

# Drone Educational Ecosystem at UC Merced (#UAS4STEM)

YangQuan Chen, Ph.D., Director,

**MESA**(Mechatronics, Embedded Systems and Automation)**LAB**

**ME/EECS/SNRI/HSRI/CITRIS, School of Engineering,**

**University of California, Merced**

**E:** [yqchen@ieee.org](mailto:yqchen@ieee.org); *or*, [yangquan.chen@ucmerced.edu](mailto:yangquan.chen@ucmerced.edu)

**T:** (209)228-4672; **O:** SE2-273; **Lab:** CAS Eng 820 (**T:** 228-4398)

11:30-11:45 March 8, 2016. Wednesday  
California Room, UC Merced Main Campus

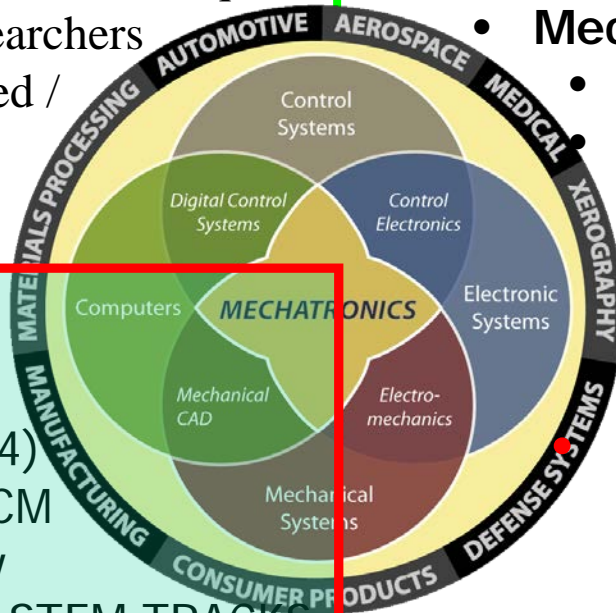
# Thanks go to

- UCM CITRIS and Dr. Joshua Viers
- MESA Lab graduate and undergraduate researchers
- Brandon Stark, Director, UC UAS Safety Center
- You for coming and supporting!

## Mechatronics, Embedded Systems and Automation Lab

### Real solutions for sustainability!

Established Aug. 2012 @ Castle, 5,000+ sq ft  
7 Ph.D./40+ undergraduate researchers  
10+ visiting scholars || sponsored / mentored many capstone teams



### Research Areas of Excellence:

(ISI H-index=41, Google H-index=67; i10-index=351)

- Unmanned Aerial Systems & UAV-based Personal Remote Sensing (PRS)
- **Cyber-Physical Systems (CPS)**
  - Mechatronics
  - Applied Fractional Calculus
  - Modeling and Control of Renewable Energy Systems

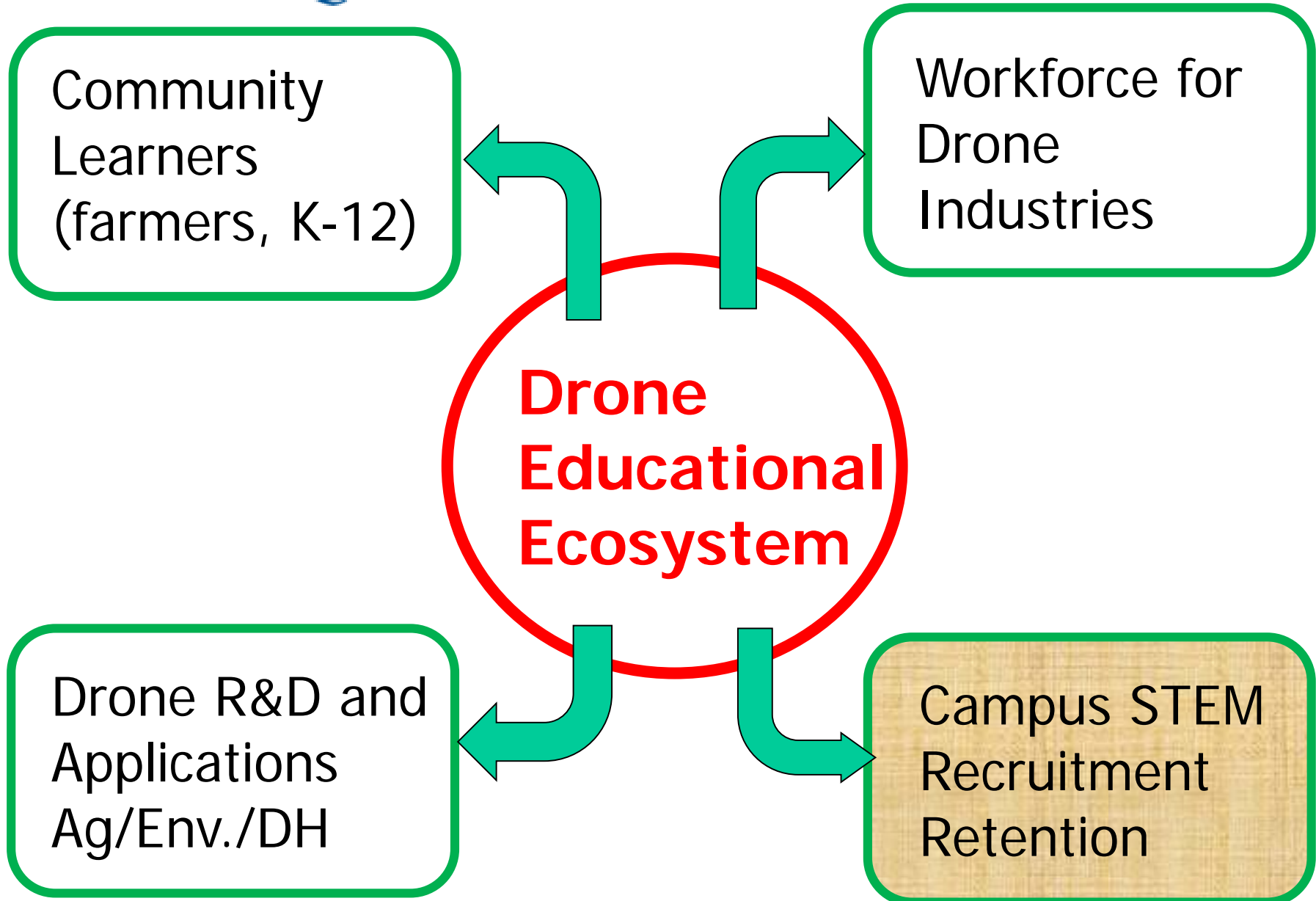
### Education and Outreach Activities:

