### UC San Diego Jacobs School of Engineering

## Welcome CAP Executive Board June 11<sup>th</sup>, 2015

### CAP Executive Leadership 2014 - 2015



### CAP Chairman: *Jeff Carter* <sub>CS Alumnus</sub> '86 *Vice President and General Manager of Teradata Platforms*



CAP Vice Chairman: Mark Ambrose San Diego Site Executive, Raytheon



## Welcome New CAP Members!







## Welcome Distinguished Students

#### Triton Engineering Student Council (TESC)

### Institute of Electrical and Electronics Engineers (IEEE)





# Jacobs School of Engineering



Amy Chung **TESC VP External** Chemical Engineering '16



#### UC San Diego Jacobs School of Engineering

#### **Upcoming Events for Fall**

SD Hacks, October 2-4

Engineers on the Green, September 28

Dinner with the Deans, October 23

Networking for faculty and students

#### Goals

- Increased corporate interaction
- Expanding student communication with industry beyond DECaF

#### **Potential events**

- Networking with Industry
- Company Tours
- Workshops
- Graduate Panels

# SD Hacks

October 2-4, 2015



Where community and collaboration meets innovation

- 1000+ attendees from across the nation
  - Programmers, entrepreneurs, innovators
- 36 hours of student interaction
- Aiming to become the premiere hackathon in the west coast

#### Save the Date

- June 15th
  - Website Launch: <u>http://sdhacks.io/</u>
  - Participation registration opens

Contact Us Ryan Hill, Director rjhill@ucsd.edu

Website: <u>http://sdhacks.io/</u>

Sponsorship Inquiries: <u>sponsor@sdhacks.io</u>

## **Sponsor Tiers**



	Bronze	Silver	Gold	Platinum
	\$3,000	\$10,000	\$15,000	\$30,000
General				
Tickets	2	5	10	Unlimited
Space	None	Table	+ Canopy	Lounge
Facetime	Mixer	During	During	+ Ceremonies
Branding				
Logo on T-Shirt		•	•	•
Swag	•	•	•	٠
Logo on Website	•	•	•	٠
Mentions + Shoutouts			Some	More
In-Event Ad Space			Small	Large
Recruiting				
Resume / Portfolio		Post-Event	Pre-Event	Pre-Event
Interview Rooms				Some Access
Distribution Materials	•	•	•	٠
Outreach				
Side Events		15 Mins	30 Mins	1+ Hrs
API Directory	•	•	•	•
Hardware Lab	•	•	•	۰
Extended Workshops	1		٠	۲

Company logo will appear during launch if sponsorship initiated before 6/15

#### **Opportunities**

- o Recruitment
- Feedback/product adaptation
- o Brand recognition and exposure

Sponsorship Inquiries:

sponsor@sdhacks.io



### February 16-19, 2016

#### DECaF 2015 Recap

- 93 companies
- 12 corporate sponsors
- Nearly 2000 student attendees (record attendance)
- Reached capacity for Price Center Ballrooms
- Increased company diversity
- T.O.P. Program implemented

#### Goals for DECaF 2016

- Start promotion August
- Venue expansion
- Expansion to 100 companies
- Continued increase in company diversity



#### **Contact Us!**

- Vivek Koppuru, External Career Fairs Lead <u>lkoppuru@ucsd.edu</u>
- Dhruhin Kurli, Internal Career Fairs Lead
   <u>dkurli@ucsd.edu</u>
- Amy Chung <u>amchung@eng.ucsd.edu</u>

# IEEE UCSD Student Branch



#### Ryan Collins, President - UCSD IEEE rjcollin@ucsd.edu

#### Who Are we?

**UC San Diego** Jacobs School of Engineering

#### 500+ student members

EE, CE, CS, and various other majors at UCSD

2<sup>nd</sup> largest IEEE student branch in the country

#### What is Our Purpose?

Develop students into successful engineers by offering the following

- 1. Team projects
- 2. Technical workshops
- 3. Community-building events
- 4. Professional development
- 5. Technical information sessions

### We Explore Projects and Compete

- Micromouse 8 teams of 5 students
- GrandprIEEE 8 teams of 5 students
- Robomagellan 8 students
- Quadcopter 8 students



