

# CSUCI: Mechatronics Engineering Update

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# Introduction and Agenda

## Introduction

What is Mechatronics Engineering?

Why Mechatronics Engineering?

Overview of Program

Current Curriculum

4 – Year Roadmap

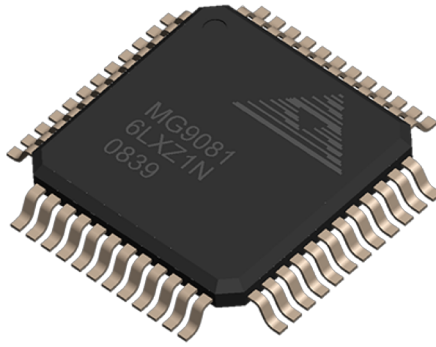
Student Projects

Ways to Get Involved

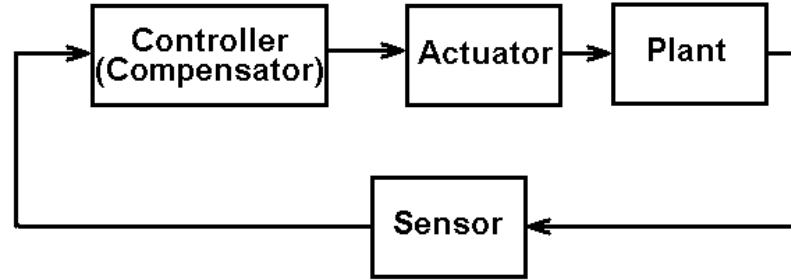




# My Experience as a Mechatronics Engineer



ASIC Design



Control Systems Design

```
oid ProcessIO(void)           //Main Program Loop

static unsigned char state, fred = 0;
static int counter = 0;
int myInt;

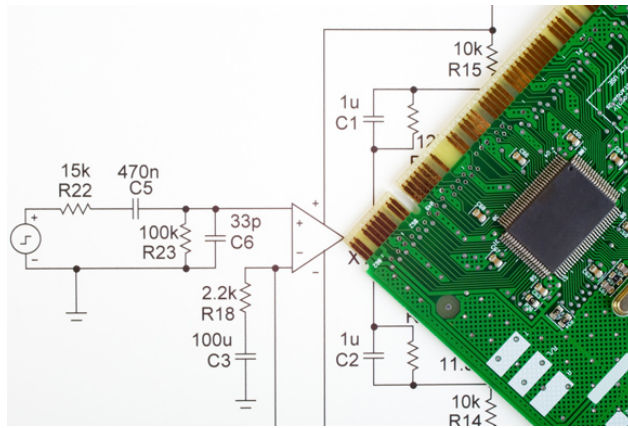
unsigned float myfloat;
unsigned char temp;

if((usb_device_state < CONFIGURED_STATE)|| (UCONbits.SUSPND

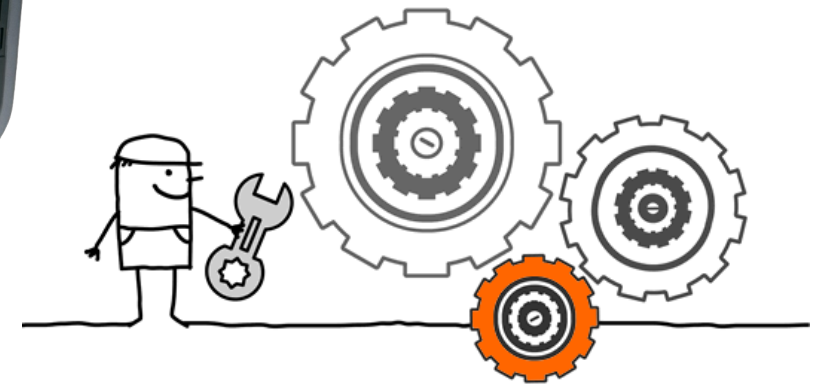
readUSB();
counter++;
rCompass();

if ((counter % (int)250) == 0)
{
    GRN = !GRN;
    RED = 0;
}
```

