Lunch with an Entrepreneur:
- **Fall:** Pravin Jain, 3D Printing
- **Winter:** Shawn Lange, L2F Automation
- **Spring:** Preet Anand, 4Taps

Quarterly Competitions:
- **Fall:** Nike+ Storyboard (3-week) – shoe-sensing technology
- **Winter:** Maker Spirit (4-week) – produce School swag
- **Spring:** SporeSat (3-week) – develop a mission patch NASA
Entrepreneurialism Continues
moving beyond Senior Design

8 CAPE PROJECTS
LED BY CURRENT OR FORMER ENGINEERING STUDENTS:

**YUN JIA** (current engineering management and leadership student)
software to help make grocery shopping easier, cheaper, and more

**YUN JIA** (current engineering management and leadership student)
mobile game to help people learn Chinese in an easy and efficient way

**NARAYANI BALASUBRAMANIAM '05** (SCU alum, M.S. computer engineering)
a one-stop-shop for gifts that pop and sizzle

**CESAR PHILIPPIDIS '05** (SCU alum, M.S. computer engineering)
real-time image enhancing software products and services

**NICHOLAS XYDES '13** (B.S. and current M.S. mechanical engineering)
(with Chris Mora '13 economics)
affordable, aerial filming device

**JOSERGIO ZARAGOZA '13, WILLIAM TRUONG '13** (B.S. bioengineering, current M.S. students)
enhancing the strength and viscoelastic properties of soft polymers using silica nanoparticles

**DOMINIC VILLA '13** (B.S. mechanical engineering) (with Daniel Dayan '13, B.S. accounting)
building energy-generating flooring for public locations, commercial buildings and homes

**RAHUL KRISHNAKUMAR '13, KAROLY SOMOGYVARI '13, GRAHAM TURBYNE '13**
(B.S. computer science and engineering), **ALAN RUIZ '13** (B.S. web design and engineering),
a fresh approach to the problem of e-mail overload
Community Outreach

Service Mentality

Spring Engineering Education Days
Fun and educational engineering sessions for high school students, Saturdays in April

Third Street Community Center
Bronco volunteers introduce engineering concepts to youngsters each Tuesday in February

Summer Engineering Seminar
Residential program introduces high school students to engineering and college life

Many More Programs
Introduce high school girls and others to engineering

Hack for the Homeless
SCU students compete for a cause in a 24-hour programming marathon
Focus on justice and sustainability
A leader in energy studies

Latimer Energy Scholars

Graduate M.S. and Certificate

Energy Club
SCU undergraduate engineering among “2014 Best Colleges”

SCU graduate engineering among “Top 100” in U.S.
2nd largest enrollments in 22 Catholic Colleges

ASEE 2013 Preliminary Data
Catholic Engineering Schools Enrollments

- Doctorate
- Masters
- Undergraduate

Schools:
- Dayton
- Santa Clara
- Notre Dame
- Villanova
- Marquette
- Manhattan
- Gonzaga
- Saint Thomas
- Detroit Mercy
- Saint Louis
- Portland
- Seattle
- Loyola Marymount
- San Diego
- Gannon
- Catholic Univ.
- St. Mary’s
- Saint Martin’s
- Christian Brothers
- Loyola College
- Fairfield
- Merrimack
Undergraduate Departments and Degrees

- Bioengineering: 19%
- Civil Engineering: 13%
- Computer Science and Engineering: 27%
- Electrical Engineering: 9%
- Mechanical Engineering: 20%
- Web Design and Engineering: 3%
- General Engineering: 1%
- Undeclared: 9%
Undergraduate Trends

2014-2015
Undergraduate Snapshot

- 937 undergraduate students
- 218 women students; 23%

2014 Deposited First Year Students

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>BIOE</td>
<td>17%</td>
</tr>
<tr>
<td>Civil</td>
<td>6%</td>
</tr>
<tr>
<td>Mechanical</td>
<td>19%</td>
</tr>
<tr>
<td>Electrical</td>
<td>4%</td>
</tr>
<tr>
<td>Undeclared</td>
<td>19%</td>
</tr>
<tr>
<td>WEB</td>
<td>1%</td>
</tr>
<tr>
<td>General</td>
<td>2%</td>
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First Year Enrollment