- Eng Service Learning (Sp14)
- AIAA Student Branch @UCM
- Preview Days, Bobcat Day
- Robots-n-Ribs | MESABox! STEM-TRACKS
- TEAM-E
- UAS4STEM. USDA/NIFA HSI: 2016-2020
- **ME142 Mechatronics** (take-home labs)
- **ME280 Fractional Order Mechanics**
- **ME211 Nonlinear Control**
- **ME190 Unmanned Aerial Systems**

### Projects Related to San Joaquin Valley:

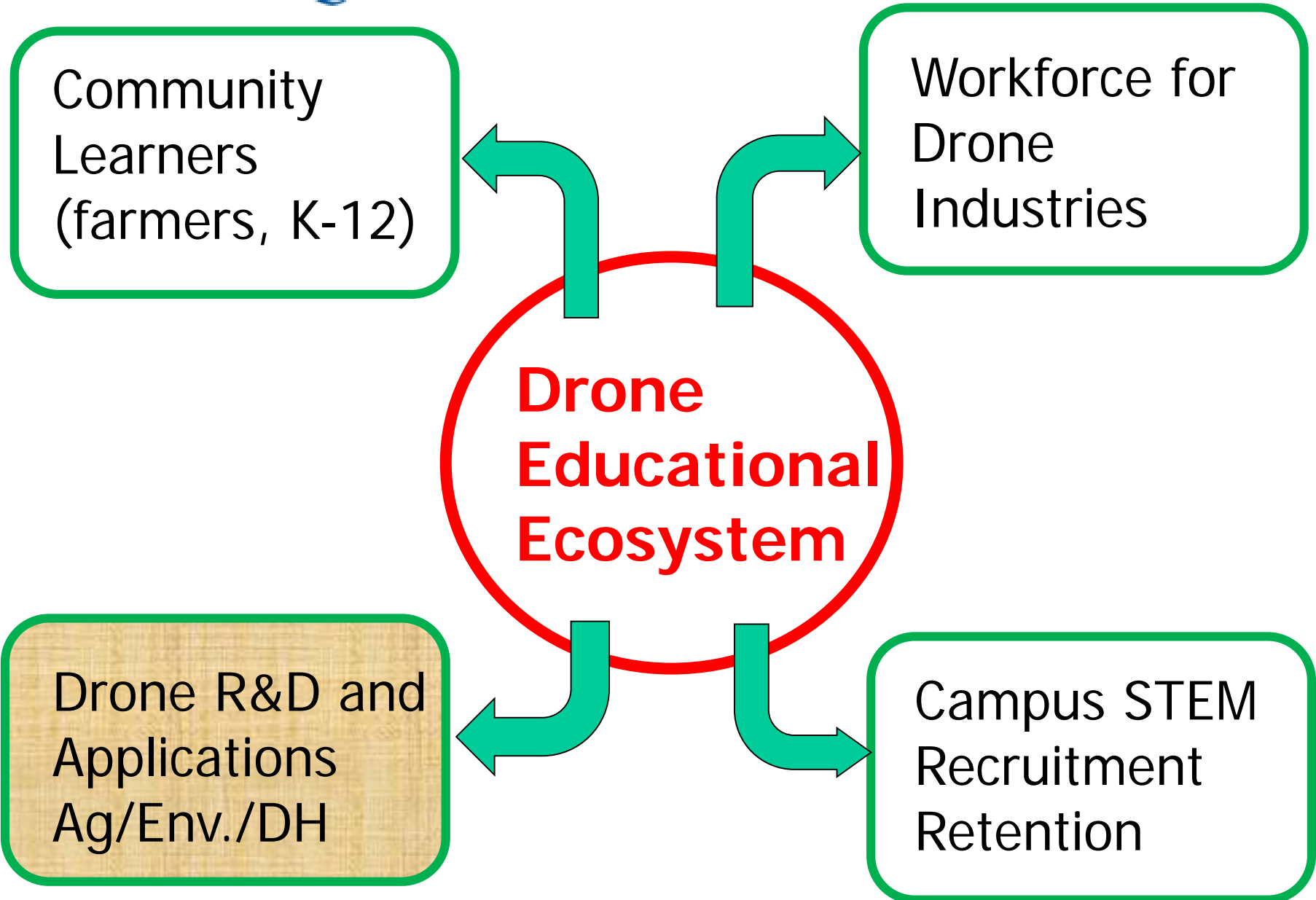
**Energy** [Solar/wind energy, Building efficiency (HVAC lighting), smart grids integration, NG pipelines]

- **Water** (Water/soil salinity management, water sampling UAVs)
- **Precision Ag/Environment** (Crop dynamics, optimal harvest, pest, methane sniffing/mapping ...)