#### Totals from 2014/2015:

- Available spots 96
- Applicants 300+

UC San Diego Jacobs School of Engineering



# Goals for 2015-2016 Goals

- Improve Micromouse and Grand PrIEEE competition
- Increase workshop quality
- Improve outreach to middle and high school for STEM awareness
- Prepare members for job and internship experiences









## Dean's Report



### Dean Albert P. Pisano Jacobs School of Engineering



# The Engineering School of The Future



FocusLook, Think and Act as a Top 10Professional Engineering School

ValuesEngineering for the Global GoodExponential Impact through EntrepreneurismCollaboration to Enrich Relevance



## **Jacobs School Strategies**

- Maintain Quality and Serve Student/Industry Demand
- Build Strength around Strategic Themes with Cross-Campus and Industry Partners
- Enhance our Innovation Engine





## **Balanced Growth**

#### **Ensure Quality and Meet Demand**

	2014	2020	Top 10* Average
Faculty	208	280	344
Undergraduates	6,850	5,800	5,044
Ugrad/Faculty	33:1	21:1	15:1
Masters	700	1,450	1,217
Ph.D.	1,050	1,300	1,510
Graduate/Faculty	8:1	10:1	8:1

\*MIT, Stanford, UC Berkeley, Caltech, CMU, Ulllinois, Purdue, Michigan, Texas-Austin



## Fall 2015 Freshman Class at a Glance

19,000 Applications – 4,416 Admitted – 900 Acceptances

**Among 900 Registered Students:** 

Average GPA: 4.19 Average SAT: 2042 (4.4 scale) (2400 possible)

Female: URM 28% 14%





## Fall 2015 Transfer Class at a Glance

3,306 Applications – 718 Admitted – 325 Acceptances

**Among 325 Registered Students:** 

Average GPA: 3.68 (4.0 scale)

 Female:
 23%

 URM
 15%





## Fall 2015 Masters Class at a Glance

5,726 Applications – 1663 Admitted – 724 Acceptances

Among 724 Registered Students:

Average GRE: 320 composite

Quantitative:166Verbal:154





### Growing Demand for Empowered Masters-level Talent

#### Industry demand, regional economic need



Jacobs School of Engineering

## **Student-Centered Education**

- Student Success Initiative Programs to improve retention and enhance academic success, particularly amongst women and URM.
- 140 Engineering/40 General Education
   180 unit degree goal to enable students to graduate in four years.
- Experience Engineering (E4)
   Design-Make-Break courses, throughout all four years to improve retention and enhance career preparedness.
- Team Internship Program
   Engineering projects onsite with corporate partners to enhance career preparedness.



## **Student Success Initiative**

#### Increase Diversity and Retain Students in the Major





# E4 Freshman Pilots in Progress



*Electrophysiology for Brain-Machine-Body Interface* 

✓ Mechanical Engineering:
 Spring 2015



Electric motor propeller plane

Computer Science: Fall 2015



Assemble and Program Simple Robot

#### Electrical Engineering: Fall 2015



**Manipulating Sound** 

✓ NanoEngineering
 In Progress



Nanoparticle Color Displays

 ✓ Structural Engineering In Progress



Structural Performance Projects



### E4 Project - Computer Science & Engineering

Key concepts as an introduction to CSE Major:

- Simple programming
- Simple debugging
- Simple design



- Assembling simple computing devices
- Links between software and the real world

Steve Swanson, Prof. CSE Department Rajesh Gupta, Chairman & Prof. CSE Department



<u>Hypothesis</u>: Using a simple programming language, I can make the robot move, flash lights, respond to input, etc

Exercise: Program a pre-built robot to perform simple tasks

<u>Analysis</u>: Understanding the relationship between code and action, see what's possible for the robot

Tools: Lab space, pre-built robots





## 2. Design and Build a Robot

Hypothesis: I can design and build a robot

Exercise: Set goals for the robot. Design it (including decorative elements) using simple web-based tools. Assemble it. Test it

<u>Analysis</u>: Identify robot features necessary to achieve the robot's goal

<u>Tools</u>: Soldering facilities, circuit mill, 3D printers, Laser cutters





<u>Hypothesis</u>: The robot I designed can achieve the goals I set for it

Exercise: Program the robot to achieve its goals

<u>Analysis</u>: Debugging, refinement of goals, understanding shortcomings and mistakes

Tools: Lab space





### E4 Project – Electrical & Computer Engineering

Key concepts that students will learn as an introduction to their major:

- Circuit theory, assembly, and testing
- Embedded systems programming and debugging
- Transducer mechanisms and interfacing transducers
- Signals and systems theory
- Digital signal processing
- Modular design techniques



Drew Hall, Prof. ECE Department Truong Nguyen, Chairman & Prof. ECE Department



# 1. Manipulating Sound

<u>Hypothesis</u>: With basics of circuit theory, I can create sound waves and learn common electrical test equipment

<u>Exercise</u>: Build an audio amplifier with various filters to attenuate/amplify different frequency bands

<u>Analysis</u>: Characterize the transfer function of their circuit and also how they perceive the various filters

Equipment: Breadboard, passive components, microphone, speaker, and OpAmps. Test equipment - power supplies, oscilloscopes, function generators, and signal analyzers



Source: Dolphin-Media.



Source: Sergiu Bacioiu



# 2. Interfacing the Physical World

Hypothesis: I will learn to interface electronics through embedded systems programming, debugging, and the theory behind various transduction

<u>Exercise</u>: Build circuit interface sensor modules including: GPS, accelerometer, gyroscope, humidity, pressure, and audio

<u>Analysis</u>: Analyze the measured signals using digital signal processing techniques

Equipment: Arduino microcontrollers and sensor shields will be used for rapid prototyping



Source: Instructables.com



Source: Instructables.com



# 3. Communication Links

<u>Hypothesis</u>: I can transmit, receive and interpret information through embedded systems programming, debugging, and communication theory

Exercise: Build circuits to transmit and receive data over an optical link

<u>Analysis</u>: Analyze the transmitted and received signals including different modulation/demodulation techniques

Equipment: Arduino microcontrollers, IR LED, IR photodiode, power supplies, and oscilloscopes







Source: Krazatchu



### Institutes - Collaboration to Enrich Relevance



## **Contextual Robotic Technologies**

#### Partner: Cognitive Science Department (Social Sciences)

7 New Faculty in Engineering and Cognitive Science \$50 Million+ Research Program Already Underway

#### Goal: Develop Systems that "SEE", "THINK" and "DO"

#### Environmental Monitoring/ Disaster Response



Manufacturing, Transportation, Logistics

Education



Assisted Living





# **Contextual Robotic Research**

#### **Demonstrate Relevance Robotics Innovation**

#### Northrop Grumman

Launch Robotics Institute through seed research gift in the field.

#### Four Projects Awarded:

- Swarm Coordination in Disaster Response Operations
   Professor Jorge Cortes and Professor Sonia Martinez
- Real Time Object Detection with Deep Learning Models
   Professor Nuno Vasconcelos
- Information Bottlenecks in Contextual Robotics
   Post-doc Balakrishnan Narayanaswamy
- Image-To-Image Paradigm, A Roadmap to Rapid Contextual Science and Language Understanding Professor Zhuowen Tu







# **Global Production & Innovation**

#### Partner: School of Global Policy and Strategy



Study the interaction between production/innovation driven by new technologies; and consequences for the world economy.



Provide effective foresight to policy makers and industry partners.



# Cali-Baja Partnership Opportunities

Strengthen Design-Manufacturing Ecosystem: Proximity Matters

#### **Skyworks** Pilot

- Summer 2015 Internship Program: 15 students
- Faculty Speaker Series (Jan-June: Skyworks and CETYS)
- Discussions underway about master's-level education partnerships




# **Questions/Discussion**



# Inaugural "Agile" Research Centers

#### Center for Wearable Sensors Joseph Wang, Patrick Mercier



#### Center for Visual Computing Ravi Ramamoorthi



# Center for Extreme Events Research J.S. Chen



#### Sustainable Power and Energy Center Shirley Meng



- Cell Factories for Pharmaceutical Production
- Drones and UAVs



# **Faculty Presentation**

# Darren Lipomi Professor of Nanoengineering

Molecular Stretchable Electronics: Towards the Next Generation Robust & Wearable Devices in Energy & Healthcare







### **Molecularly Stretchable Electronics**

for Next-Generation Robust & Wearable Devices in Energy & Healthcare

Darren J. Lipomi

dlipomi@ucsd.edu group.darrenlipomi.com

Center for Wearable Sensors Jacobs School of Engineering CAP Executive Board Meeting June 11<sup>th</sup>, 2015



# **Research History**

NHCO<sub>2</sub>R<sup>2</sup>



#### Boston University (2001 – 2005); Prof. James S. Panek **Beckman Scholars Fellowship**

Medicinal chemistry O

#### Sensor in







External antenna

- Stretchable solar cells
- **Transparent sensors**





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2014, 6, 788

intracranial

H<sub>2</sub>N

More energy in the form of sunlight strikes the earth in an hour than is consumed by human activity in a year.

