Minority University Research and Education Project Aerospace Academy at the University of Central Florida

Justin Urso

Principal Investigator: Dr. Subith S. Vasu

Department of Mechanical and Aerospace Engineering
University of Central Florida

MUREP Aerospace Academy Year 2 Overview

- Meet your team
- MUREP Goals
- Activities
  - NASA Challenge
  - Field trips

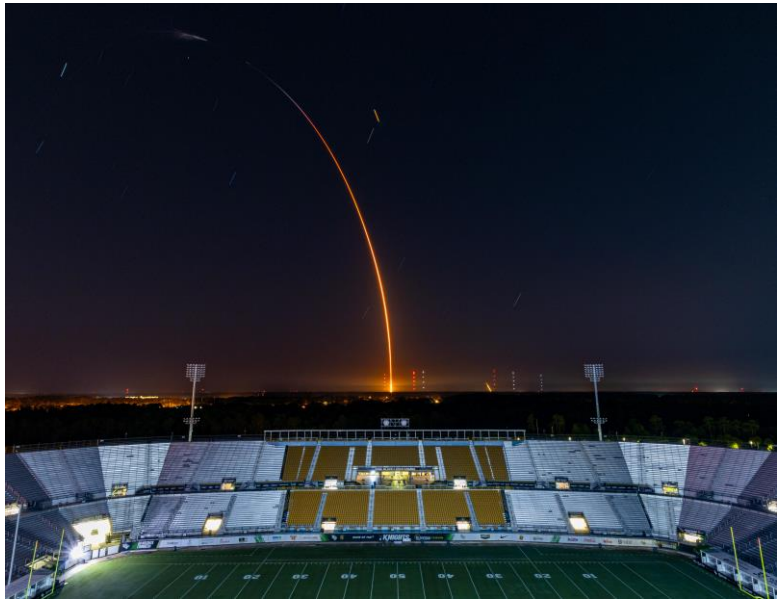


Photo credit: /u/zach8870

Photo credit: @UCF_Football

Who Are We?

- Vasu Labs Research Group
  - Combustion
    - Chemical kinetics and mechanism development
    - Combustor design for engines and turbines
  - Propulsion
    - Measuring engine efficiency and performance from exhaust and exhaust plumes
  - Laser Diagnostics and Absorption Sensors
  - Fundamental Aerodynamic Phenomena
    - Hypersonics
  - Alternative Fuels

Who Are We? NEXTGEN-EDC

- Novel Experience Geared To NASA Engineering Design Challenges
  - NASA MUREP Aerospace Academy (NASA MAA)
    - Year 2 of 3 (hopefully more!)
    - Year 1 SLOPE Capstone

NASA Goals for STEM Engagement Using MAA

- Attract diverse groups to STEM via targeted opportunities
  - Utilizing NASA STEM engagement resources and content
- Foster exposure to STEM careers
  - Direct and virtual experience with NASA personnel and work
- Emphasize diversity and inclusion
  - Target beneficiary strategies
  - Drive scalability and accessibility
    - Capitalize on NASA's STEM workers as role models
- https://www.nasa.gov/stem/murep/home/index.html

Enhance **research, academic, and technological capabilities** at MSIs by providing **authentic student learning experiences** related to NASA missions that contribute to a **Diverse Future STEM Workforce**

MAA Overview

Inputs What we invest	MAA Objectives What MUREP aims to do	Activities What we do	Outcomes What we create
University Faculty **Affiliated Staff** **STEM Education** **Professional Mentors** **Student Mentors** **Financial Opportunity** **Structured Activities** **Technology** **Partners** **College and Career Guidance** **Career Training**	**Increase** Underrepresented and underserved students for NASA-specific STEM degrees and careers **Build** Students' STEM identity, skills, and knowledge **Broaden** STEM career prospects **Provide** Near-peer mentors to transition to college **Develop** Student ability to be successful in STEM endeavors **Guide** Families to develop a STEM-supportive environment	**EDC Lab Events** Learn engineering principles from mentors Collaborate with peers on a capstone project addressing a NASA engineering challenge **College Tours** Campus tours to see facilities and amenities **College and Career Workshops** College application, studying techniques, time management skills, scholarship applications **Professional Development** Experience for educators to develop STEM teaching techniques **Field Trips** Immersive STEM learning opportunities at partnering institutions **Instill a Positive Outlook** Enable students to approach unfamiliar situations and apply innate problem analysis and solution development skills to ensure success	**Students and Families** College ready Life skills STEM literacy Family engagement Workforce capacity Scientific curiosity Professional speakers Support networks **National Impact** NASA-ready workforce Increased STEM diversity STEM education model Research publications ---------- **Outcome Assessment** Student tracking Surveys Peer-review Professional feedback