- Preview Day (October)
- Bobcat Day (April)
- Engineering Week (Feb.)
- Research Week (March)





## UC Multi-campus Synergy on **CIDERS**

### California Institute of Data-drone Engineering and Services



UCM, UCSC,UCB, UCSD,  
LLNL

CIDERS in Scientific data-drones: platforms, operation, and certification



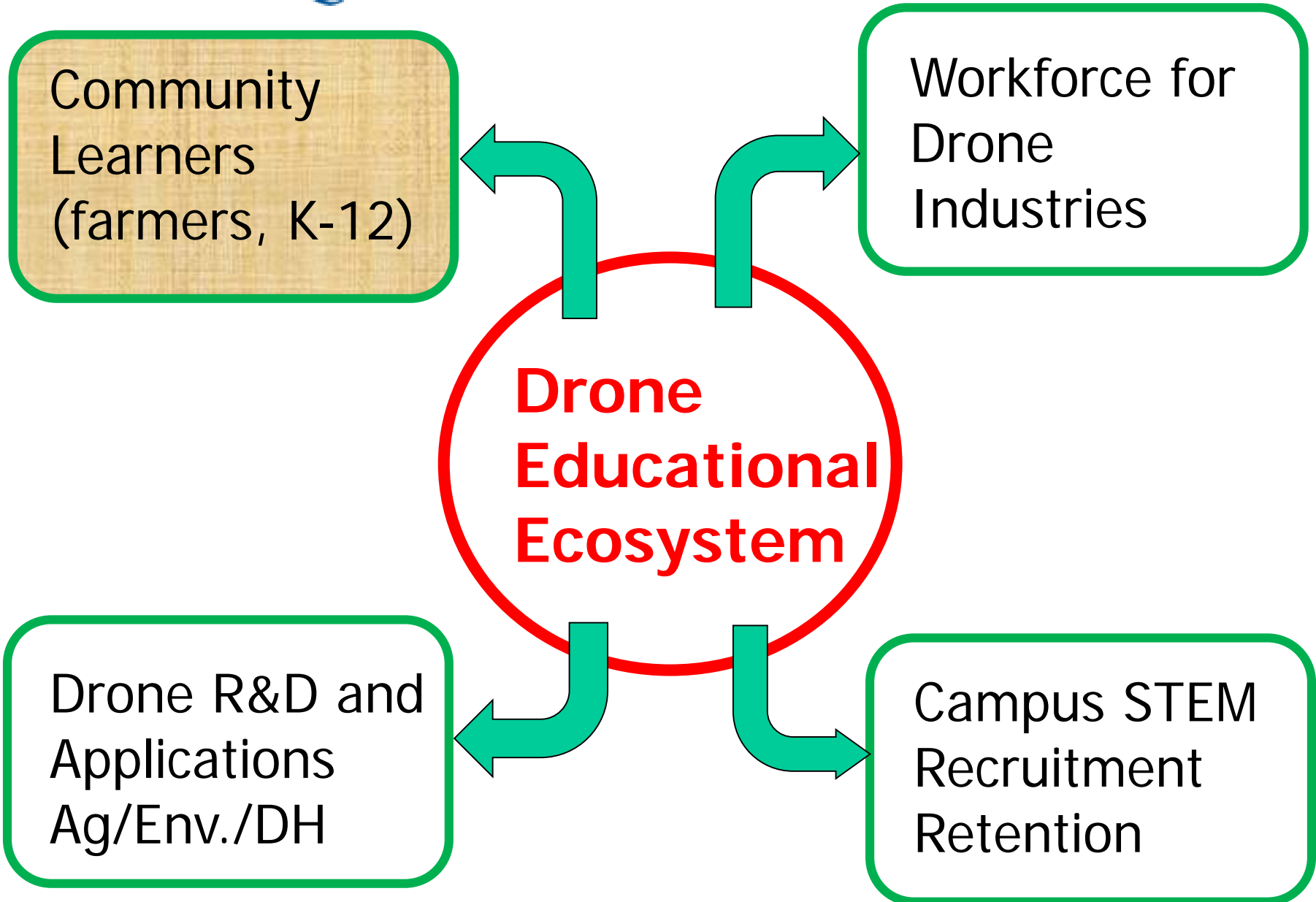
UCM  
UCD  
UCSD

CIDERS in precision agriculture

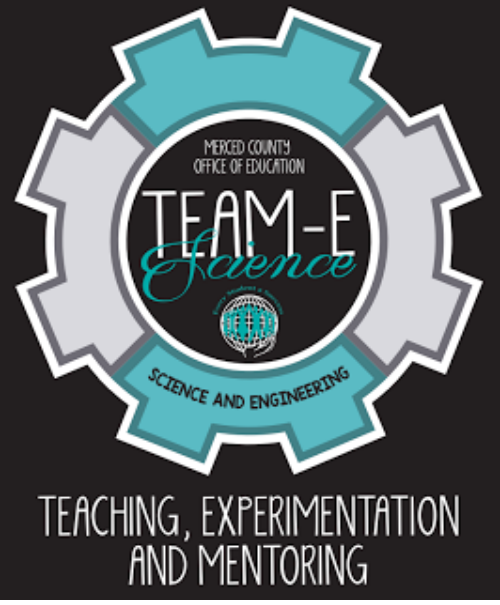
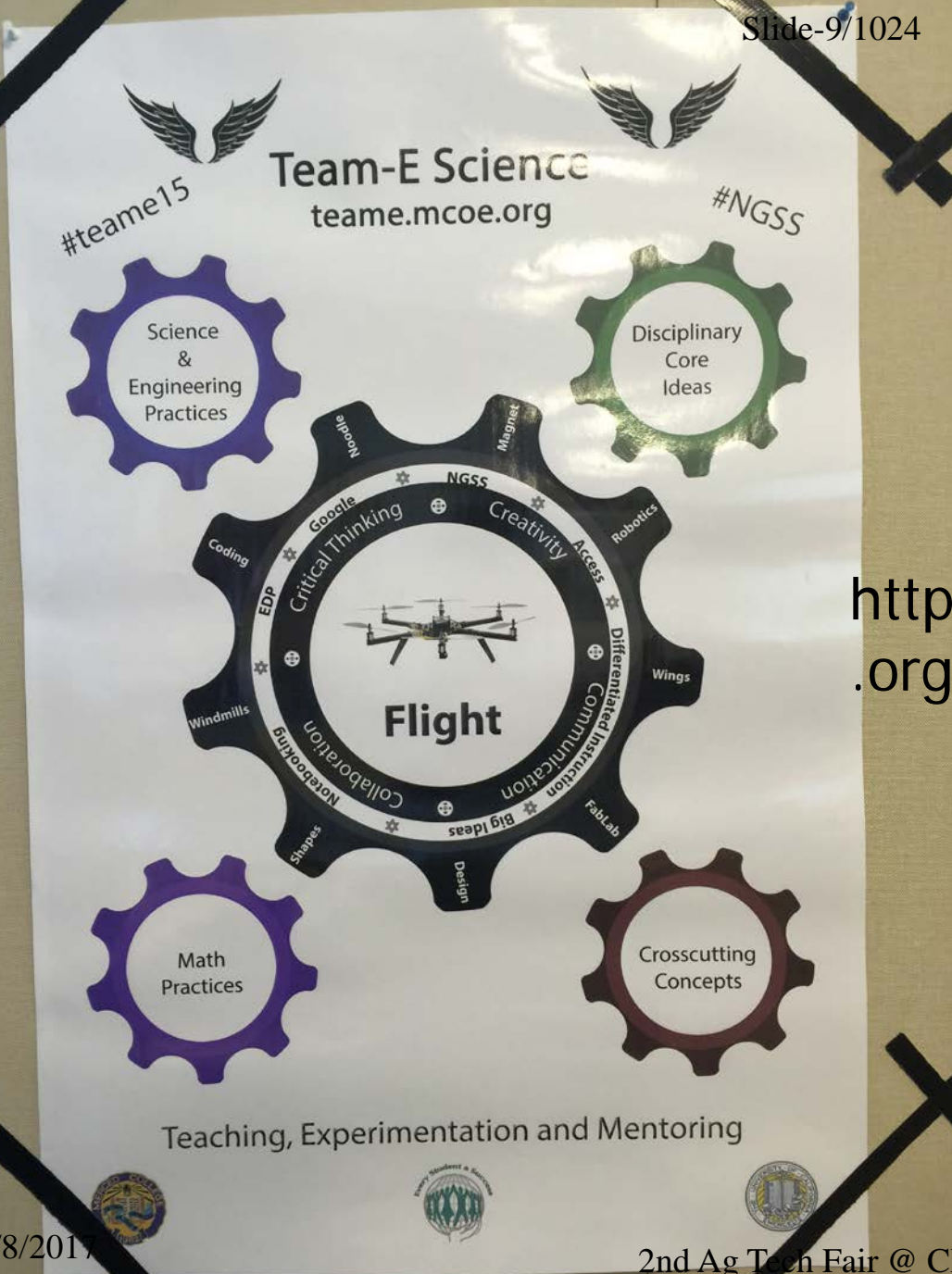