<table>
<thead>
<tr>
<th>Year</th>
<th>Enrollment</th>
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<tbody>
<tr>
<td>2008</td>
<td>216</td>
</tr>
<tr>
<td>2009</td>
<td>173</td>
</tr>
<tr>
<td>2010</td>
<td>278</td>
</tr>
<tr>
<td>2011</td>
<td>178</td>
</tr>
<tr>
<td>2012</td>
<td>219</td>
</tr>
<tr>
<td>2013</td>
<td>216</td>
</tr>
<tr>
<td>2014</td>
<td>285</td>
</tr>
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Graduate Departments and Degrees

M.S. Student Summary FY 2013-2014
(727 Total - Reflects currently enrolled students only)

- MECH: 126 (17%)
- COEN: 256 (35%)
- ELEN: 125 (17%)
- EMTG: 126 (17%)
- SOFT: 15 (2%)
- AMTH: 7 (1%)
- Certificate: 25 (4%)
- BIOE: 16 (2%)
- CENG: 17 (2%)
- SUST. ENERGY: 14 (2%)
- Open Univ.: 43 (6%)

Quarterly Swing Dance lessons are a big hit!

Ph. D. Students by Department, FY 2013-2014
(45 Total - Reflects currently enrolled students only)

- COEN: 23 (51%)
- MECH: 6 (13%)
- ELEN: 16 (35%)

SCHOOL OF ENGINEERING - 2014
Applied Mathematics

offering courses to serve engineering students

New undergraduate course:

Applied Mathematics 112
Risk Analysis in Civil Engineering

developed at the request of civil engineering faculty

treats probability and statistics with examples from areas of civil engineering

24 students enrolled
Bioengineering

the fastest growing department in the School

6-fold increase in enrollment over 5 years!

23 enrolled in MS program begun in 2012

4 tenure-track faculty
1 academic year adjunct lecturer
9 quarterly appointed lecturers
1 lab manager
2 AYAL searches on-going
Bioengineering

Active faculty mentor students, advance research

Faculty and student publications in AY 2013-14:

- 5 journal papers
- 3 book chapters
- 7 conference papers

Faculty serve as co-chair and session chair for international conferences

Research collaborations (UC Berkeley, UC San Diego, Scripps, Stanford, Saint Louis, Clemson, China, Japan, Europe)

Summer exchange program with SJTU

Students participate in faculty research

Professional conference presentations
Civil Engineering

Enhancements for busy teaching labs

- Senior Design test of bamboo culms under compressive load
- Environmental mixing system analysis
- Novel Dye Sensor and Data Acquisition System

Field Trips

- Santa Teresa Park
- Samsung Research Facility (Devcon)

ASCE Mid-Pac Competition

SCHOOL OF ENGINEERING - 2014
New Faculty:

Tracy Abbott
Structural Engineering

Ali Abrishamchi
Computational Fluid Dynamics and Hydrology

Faculty News:

Ed Maurer
Exclusive invitation: CORDEX
International Conference on Regional Climate

Reynaud Serrette
Sabbatical research: Cold-formed steel moment frame connections, high aspect ratio shear walls...
new faculty and international collaboration

- **New Full-time Faculty & Researcher**
  - Simon Koo, Adjunct Assistant Professor
  - Katerina Potika, Lecturer
  - Zhouye Gu, Postdoctoral Research Fellow

- **New QPT Lecturers**
  - Hired eight new QPT lecturers to meet huge increase in classes

- **New Visiting Professors/Scholars**
  - From UAE, Spain, China (2)
Computer Science and Engineering

growth, innovation, external funding

Strong Growth in Enrollment
Continuing highest enrollment in combined undergrad and grad

Major Curriculum Innovation
Created Data Science track in MS program – focus on Big Data Technology

External Funding
Nam Ling & Zhouye Gu: $100,220 contract from Huawei Technologies
Ahmed Amer: $75,000 gift from Wells Fargo Foundation
Yi Fang: $50,000 gift from TCL Research America
Silvia Figueira: $11,041 gift from Datacare