Firmware Design

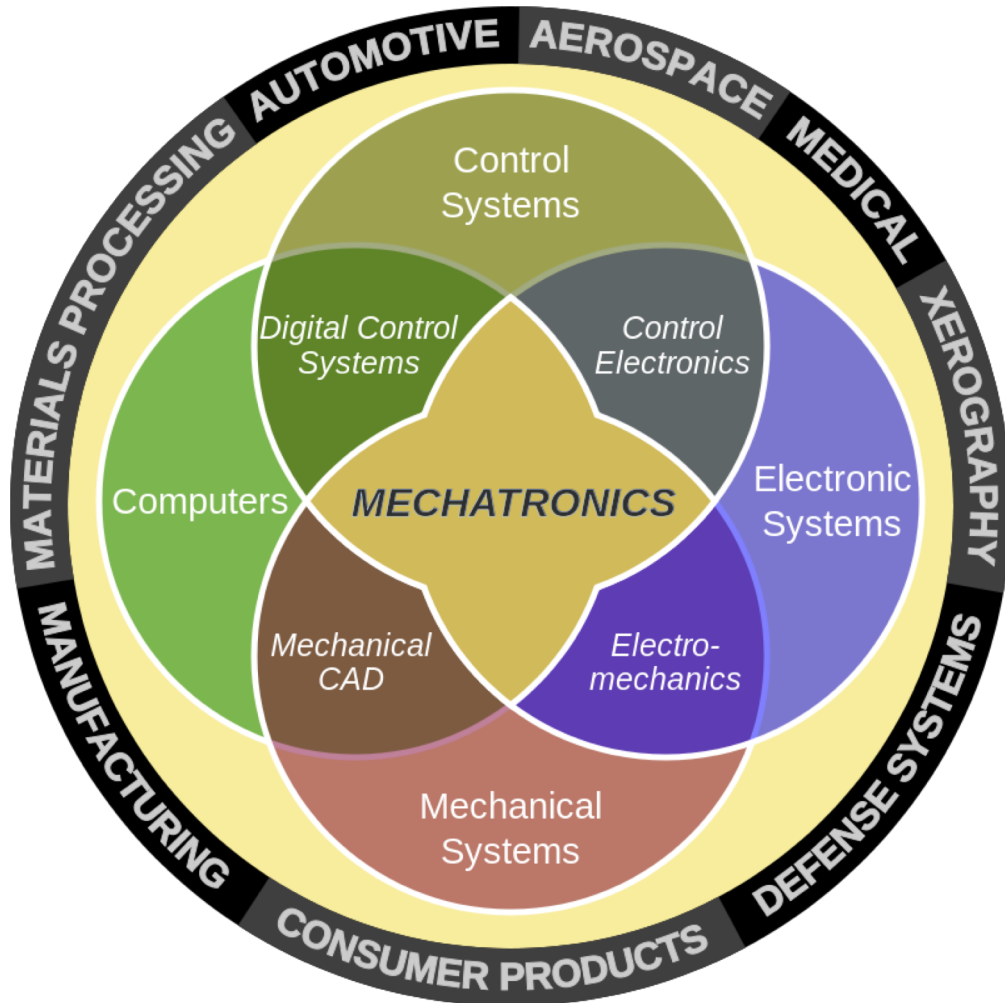


Electronics Design



Mechanical Design

# What is Mechatronics Engineering?



[Kevin Craig: Hofstra University]

Mechatronics is multidisciplinary systems engineering for the 21st century.

Mechatronics integrates at the ***beginning*** of the conceptual design stage different technologies

- Mechanical Systems
- Electrical Systems
- Control Systems
- Computer Systems

# Why Mechatronics Engineering?

Jobs are available and high paying.

Mechatronics technologies are driving economy.

- Self Driving Cars
- Unmanned Aerial Vehicles
- Industrial and Agricultural Automation



# Program Overview

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First year of study is common with other fields of Engineering