UCM  
UCD  
LBL  
SNL  
UCSD

CIDERS in environmental monitoring: water, **fire**, soil, dust, AQ ...







TEACHING, EXPERIMENTATION AND MENTORING

<https://sites.google.com/a/mcoe.org/teamescience/home>

California Math and Science Partnership Grant through the California Department of Education

NGSS

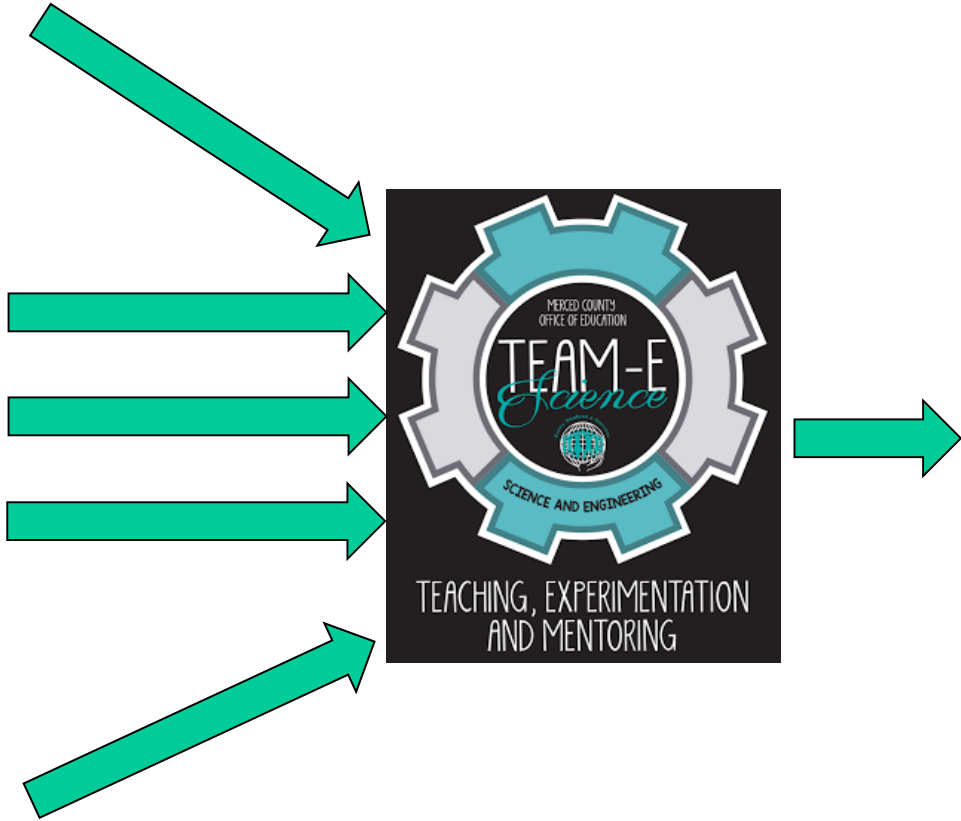
Engineering  
Design  
Process

Materials

Energy

Wing