What We Invest

- Faculty and Staff
  - Prof. Subith Vasu, Program Director
  - Dr. Justin Urso, Program Manager
  - Dr. Gihun Kim, Asst Program Manager
  - Mentor Leads
    - Marley Albright – Administrative Lead
    - Sam Klopp – Technical Lead
    - Amanda Maia – Site Leader, Orlando Science High School
    - Kate Rickman – Site Leader, UCF
    - Guillermo Barrios – Site Leader, Marion County Public Schools
- Professional Mentors
- Financial Opportunities
  - Scholarships, scholarship workshops, financial aid workshops
- Structured Activities
- Student Mentors
- College and Career Guidance

What We Invest: Partners and Career Training

- Dr. Travis Gabriel, USGS
- Dr. Jaydeep Mukherjee, Administrator FSGC
- Dr. Melissa Dagley, Executive Director, UCF iSTEM
- TSgt Kalixta J Nichols, USSF Program Manager/Recruiter
- MSgt Chase B Griffin, USAF Enlisted Accessions Recruiter
- Philip Hargrove, KSC Exploration Station Manager

USGS science for a changing world

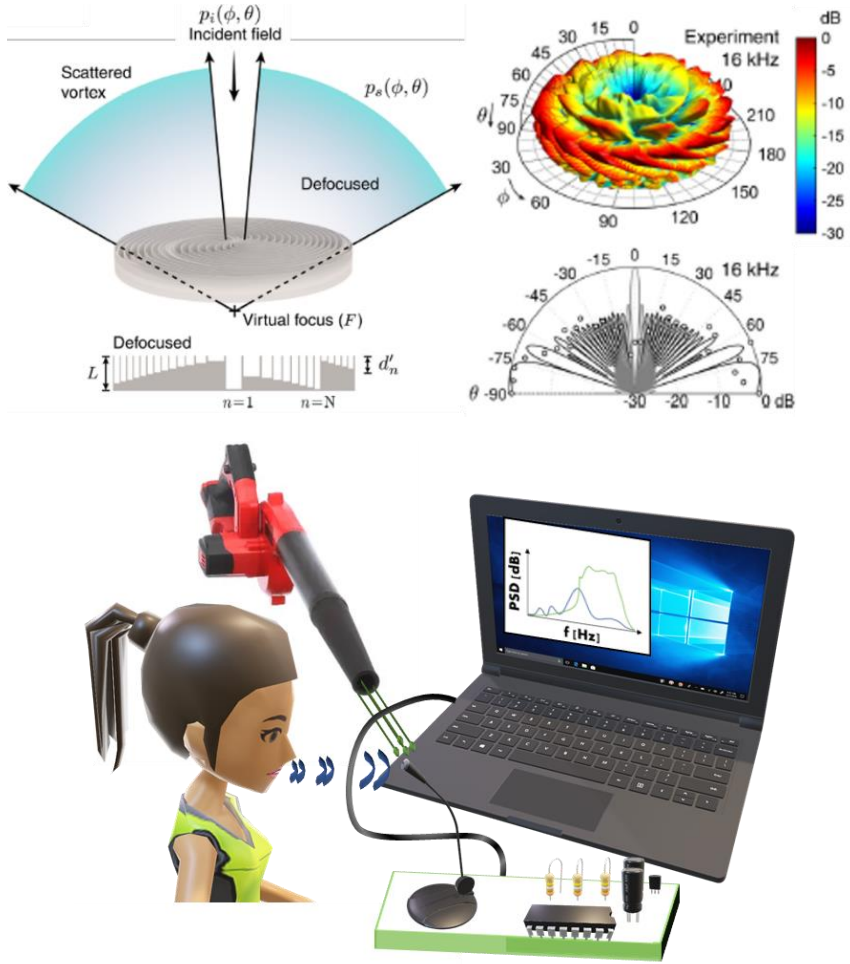
U.S. AIR FORCE

What MUREP Aims to Do: MAA Objectives

- Four key components:
  - STEM Experiential Learning Opportunities
    - NASA capstone activity and student research presentations
  - Engagement Opportunities with STEM Professionals and Settings
    - Partnerships and collaborations with US STEM industries, agencies, or organizations