- Calculus, Computer Science, Chemistry, and Physics

Hiring 2 new Mechatronics Engineering faculty

- In addition to engineering faculty already in CS Department

Focus on small robotics

Collaboration with local businesses and government installations

Southern California Edison Mechatronics Engineering Scholarship

- Congratulations Antonio Moreno and Hugo Quintero

# Growth Plan

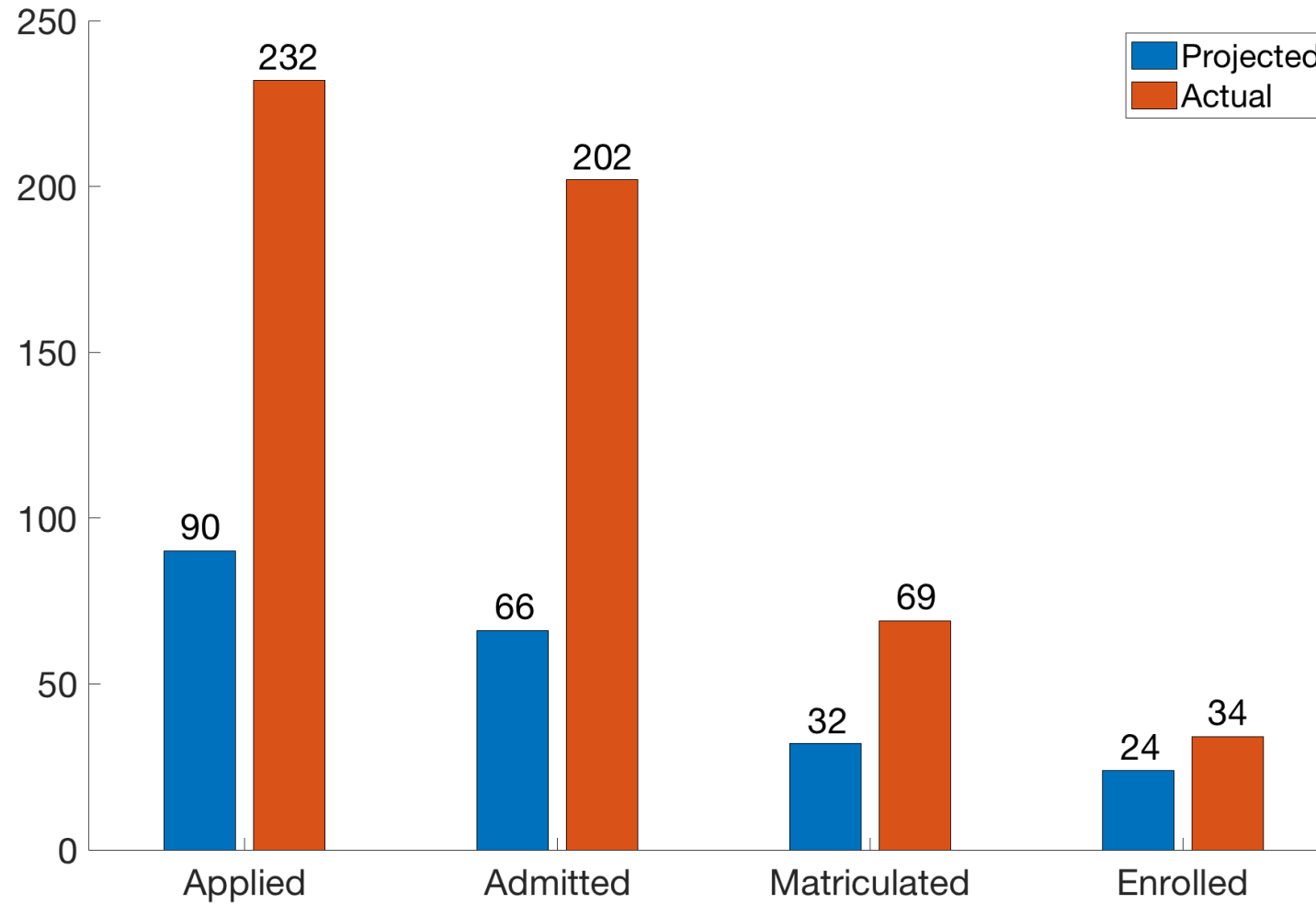
Admit 24 Students Per Year

Student Faculty Ratio at around 20:1

	Year 1	Year 2	Year 3	Year 4	Year 5		Year 1 native: 24
Fresh	24	24	24	24	24	native	
	0	0	0	0	0	transfers	Attrition: 15%
Soph	0	20	20	20	20	natives	
	0	0	0	0	0	transfers	
Junior	0	0	17	17	17	natives	
	0	0	7	7	7	transfers	
Senior	0	0	0	14	14	natives	
	0	0	0	6	6	transfers	
Total students	24	44	68	88	88		
Total graduates	0	0	0	20	20		



# Admissions Reality: Fall 2018



# Impacted Program

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Applications only accepted for first time freshman

- **Transfer Students and 2nd Bachelor Degree not accepted**

First Time Freshman will be required to select an alternate major

Freshman applicants will be rank ordered based on eligibility index

- $(\text{GPA}^* \times 800) + \text{SAT 1 Total}$
- $(\text{GPA}^* \times 200) + (10 \times \text{ACT COMP})$

