

MECH/ENGR 371 & 372  
Space Systems Design and  
Engineering I & II

Course Introduction  
Introduction to Space Systems

Dr. Christopher Kitts  
Associate Professor, Santa Clara University

# Overview

---

- Introduction to SCU satellite programs
- Course introduction
- Introduction to space systems

# SCU Robotic Systems Laboratory

**Activities:** Student-based development of robotic systems, devices, technologies  
 Collaboration with scientists to integrate instruments & technologies  
 Execution of field missions to conduct science & validate systems

**Expertise:** Robotic system design, controls, tele-operation, automation

**Student-centered:** students design & operate systems, manage projects, and  
 develop new instruments / technologies / system capabilities

## Current Field Robotics

-----*Land – Sea – Air – Space*-----



----- *Sponsors & Partners*-----

*Gov: NSF, NASA, USAF, NOAA, USGS...*  
*Ind: Lockheed, CSA, Mitsubishi, BMW...*  
*Univ: Stanford, Wash U, UT Austin...*  
*Non-Profit: CSGC, MBARI, IEEE, MTS...*

--*Field Operation for Real-World Missions*--

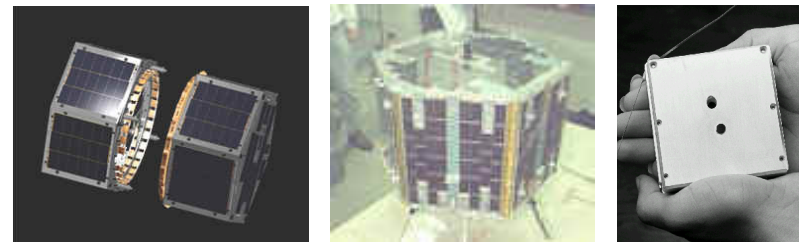
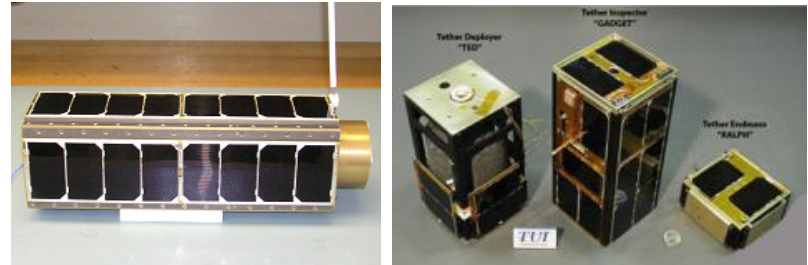
----- *Real Mission Data Products*----- - *Applications*-



*Geology*  
*Biology*  
*Land Mngmnt*  
*Remote Sensing*  
*Archeology*

# SCU Robotics - Space

- Projects
  - NASA Mission Operations
  - Nanosatellite Development
  - Technology Development
- Education
  - Masters depth areas
  - Graduate Courses: 371, 372, 379..  
s
  - U/grad capstone projects
- Research
  - Autonomous command and control
  - Model-based anomaly management
  - Subsystem technologies such as on-board computing, etc.



# Mech 371 / 372 Space Systems

---

- Introduce conceptual foundations, engineering principles, technical subsystems, and design processes relevant to the development and operation of space systems.
- Two 4-unit courses (splitting the topics)
- Background of instructor (Dr. Kitts)
  - My aerospace background: USAF, NASA, university programs
  - The course: USAF (9 month), Stanford (grad courses), Sweden (8 wk)
- Other graduate courses and initiatives
  - Satellite operations, orbit mechanics, attitude dynamics, structures, etc.
  - Lockheed collaboration: degrees, adjuncts, portable cores/degrees
  - Space system research at Masters, Engineers and PhD levels
  - Flight experiments and on-orbit operations for real flight missions

# MECH 371/372: Primary Topics

---

- **General**

- Missions and Architectures
- Payloads
- Space Environment
- Orbit Mechanics

- **Functional Subsystems**

- Basic Electronics
- Basic Mechanics
- Communications
- Command and Data Handling,
- Flight Processing & Software
- Power Systems
- Attitude Dynamics and Control
- Propulsion
- Structures, Materials and Mechanisms
- Thermal Systems

- **Lifecycle Processes**

- Systems engineering
- Design methods
- Testing and verification
- Operations

## A Very Broad Range of Topics

### Consistent Treatment of Subsystems

General Functions & Challenges

Fundamental Principles

1 or 2 Governing Equations

1 or 2 Key Design Analyses or Processes

Typical Components & Performance Data

### Consistent Treatment of Processes

Project management & Systems Engineering View

Use of Methodology and Process Control

Typical Activities and Practices

### Non-optimal ordering of topics due to:

Balance of disciplines per quarter

Balance of subsystems vs process per quarter

Availability of lecturers

Timing of assignments

Etc.

# Course Introduction

---

- Web site
- Syllabus
- Schedule
- Course Format
- Textbook and references
- Office Hours / Consultations
- Class Logistics
- Class Location
- Other issues...