    - Encouraged to form partnerships and collaborations with community groups
      - Businesses
      - STEM professional organizations
      - Museums
      - Youth-serving organizations
  - College & Career Readiness Opportunities
    - College readiness skills, exploration, internship and career information settings
    - Near-peer mentors
  - Family Involvement
    - Family engagement in STEM
    - College exploration sessions/workshops with and for family members

What We Do, Year 2: Aeronautics Acoustic Damping

- Learn about:
  - Electrical-mechanical-acoustic analogs
  - Wave propagation
  - Signal processing
  - Jet engine sound adverse effects
  - Radio communication
- Learn to:
  - Design models in computer software
  - Develop experiments
  - Collect results using advanced instrumentation
  - Collaborate with peers on differing design philosophies



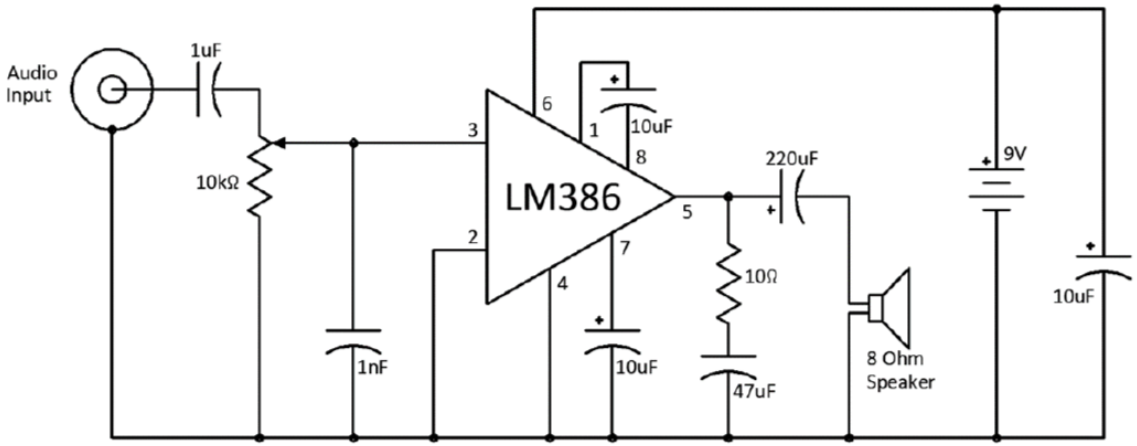
NASA Capstone

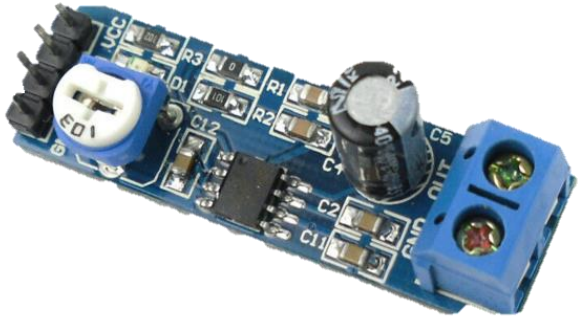
- STEM Prior Knowledge
  - How does sound travel?
  - How does sound move through different media?
  - What are the frequency and amplitude of sound waves?
  - How are the loudness and pitch of sounds measured?
  - What is ambient noise?
  - What is noise pollution?
  - How does noise pollution affect people? Animals?
  - How quiet is quiet? How loud is loud? How can you determine this?