Coding



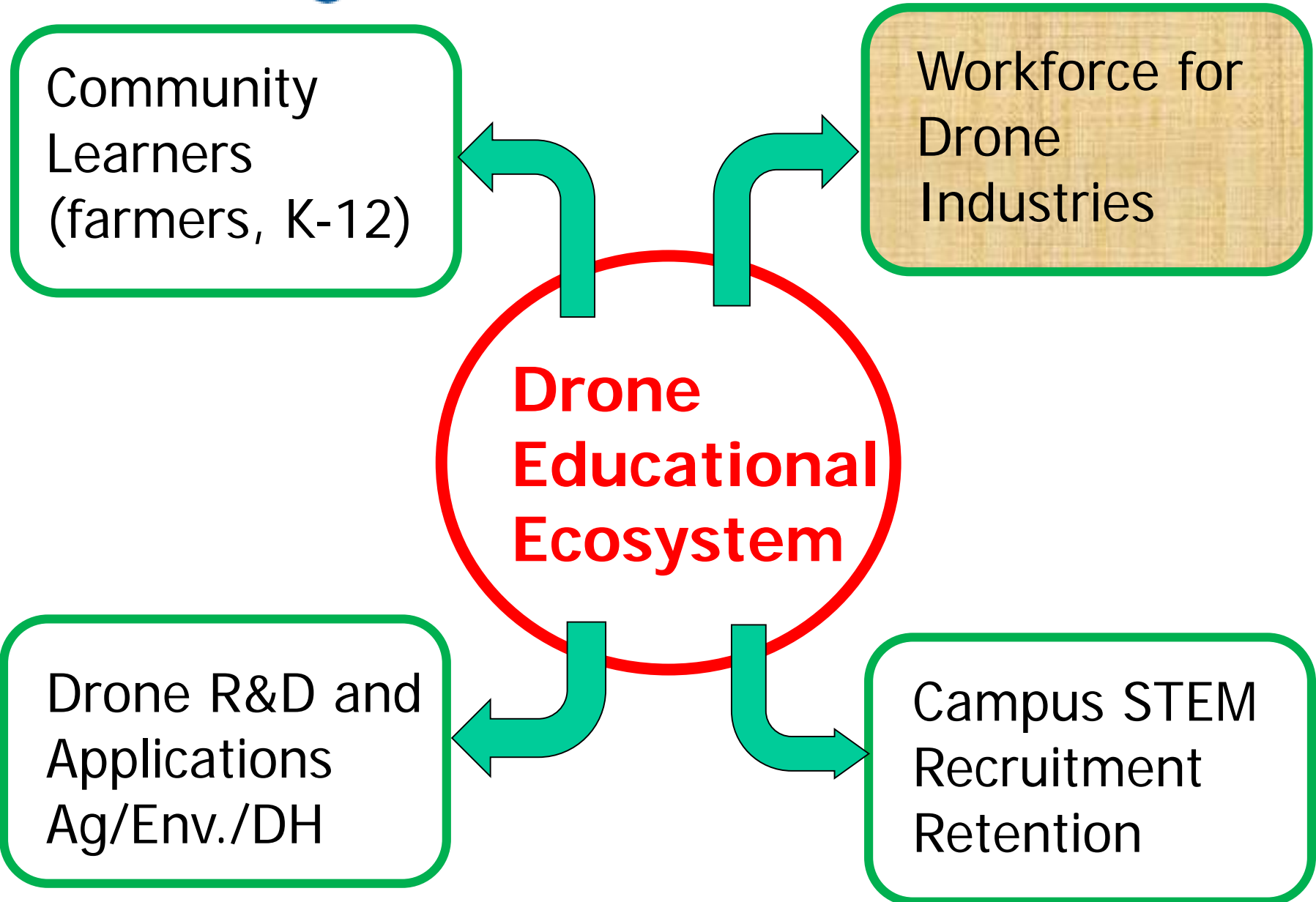
Data-drones

STEM-TRACKS, CaMSP Grant, Cohort 10, Tuolumne COE, 2014;  
CaMSP Cohort 12. TEAM-E (MCOE) Summer Institute @ UCM, 2015

# UCM Extension

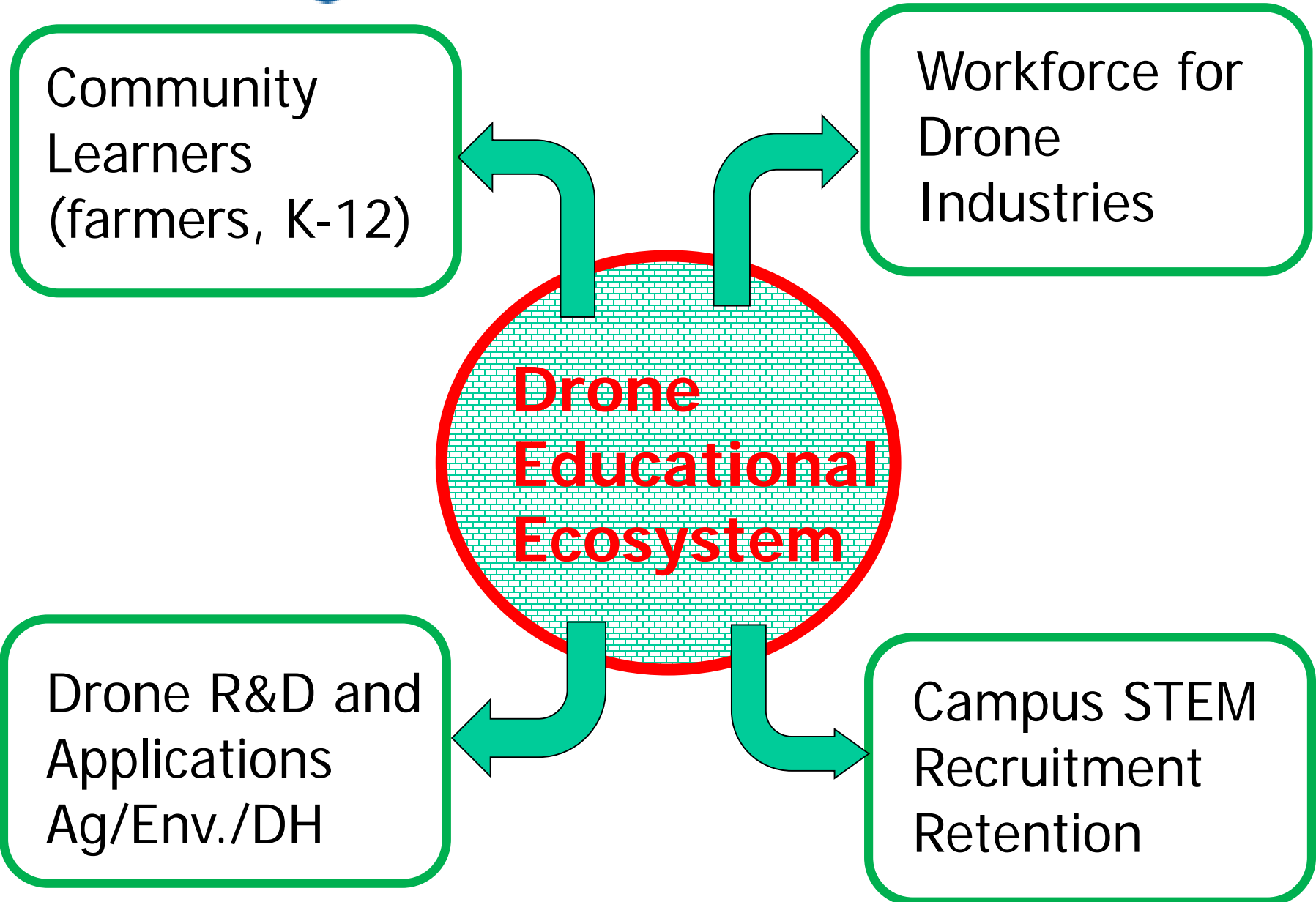
- Engaging the Central Valley community in scholarship and creativity while fostering a culture of inquiry and discovery learning
- <http://extension.ucmerced.edu/>