# Land Area

- Is the requirement for land area a deal-breaker for solar?
  - Solar panels: **10-20 W/m<sup>2</sup>**
  - Wind: **1-2 W/m<sup>2</sup>**
  - Hydroelectric (Lake Mead): **3 W/m<sup>2</sup>**
  - Biomass (3% efficient algae): 3 W/m<sup>2</sup>
  - Corn ethanol: 0.1 W/m<sup>2</sup>
  - Hydrothermal flux: **0.057 W/m<sup>2</sup>**

Saul Griffith, X-prize lecture: http://www.youtube.com/watch?v=jhT94Bbl70M

# **Solar Paint?**



Lewis, N.S. http://nsl.caltech.edu/

*"the solar energy conversion system can cost [no more than] 10 times more than the cost of paint."* 

Lewis and Nocera, PNAS 2006



# **Plastic Solar Cells**

 Plastic solar cells are >10% efficient (lab scale), have high power to mass ratio (10 W/g), and energy payback of 1 day



Krebs et al. Adv. Mater. 2014, 26, 29



### *"...mechanical failure mechanisms were dominant during the field test."*

Krebs et al. Energy Environ. Sci. 2010 3, 512

I've learned at times it's best to bend, 'cause if you don't, well those are the breaks.

#### *—Jim Croce "The Hard Way Every Time"*





Croce's Restaurant, Gaslamp Quarter (Now Banker's Hill)

# Goals

- **1.** Improve mechanical stability
- 2. Enable molecularly stretchable electronics
  - a. integration with moving parts
  - **b.** bonding to 3D surfaces







Kim et al. Nature Mater. 2010, 9, 511



Shepherd et al. PNAS 2011, 50, 1890



# **Elasticity of Electronic Plastics**

Effect of molecular structure on stiffness of materials



Savagatrup, Makaram, Burke, Lipomi Adv. Funct. Mater. 2014, 24, 1169

### **Stretching & Bonding to 3D Surfaces**



O'Connor, Zaretski, Shiravi, Savagatrup, Printz, Diaz, Lipomi Energy Environ. Sci. 2014, 7, 370

### **The Best of Both Worlds**

Is it possible to maximize efficiency and minimize stiffness?



Answer: yes!

Savagatrup, Printz, Rodriquez, Lipomi *Macromolecules* **2014**, *47*, 1981 Savagatrup, Printz, Wu, Rajan, Sawyer, Bettinger, Lipomi *Synth. Met.* **2015** (accepted)

### **Prediction of Molecular Stretchability**

with Prof. Gaurav Arya



Root, Arya, Lipomi (in preparation)

### **Automated Mechanical Tests**

with Prof. Frederik Krebs, DTU









Zaretski, Roth, Krebs, Lipomi

# **Epidermal Solar Cells**











O'Connor, Zaretski, Savagatrup, Printz, Wilkes, Diaz, Rodriquez, Lipomi et al. (in revision)

# **Graphene as Transparent Barrier Film?**

Source: Wikipedia. Author: AlexanderAIUS

# **Low-Cost Manufacturing of Graphene**

Strongest, most conductive material known to science



Zaretski, Moetazedi, Kong, Sawyer, Savagatrup, Valle, O'Connor, Printz, Lipomi Nanotechnology 2014, 26, 045301

# **Future Bio-Inspired Electronic Materials**

- Characteristics of human tissue
  - 1. Extreme elasticity
  - 2. Biodegradability
  - 3. Capacity for self-repair

Self-repair

(Bio)chemical sensing

i)

ii)



**Biodegradable elastomeric segment** 

**π-Conjugated semiconducting segment** 

# Impact

- Market forecasts (by 2020)
  - Transparent electrodes: \$5B
  - Wearable electronics: **\$12B**
  - Flexible packaging: **\$250B**
  - Solar photovoltaics: \$345B
- Social benefits
  - Fracture-proof, ultra-thin modules for solar energy for offgrid, disaster relief, military, intelligence, & developing world applications
  - Stretchable, wearable, implantable, biodegradable devices for preventive medicine & postoperative care

http://electroiq.com/blog/2013/05/transparent-electrode-market-to-grow-to-5-1-billion-by-2020/ http://www.marketsandmarkets.com/PressReleases/wearable-electronics.asp http://www.smitherspira.com/products/market-reports/packaging/flexible-packaging/flexible-packaging-market-size-trends-report http://www.prnewswire.com/news-releases/photovoltaics-market-worth-34559-billion-by-2020-291640941.html