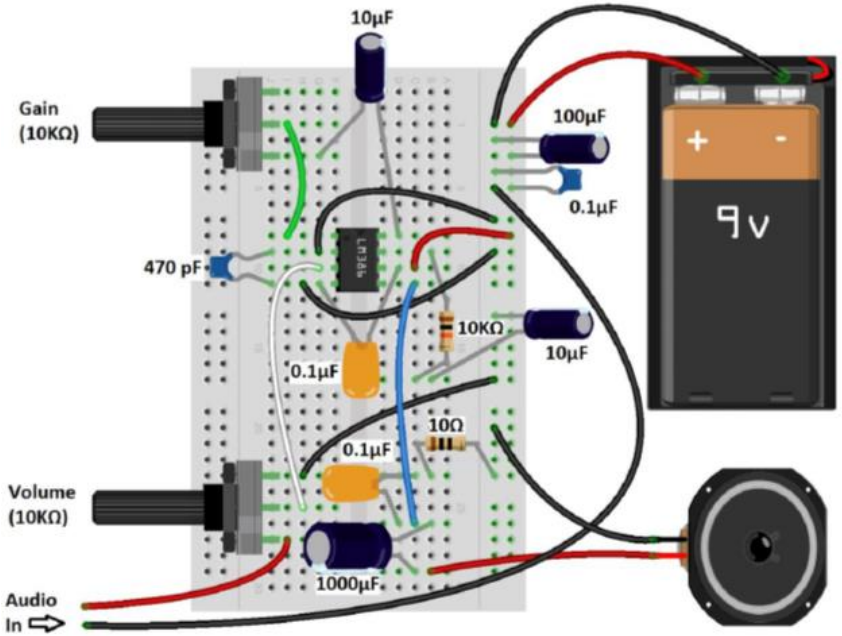
NASA Capstone

- Learn how to read circuitry diagrams
- Design and 3D print acoustic chambers to mitigate sound
- Learn how to measure and analyze signals using oscilloscopes and more
- Present your designs and results to your families, peers, and NASA Subject Matter Experts (SMEs)