# Drone Workforce Production @ UCM

- Well interested by clubs (over 200)
- Well informed by drone courses (over 100)
- Research experienced (over 100)
- and, FAA Certified drone pilot licenses (15)
  - <http://mechatronics.ucmerced.edu/dronepilots>
- Hired by
  - Google Project Wing
  - AeroVironmental
  - An SV unmanned systems startup



Community Learners  
(farmers, K-12)

Workforce for  
Drone  
Industries

**Drone  
Educational  
Ecosystem**

Drone R&D and  
Applications  
Ag/Env./DH

Campus STEM  
Recruitment  
Retention

## Multi-tier UAS4STEM ecosystem at UC Merced

- Tier-0: (*K-12 outreach*) Sample effort: [TEAM-E Summer Institute](#)
- Tier-1: (*student clubs*) UAS related Student Clubs ([AIAA UCM DBF](#), [Drone Racing Club](#))
- Tier-2: (*service learning*) [Engineering Service Learning UAV Team](#) (since Spring 2014)
- Tier-3: (*extension*) [CITRIS Aviation](#) / [UCM Extension UAS training courses](#)



## Multi-tier UAS4STEM ecosystem at UC Merced

- Tier-4: (*for credit courses*)
  - Undergraduate Technical Elective course: ME190 "Unmanned Aerial Systems" (**4 credits**, lab intensive) ([Summer17](#))
  - Undergraduate Independent Research courses related to drones (ENGR195, ME195, CSE195) (**1-4 credits**)
  - Capstone projects for seniors related to beneficial use of drones (sample project: 2013 [Team GLASS](#))
- Tier-5: (*graduate research*) Graduate education: [UAS Research](#); our [UAS papers](#).

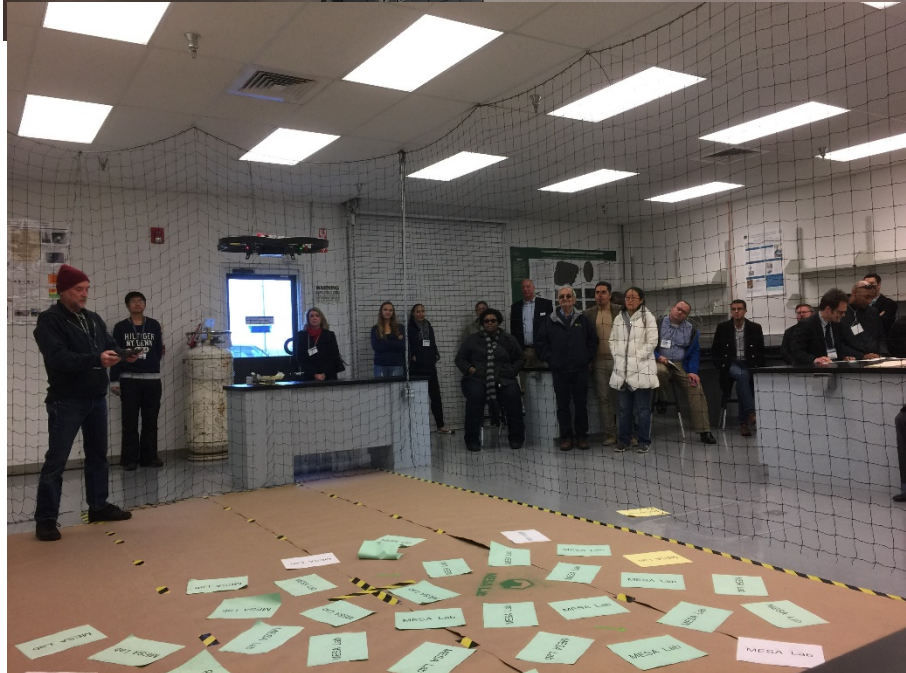
# “*Drones Deliver*” Program

- Innovation and Entrepreneurship Ecosystem
  - <http://AgTech.ucmerced.edu> (USDA Grant 2017-2021, PI: J. Q. Sun, Co-PIs: Y.Q. Chen and F. Tsoulouhas)
  - ME190 UAS Final Projects
    - 8 “drone startup companies”
  - ... (Peter Schuerman has more)