Additional GPA points will be awarded for following criteria:

- +0.05 for Participation in Verified Engineering Academy
- +0.10 for Math College Level Ready

# Impacted Program Transfer Plan

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Apply for Impaction for Transfer Students in 2020

Fill any empty spots due to attrition up to 24 students

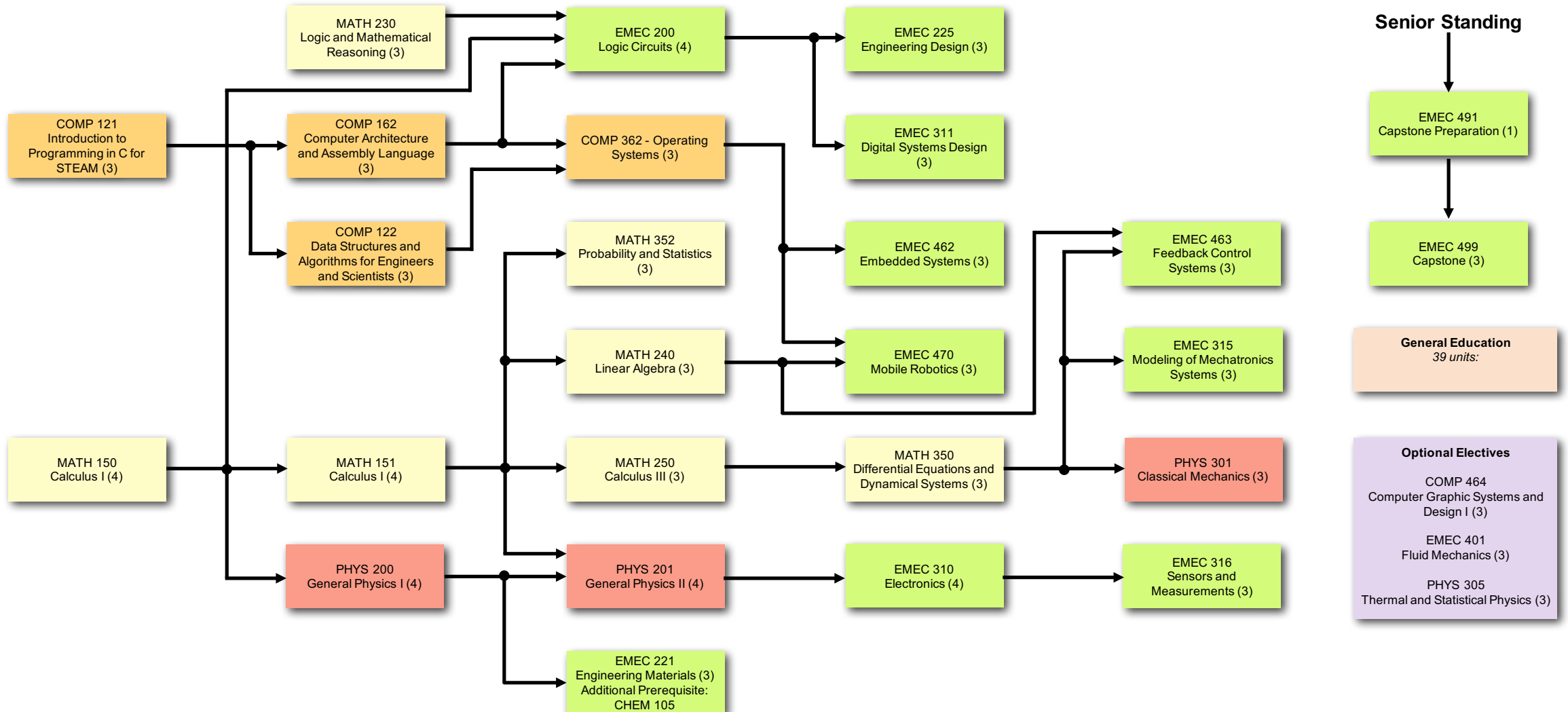
Upper Division Only (Goal to graduate in 2 years)

Will seek input when deciding criteria

- GPA
- Pre-Engineering or AA degrees
- Local Preference

# MECHATRONICS ENGINEERING B.S. DEGREE CHART

*Total units: 125. C- or better grade required in all pre-requisite courses in the major.*