Acoustic Damping Project Amplifier Circuit





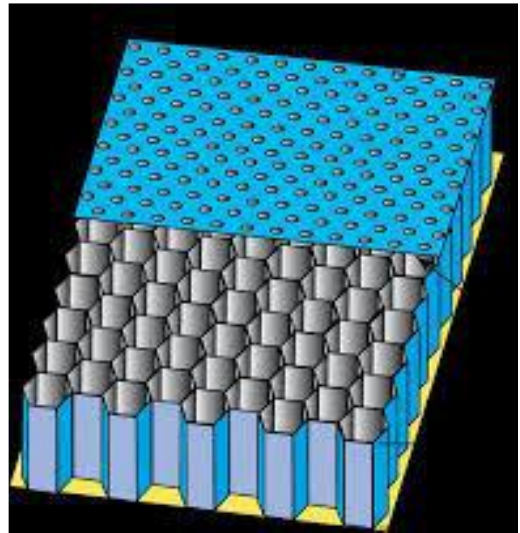


NASA Capstone

Low-Cost Impedance Tube
Fixed end configuration

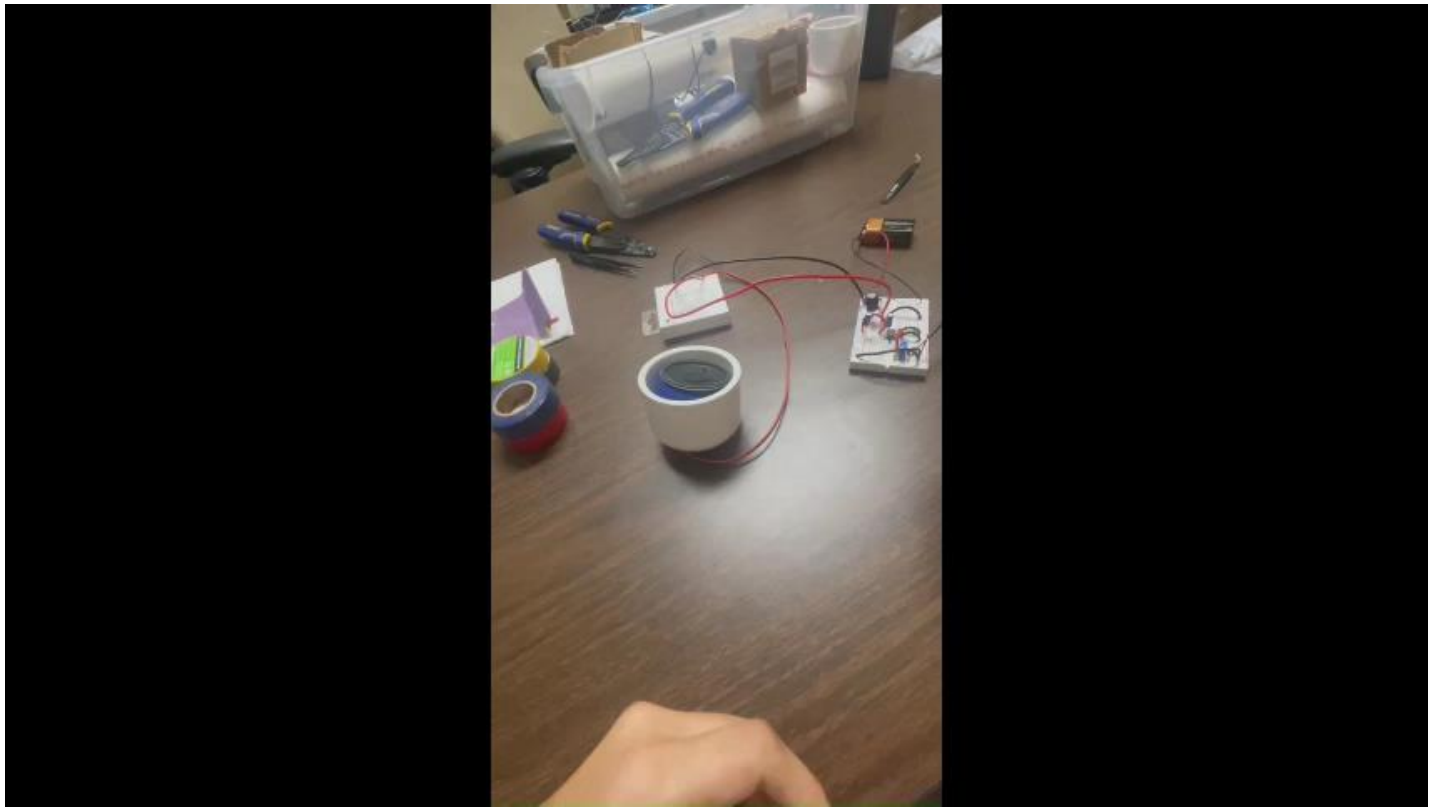
The impedance tube test rig will require the following components:

- PVC Impendence Tub (Minimum 2-inch diameter with brass termination end)
- Audio speaker
- Audio Amplifier
- Function Wave Generator
- High Precision Microphone
- Oscilloscope
- Data Acquisition Card