# MESA Lab Ph.D. Students' Recognitions Earned

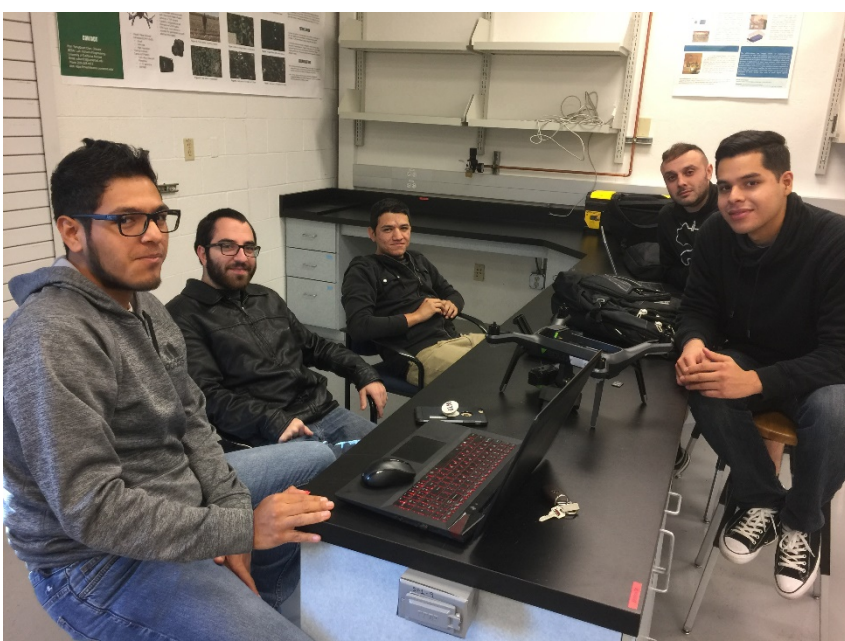
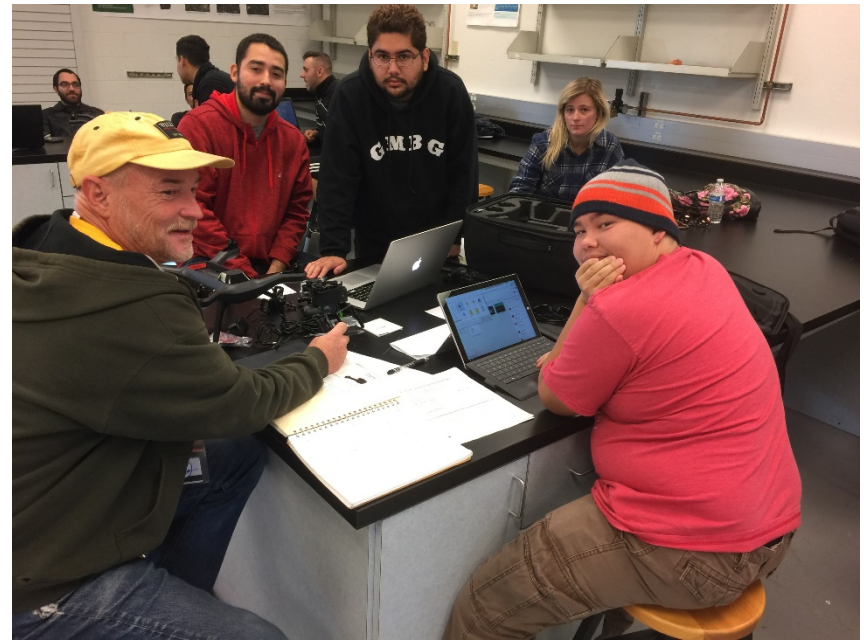
- **Brandon Stark (\*)**
  - Graduate Student of the Year (2016)
  - ICUAS 2016 Best Paper Award (only one award)
- **Tiebiao Zhao (\*)**
  - Yara Almond Fellowship (2016) (only two in USA)
- **Brendan Smith (\*)**
  - JPL Internship (2016-2017)
- **Derek Hollenbeck (\*)**
  - IEEE RAS Winter School Award (2017) Las Vegas CES17
  - NSF NRT IAS Fellowship (2017)
- **Guoxiang Zhang**
  - IEEE RAS Winter School Award (2017) Las Vegas CES17