# Year 1 Roadmap

Course Code	Name	Units	Prerequisites	GE
<b>Fall</b>	<b>Year 1</b>			
CHEM 105	Introduction to Chemistry	3	Entry Level Mathematics Exam (ELM)	B1
COMP 121	Introduction to Programming in C for STEAM	3	None	B4 and E
MATH 150	Calculus I	4	Calculus Placement Exam or MATH 105	B3
ENGL 105	Composition and Rhetoric	3	None	A2
MATH 230	Logic and Mathematical Reasoning	3	None	A3 and B3
	Units	16		
<b>Spring</b>	<b>Year 1</b>			
COMP 122	Data Structures and Algorithms for Engineers and Scientists	3	COMP 121	
COMP 162	Computer Architecture and Assembly Language	3	COMP 121 or COMP 150 or IT 151	
MATH 151	Calculus II	4	MATH 150	
GE	G.E.: Category C, D, or E (3)	3		C or D or E
PHYS 200	General Physics I	4	MATH 150	B1
	Units	17		



# Year 2 Roadmap

Course Code	Name	Units	Prerequisites	GE
<b>Fall</b>	<b>Year 2</b>			
EMEC 200	Logic Circuits	4	MATH 150 and MATH 230 and COMP 162	
MATH 250	Calculus III	3	MATH 151	
PHYS 201	General Physics II	4	PHYS 200	B1
GE	GE: Category A, B, C, D, or E	3		A or B or C or D or E
	Units	14		
<b>Spring</b>	<b>Year 2</b>			
EMEC 221	Engineering Materials	3	CHEM 105 and PHYS 200	
EMEC 225	Engineering Design	3	EMEC 200	
MATH 240	Linear Algebra	3	MATH 151	
MATH 350	Differential Equations and Dynamical Systems	3	MATH 250	
GE	G.E.: Category C, D, or E (3)	3		
	Units	15		