Video Coding Research Team Results for 2013-14
(Led by Nam Ling, with Zhouye Gu, Ph.D. students, and researchers from Huawei/Hisilicon)

1 U.S. Patent Granted
8 Provisional U.S. Patents
2 China Patents Filed
4 contributions adopted as international video coding standard:
2 normative, 2 informative
new courses and faculty support emerging areas:

For freshmen: energy and nanoscience

Ugrad electives: energy systems, RF, power systems

For ugrads and grads: signal integrity (related to IOT)

For grads: advanced control, RF

Adjunct Associate Professor
Ramesh Abhari:
signal integrity, RF, microwave, IOT
2nd lab renovation in 2 years; more are planned

EC 305
Before and After
Engineering Management & Leadership

preparing engineers to be competent leaders

36 management courses on topics essential to today's high performance global organizations

delivered by 21 instructors working in Silicon Valley organizations
Mechanical Engineering

meeting the need of the increased enrollment!

- Lab Work
- Experience

Undergraduate unit growth as a percentage

Graduate unit growth as a percentage

7 new adjunct lecturers hired to teach:
- Fluid Mechanics
- Intro to Polymers (Special Topics)
- Modern Instrumentation (Graduate)
- Thermal Systems
- Thermodynamics
- Vibration and Controls
- Vibration and Dynamics
Mechanical Engineering

providing a wide range of experiences for students

Human Powered Vehicle Challenge – held at SCU

Solar Decathlon Team in Spain (led by Tim Hight, right)

Junior Design

NASA Field Trip

Robotics Systems Lab
SCU Faculty Recognition Award Recipients:
Tim Healy, Presidential Award for Exemplary Service
Shoba Krishnan, Presidential Special Recognition Award
Ed Maurer, Award for Recent Achievement in Scholarship
Samiha Mourad, Faculty Senate Professor Award

Tenure and Promotion:
Yuling Yan (bioengineering), full professor
Mohammad Ayoubi (mechanical engineering), associate professor
Fellows and Editors

Sarah Kate Wilson
IEEE Fellow

Mahantesh Hiremath
ASME Congress’l Fellow

Chris Kitts
Associate Fellow AIAA

Sukhmander Singh
Associate Editor, International Journal of Science in Society

Prashanth Asuri
Editor, Enzyme Bioengineering

Sally Wood
Editorial Board, Proceedings of the IEEE

Chris Kitts
Associate Editor, IEEE Access
Ed. Board, Int’l Journal of Advanced Robotic Systems

Sarah Kate Wilson
Vice President of Publications, IEEE Communications Society
External Recognition

Bonita Banducci
Silicon Valley Business Journal
Woman of Influence

Silvia Figueira
National Center for Women & IT
Undergraduate Research Mentoring Award

Shoba Krishnan
25th Assembly District Woman of the Year

Dan Lewis
International Society of Quality Electronic Design
Quality Educator Award

Nam Ling
Shanghai U of Elec. Power Outstanding Overseas Scholar

Tonya Nilsson
ASEE Campus Star

Hisham Said
ELECTRI International Early Career Award

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Books:

Ralph Morganstern
Department of Applied Mathematics
Adjunct Lecturer
Discrete and Continuous Probability

Marian Stetson-Rodriguez
School of Engineering
Adjunct Lecturer
Co-author Building Trust in Global Technical Teams

Heidi Williams
School of Engineering
Director of Communications
Santa Clara Engineering: Celebrating Our First Century

Contributing Authors:

Prashanth Asuri
Department of Bioengineering
Assistant Professor
Nanoparticles for Catalysis, Energy and Drug Delivery

Radha Basu
Frugal Innovation Lab Director
Globalization, Change and Learning in South Asia
2014 faculty and staff award recipients

Hohyun Lee  
Researcher of the Year

Aleksandar Zecevic  
Teaching Excellence Award

Peter Wbytowitz '80 and '93  
Adjunct Lecturer of the Year

Robert Kleninhenz, Gerald E. Markle  
Award for Teaching Excellence

Nicole Morales  
Staff Member of the Year

Patti Rimland  
Staff Member of the Year
Student Achievement

a small sampling:

Pankti Doshi '14 and Jessica Garcia '14 (bioengineering) $1000 Grand Prize at CIE's SCEO Business Plan Competition: "Methane to Methanol Conversion Device"

Amanda Holl '15 (web design & engineering) 1st Place, WEPAN STEM Poster Contest

Claire Kunkle '14 (mechanical engineering) awarded prestigious National Science Foundation Graduate Research Fellowship for Ph.D. study

Katie Le '14 (computer engineering) 3 straight years qualified for the NCAA Tennis Tournament

Neil Chintala '14 (computer engineering) 1st prize, Hack for Homeless

Allie Sibole '14 (bioengineering) starting master's program in May: bioengineering innovation and design at Johns Hopkins – hospital rotations, immersion trip to developing country

Rachel Wilmoth '14 (mechanical engineering) and Erik McAdams '14 (civil engineering) selected as alternates for Fulbright Awards

Nick Xydes '13, (mech grad student) $1,000 Technology Sector Winner of CIE's 2013 CAPE: "Skyview," an affordable aerial filming device
Alumni Achievement

a few highlights:

Michael Barone ’88
(computer science and engineering)
mentored the 1st Place winning team (of 400), Dallas Jesuit, in the First Robotics World Championship

Scott Santarosa, S.J., ’88
(civil engineering)
appointed Provincial of the Oregon Province of the Society of Jesus

Jerry Shen ’10
(engineering management and leadership)
sold his mobile app startup company to Yahoo!

Jayshree Ullal ’86
(engineering management and leadership)
recipient of the School of Engineering 2013 Distinguished Engineering Alumni Award
2014 Distinguished Engineering Alumni

Steven C. Chiesa  
B.S. Civil Engineering '75

John Maydonovitch  
M.S. Applied Mathematics '73

Timothy K. Shih  
Ph.D. Computer Engineering '93

Aleksandar Zecevic, M.S.  
Electrical Engineering '90, Ph.D. '93
A vision for the future - STEM

SANTA CLARA 2020
Integrated Strategic Plan

http://www.scu.edu/santaclara2020/
Some numbers in the SoE...

**Lengths and Distances:**
- 0.8 nm molecules in BIOE, ~1nm carbon nanotubes in CNS
- 50 ft for the Solar Decathlon 2013 House
- 60 miles to Pittsburg, CA
- 3,000 miles for the size of the networked satellite control system operated by RSL
- 384,000 person miles traveled by students, faculty for 3 Solar Decathlon contests

**Heights and Depths:**
- 7,000 m below sea level, for the deep biosphere instrument being developed by RSL
- 640,000 m above sea level, for the O/OREOS satellite (17,000 mph) being controlled by RSL

**Forces:**
- 1 pN AFM probe tip in CNS
- 110,000 lbs, 235,000 lbs on campus, to 445,000 lbs in Pittsburg Annex, CENG

**Pressures:**
- 10E-7 torr in our sputtering system
- ~700 atm deep biosphere instrument being developed by RSL
Temperatures:
77K liquid nitrogen for cell and tissue sample storage in BIOE
~1000°C for CNT growth

Frequencies, RPMs:
antenna projects operating at 60 GHz (ELEN)
centrifuge which can spin at the speed of 26,000 rpm, with force of 82,000g (BIOE)

Numbers:
500 trillionth digit of Pi. CPUs in use: 39,360 (!!!) for one computation now up to the
4 quadrillionth digit of Pi (Ed Karrels)

1.04 billion web pages, 20+ Terabytes (TB) 2013 TREC Knowledge Base Acceleration, (Yi Fang)

10.19 Gigabits/second (Gbps) Video coding (Nam Ling)

Hard disk usage goes up to about 20 TBs during computations (Ed Maurer)

AND

Class in Science & Religion (Alex Zecevic)
Annual Art Show

AND…
We have our own Holy Man !!!
Conclude

- #10 U.S. News & World Report
  - gaining external recognition

- Undergrad and Grad Enrollments on the Rise
  - significant faculty and space issues

- A Movement Toward STEM Education
  - A lot of work to be done