**(\*): FAA  
Certified  
Drone Pilot**













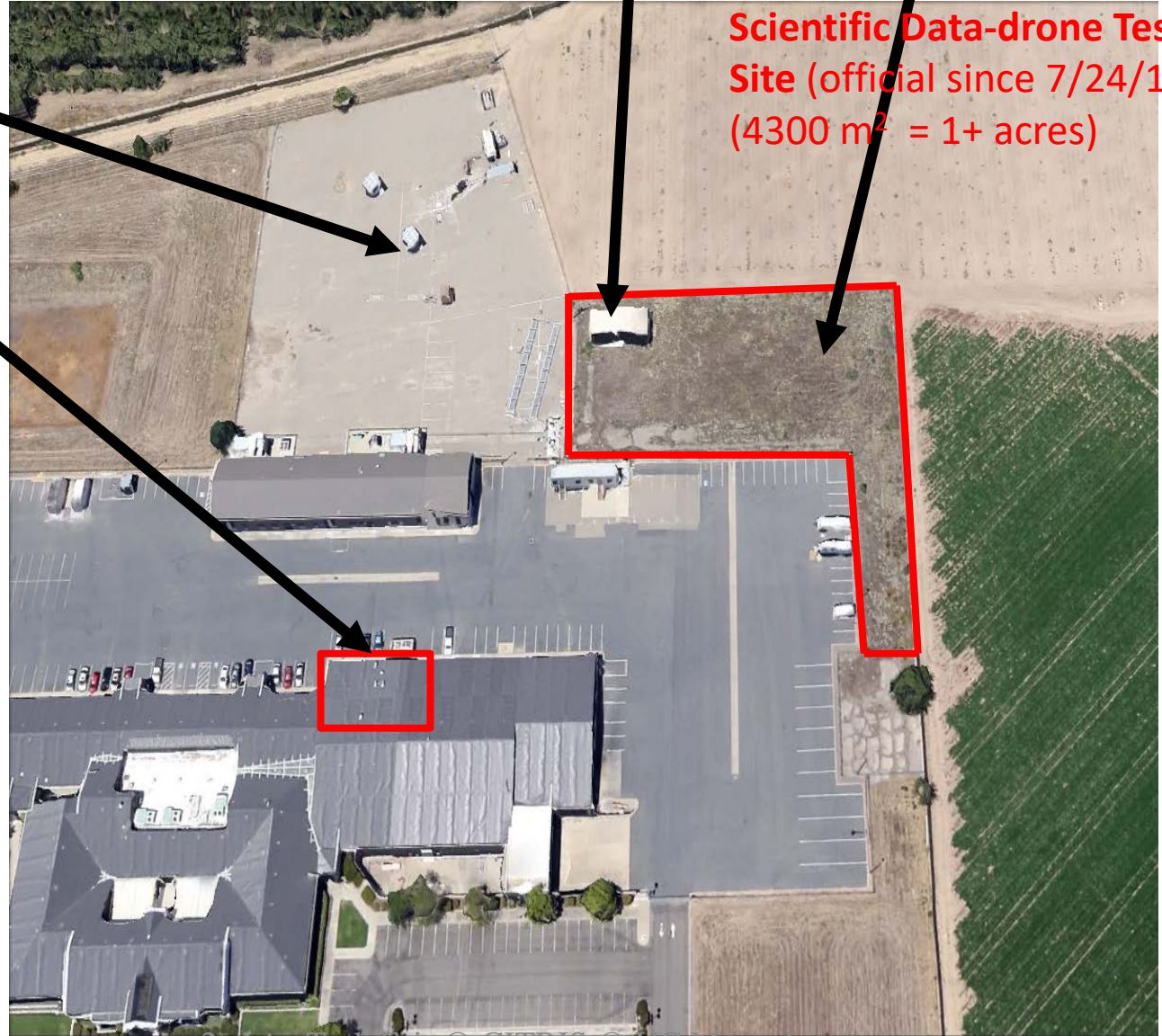
UC Merced  
Castle Research Facility

Scientific Data-drone  
Hangar (18m x 7m x 5m)

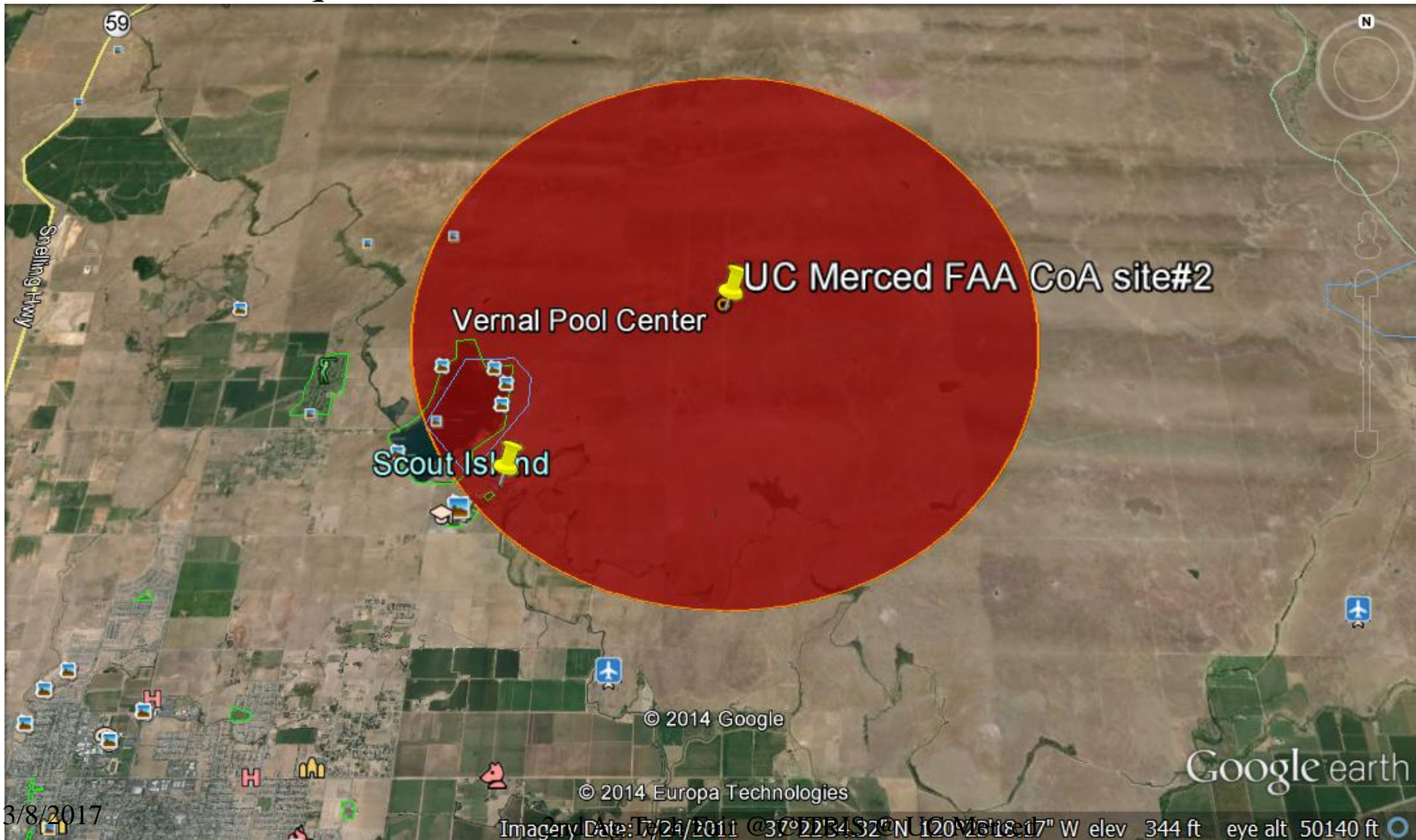
MESA Lab @ UC Merced  
Scientific Data-drone Test  
Site (official since 7/24/14)  
(4300 m<sup>2</sup> = 1+ acres)

UCSolar.org

MESA Lab



## 2<sup>nd</sup> FAA CoA Site – UC Merced (26 square miles in red, 2.5 nautical mile in radius)



# Thank you for your attention!

- Q/A
- Call for public support
  - UC Multi-campus Synergy on **CIDERS: California Institute of Data-drone Engineering and Services**
  - **WATERSTAR** initiative