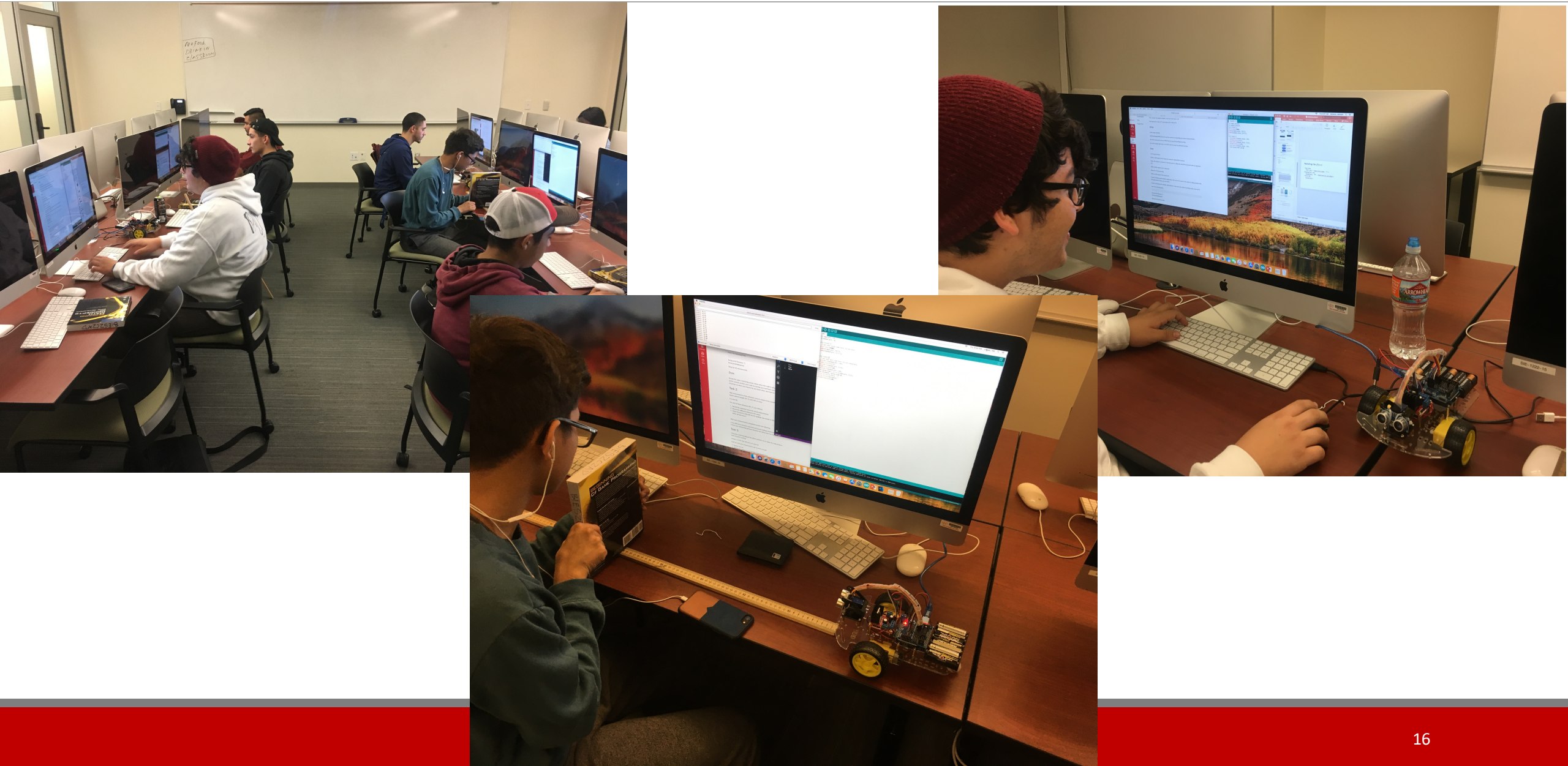
# Year 3 Roadmap

Course Code	Name	Units	Prerequisites	GE
<b>Fall</b>	<b>Year 3</b>			
COMP 362	Operating Systems	4	COMP 122 and COMP 162	
PHYS 301	Classical Mechanics	3	PHYS 200 and MAT 350	
PHYS 310	Electronics	4	PHYS 201	
GE	G.E.: Category C, D, or E (3)	3		C or D or E
GE	G.E.: Category C, D, or E (3)	3		C or D or E
	Units	17		
<b>Spring</b>	<b>Year 3</b>			
EMEC 315	Modeling of Mechatronics Systems	3	MATH 350	
EMEC 316	Sensors and Measurements	3	PHYS 310 and COMP 151	
MATH 352	Probability and Statistics	3	MATH 151	
GE	G.E.: Category C, D, or E (3)	3		C or D or E
GE	G.E.: Category C, D, or E (3)	3		C or D or E
	Units	15		

# Year 4 Roadmap

Course Code	Name	Units	Prerequisites	GE
<b>Fall</b>	<b>Year 4</b>			
COMM 101	Public Speaking	3		A1
COMP 462	Embedded Systems	3	COMP 362	
EMEC 311	Digital Systems Design	3	EMEC 200	
EMEC 491	Capstone Prep	1	Senior Standing	
GE	G.E.: Category C, D, or E (3)	3		C or D or E
GE	G.E.: Category C, D, or E (3)	3		C or D or E
	Units	16		
<b>Spring</b>	<b>Year 4</b>			
COMP 470	Mobile Robotics	3	COMP 362 and MATH 240	
EMEC 463	Feedback Control Systems	3	MATH 240 and MATH 350	
EMEC 499	Capstone Project	3	Senior Standing	
GE	G.E.: Category C, D, or E (3)	3		C or D or E
GE	G.E.: Category C, D, or E (3)	3		C or D or E
	Units	15		

# EMEC Students: Intro to C Programming



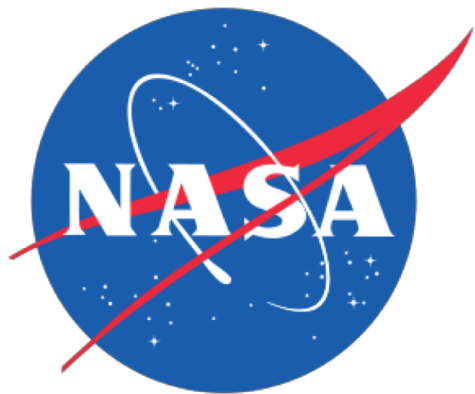


# Swarm Robotics at NASA

## NASA Wants To Use Swarms of Mars Rovers for In Situ Resource Utilization

### Goals:

- Explore For Resources
- Collect The Resources
- Deliver Them To Base
- Convert Resources To Fuel
- Return To Earth



## How NASA Will Use Robots to Create Rocket Fuel From Martian Soil

Engineers are building a prototype of a robotic factory that will create water, oxygen, and fuel on the surface of Mars

By Kurt W. Leucht



Illustration: Marek Denko/NoEmotion

**The Martians:** This artist's rendering shows excavating robots that may one day operate on Mars, long before humans ever set foot on the planet.