Capstone in Action

- Featuring Mentor Lead Kate Rickman



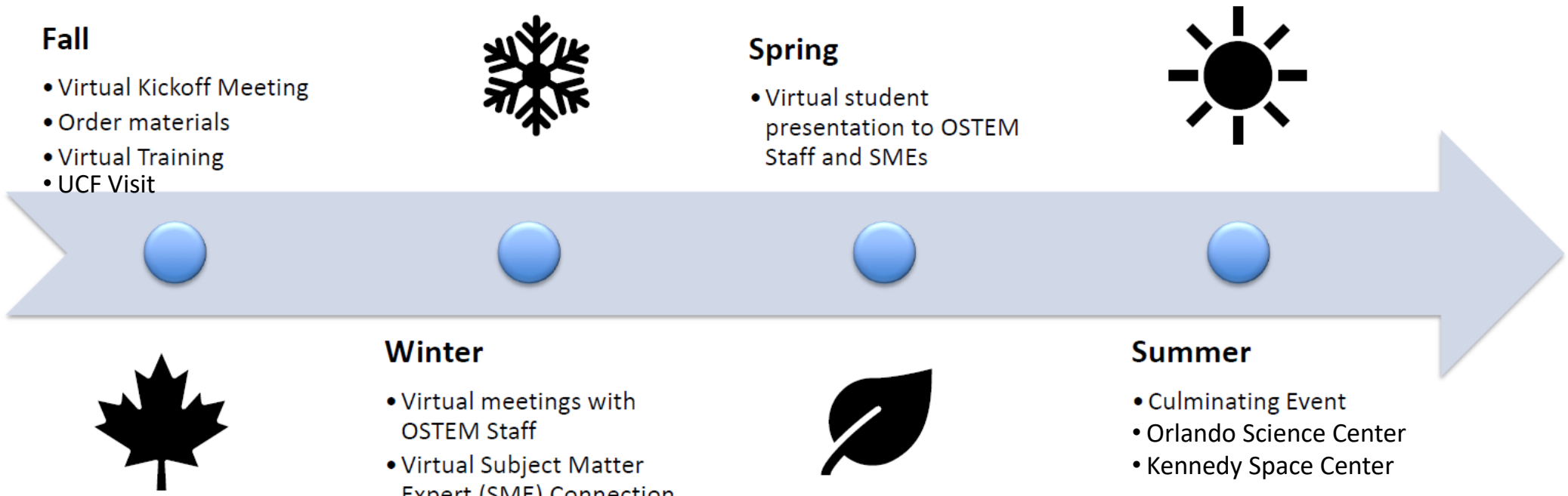
NASA Presentations

Regardless of format, student Capstone presentations should provide the following:

- ❑ Background information
- ❑ Objective
- ❑ Approach
- ❑ Test sample design
- ❑ Test sample report
- ❑ CAD model
- ❑ Data Analysis
- ❑ References
- ❑ Contact information

NASA Proposed Timeline for Project and Our Trips

- Designs reviewed by NASA SMEs
- Culminating Event at the Orlando Science Center



Course Execution Changes

- Parking covered
  - Students/parents will be provided a digital code to enter at parking kiosks in certain UCF garages
- Canvas course
  - UCF Continuing Education Canvas will be a repository for:
    - Resource materials
    - Instructional videos and pages
    - Students to collaborate with team in a moderated environment

Session Dates

- Wednesdays 6-8 PM
- Kickoff at UCF
  - Thursday, Sep 28th, 9 – 5 PM
    - Tour of campus, multiple labs, facilities, guest speakers
    - Parking passes will work for this event
    - Families welcome to attend
- Virtual presentations to NASA SMEs
  - Dates TBD based on SME availability
    - Families welcome to attend virtually
- Presentations at Orlando Science Center
  - Tentatively April 11th/12th
    - Students present their work, then tour Science Center
    - Transportation arranged
    - Families welcome to attend
      - Will need head count for event, more information coming later in program
- Kennedy Space Center Exploration Station
  - Tentative end of April
    - Students attend NASA trainings, then free to explore KSC
    - Transportation provided for students

27-Sep
4-Oct
11-Oct
18-Oct
25-Oct
1-Nov
8-Nov
15-Nov
29-Nov
6-Dec
13-Dec
10-Jan
17-Jan
24-Jan
31-Jan
7-Feb
14-Feb
21-Feb
28-Feb
6-Mar
13-Mar
27-Mar
3-Apr
10-Apr
17-Apr
24-Apr

Next Steps

- Registration forms are on site
  - https://mae.ucf.edu/VasuLab/nextgen-edc/
- Email completed forms to justin.urso@ucf.edu by 5PM September 12th
  - Include student's email to be added to the Canvas course
    - Separate login/site from UCF WebCourses
- Receive email confirmation of received forms

Questions?