Casey Kong





Mickey Finn



Nathaniel De Los Santos



**CJ** Pais



Valladolid

# Support





# HELLMAN FOUNDATION















# Viewers Like You Thank You

# **CAP Business**

# Cody Noghera

### Director Corporate Affiliates Program Jacobs School of Engineering





#### UC San Diego Jacobs School of Engineering

# RESEARCH

### April 16, 2015

### Thank You to our Corporate Affiliates Program Members and Research Expo Key Sponsors



#### Welcomed over 600 attendees







# Master of Advanced Study Updates

A master's degree for engineering professionals

# AY 2014-15 Summary

#### **142** Total students enrolled in 4 MAS programs

#### Graduating this year...

- 35 Architecture-based Enterprise Systems Engineering
- 12 Medical Device Engineering
- 24 Wireless Embedded Systems



#### MAS Engineering Degrees awarded: 246

### MAS @ Jacobs School 2011 - 2015

#### Representation from more than 100 local companies



# Master of Advanced Study Updates

A master's degree for engineering professionals

### Fall 2015 – There's still room!!

We are still accepting applications – deadline is June 30, 2015\*

\*Special consideration for CAP company employees through July 31<sup>st</sup>

- Architecture-based Enterprise Systems Engineering
- Medical Device Engineering
- Wireless Embedded Systems
- Data Science and Engineering





# Senior Design Projects

#### MAE 156B: Industry Sponsored Course

#### What the Course Provides

- Teams of 3-6 students
- 15 week project durations
- Deliver working prototype to sponsors
- IP assigned to sponsor





#### **Projects can be interdisciplinary**

- Mechanical
- Electromechanical
- Fluid mechanics
- Heat transfer
- Computer Control

Nathan Delson, Director, MAE Design Center - ndelson@ucsd.edu

https://sites.google.com/a/eng.ucsd.edu/mae3-robots/2015-spring/team-34



# **Senior Design Projects**

#### **Teradata Server Rack Cabinet Movers**



#### **SPAWAR**



#### Surface Towed Geolocation System



Water Purification



#### Robotically Controlled ATV



#### Variable Ballast System

#### **Delta Design IC Testing and Handling**



Device Under Test Holder for Thermal Testing



Gyro and Accelerometer Testing

#### **ATA Engineering: Modal Analysis Shaker**





# 2015 Team Internship Program

### 50 Companies 82 Teams 338 Students

**TIP Leadership Training Event** 

June 4th, 4:30-9:00pm

- 100 students attended
- 6 CAP Industry Members
- 4 TIP 2014 Alumni
- Business Basics
  Presentation
- Dinner & TIP
  Alumni/Industry Panel
- Team Dynamics + Leadership Presentation





# Students say...



"My favorite part is the focus on teamwork, and maintaining efficiency & productivity through team dynamics."



"I am excited to be a part of TIP and transition into the real working world.

I enjoyed meeting professionals in my field."



"Given our limited experience... It's absolutely necessary to get this training beforehand!"

> UC San Diego Jacobs School of Engineering





# CAP Year in Review 2014 - 2015



- 65 Dedicated Partners
- 5 New Members

#### 84 On-campus Recruiting Events

- 53 Days @ Jacobs
- 4 Student Lunches
- 8 Office Hour Days
- 10 Interview Days

3

5

- 4 Engineering Competitions
  - TIP Training Day

### Key Participation of CAP Executives in

- 1 Record Research Expo
  - Spirit of Solar Cruise
  - Quarterly Board Meetings
  - Center Research Reviews



# CAP Business:



#### **Dates to Remember:**

Thursday, October 15, 2015 Friday, October 30, 2015 Thursday, February 4, 2016 Thursday, April 14, 2016 CAP Executive Board Meeting Contextual Robotics Forum CAP Executive Board Meeting Jacobs School Research Expo



### UC San Diego Jacobs School of Engineering

# **Thank You CAP Executive Board**