# NASA Swarmathon Competition

Crowd Sourcing For Good Ideas

Held each year at NASA Kennedy Space Center

- NASA Swampworks Group (Kurt Leucht)
- UNM Melanie Moses Lab

Sponsored By MUREP (Minority University Research and Education Program)

2016: 12 Physical Teams and 12 Virtual Teams

2017: 19 Physical Teams and 15 Virtual Teams

2018: 22 Physical Teams and 6 Virtual Teams



# Awards



**2017**

3<sup>rd</sup> Place Physical Competition  
1<sup>st</sup> Place Technical Report



**2018**

1<sup>st</sup> Place Technical Report



# SURF 2018

## Summer Undergraduate Research Fellows

- Alberto Venegas
- Adan Sanchez
- Mark Getzinger
- Ethan Warner

10 Week Summer Research Fellowship

Developed Algorithms in C++

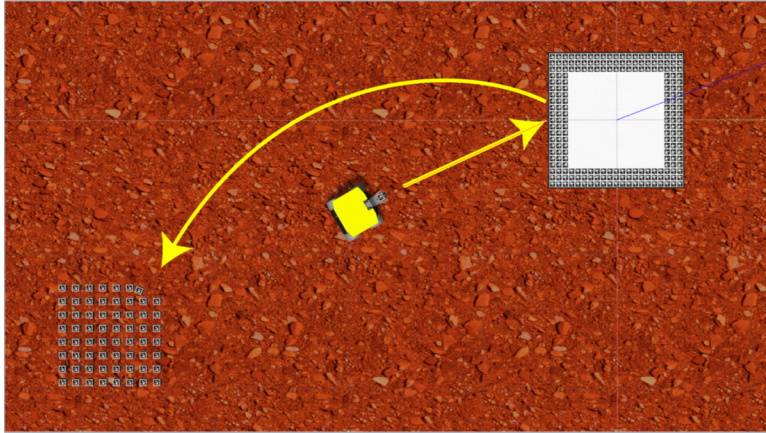
High Fidelity Simulator (ROS)

Evaluated Three Swarm Behaviors

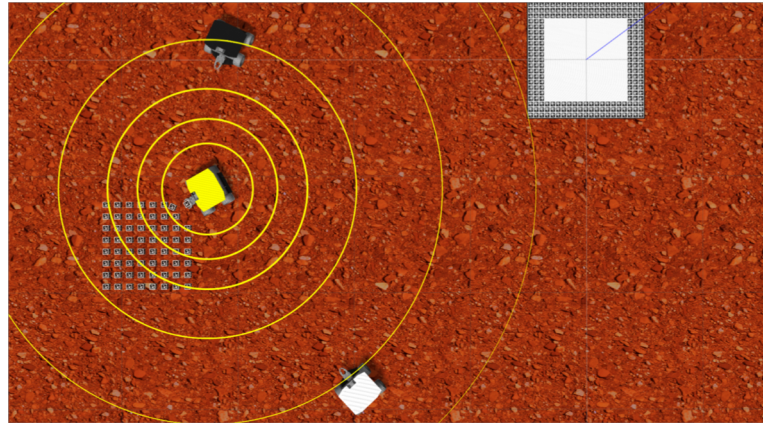




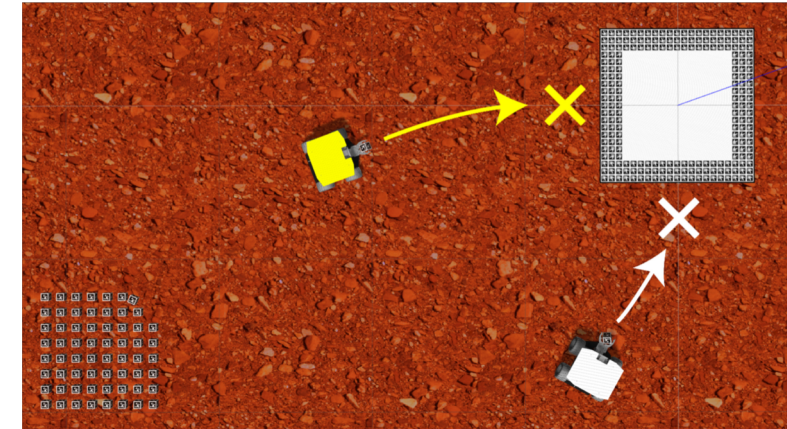
# Experiments Comparing Three Behaviors



Site Fidelity

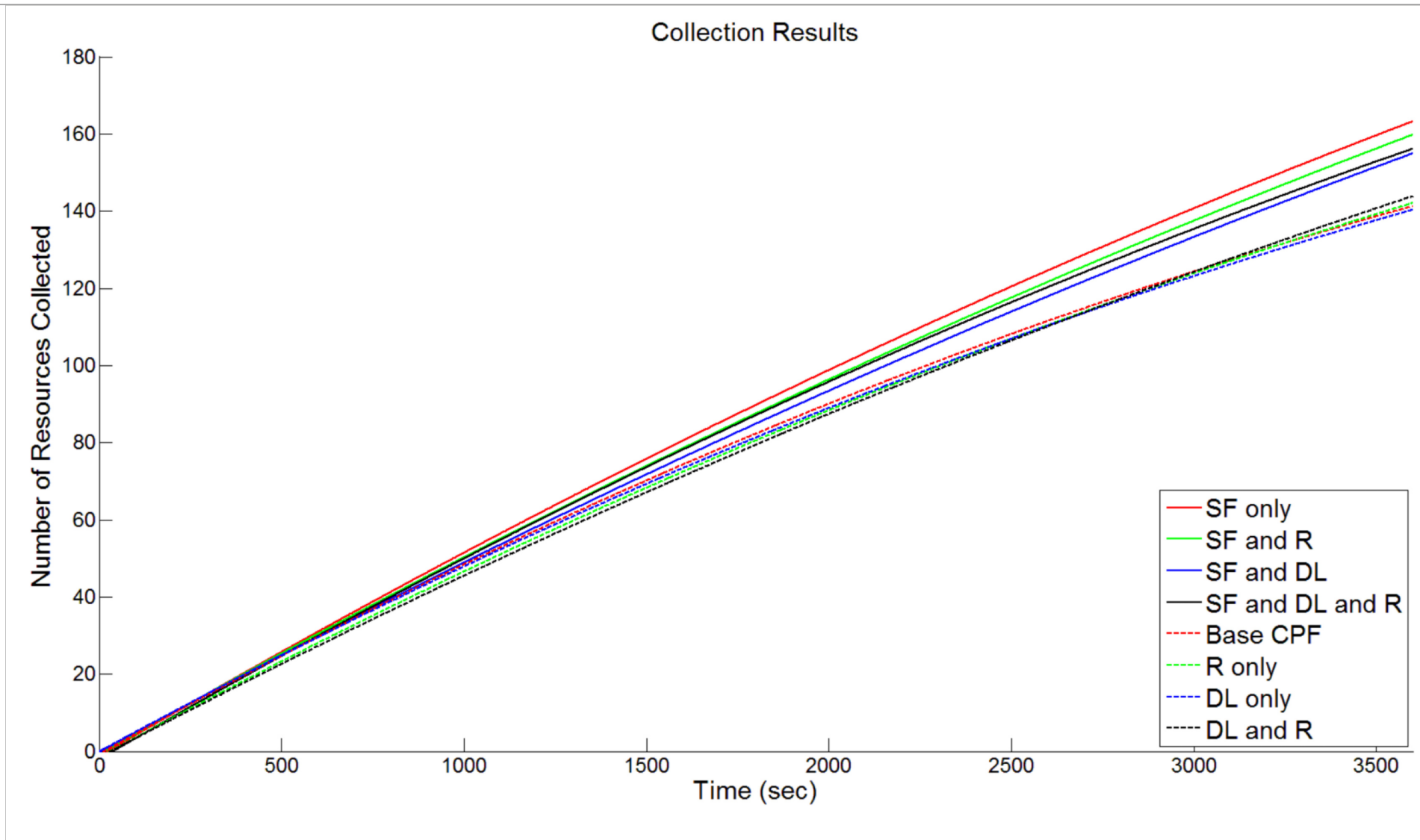


Recruitment



Spatial Negotiation

# Results





# Ways To Get Involved with Students

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Capstone Projects (EMEC 2021)

Guest Lecture in Class

Give a Seminar (Tuesday Evenings at 6 pm)

Mentor for Student Competition Teams

Internships

Scholarships