

Unmanned Aircraft Systems in the University of California



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Center of Excellence on
Unmanned Aircraft
System Safety



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Center of Excellence on Unmanned Aircraft System Safety

Mission Statement

The Center of Excellence on Unmanned Aircraft System Safety provides system-wide expertise, support and training for regulatory compliance, risk management and the safe operation of Unmanned Aircraft Systems, commonly known as drones, across the University of California system.



UNMANNED AIRCRAFT SYSTEM SAFETY

Policy Development

- Compliance with Federal, State, and Local Laws
- Long-term Policy development and assessment
- Guidance on local enforcement

Risk Management

- Fleet management for monitoring and assessing UAS usage
- Data collection for safety metric assessments

UAS Operations & Authorizations

- FAA Authorization Services
- Hazard & Risk Identification
 - Flight Operation and Management Support

“Legal” \neq “Safe”

Drone Accidents

Sample Accident Reports

Damage to foam body during landing. Full airframe and sensor inspection was conducted after flight and reseller was consulted before conducting repairs with manufacturer supplied glue. Will test fly before conducting further research flights.

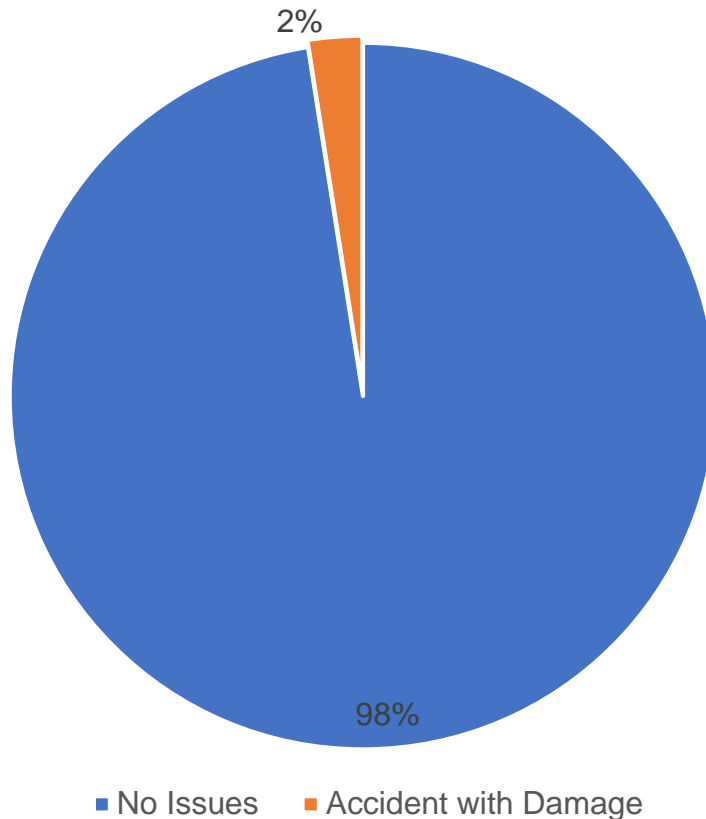
We tried auto-flight and instead of following the path we made in DJI Autopilot it rose to about 50 feet started flying erratically not in the pattern we made and uploaded to the drone. We tried to take over manually but it wasn't responding directly to our controls. Instead it started descending my making larger and larger counter-clockwise circles. That time the drone landed itsself aggressively and cracked one of the replaceable rotors. We tried to fly it totally manually a second time and it was unresponsive to our controls or lagged about 5 seconds behind our controls. We brought it up it started circling and this time when it "landed" it clipped an orange tree in the field we were flying it. No damage to the drone but a couple of small branches were taken off the tree.

our newly qualified part 107 pilot, accidentally auto-piloted our Inspire into some powerlines and fried it. Fortunately it didn't cause any damage, and no one was hurt.

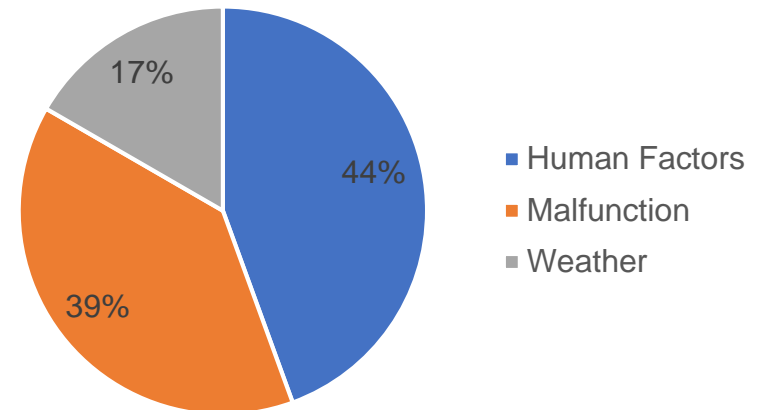
I wanted to report back on my scheduled drone flight at the ARC fields this morning. Unfortunately it did not go so well. The drone (Phantom 4) was flying autonomously (controlled by the Drone Deploy App) at 100 ft above ground in accordance to flying height restrictions imposed at the ARC fields. At the upper fields the 100 ft flying height seems sufficient, however on the main field the drone promptly crashed into a flood light. Nobody was injured and no property was damaged beside the drone.

But how often does this actually happen?

UAS Flights in 2017



Cause of Accident



Drone accidents with damage are fairly rare (< 2.5%)
Effective mitigation strategies have prevented bigger incidents

Insurance Coverages

- The UC has UAS liability coverage for 'approved' UAS activity*
- Not automatic for
 - Above 400 ft
 - International
 - BVLOS



- All non-UC UAS users must obtain their own UAS insurance
 - Including student clubs (as appropriate)
- Some companies offer UAS insurance on-site

Common Violations

- Visual Line of Sight Operations (14 CFR 107.31)
- Visual line of sight is defined by being able to:
 1. Know the unmanned aircraft's location;
 2. Determine the unmanned aircraft's attitude, altitude and direction of flight;
 3. Observe the airspace for other air traffic or hazards
 4. Determine that the unmanned aircraft does not endanger the life or property of another

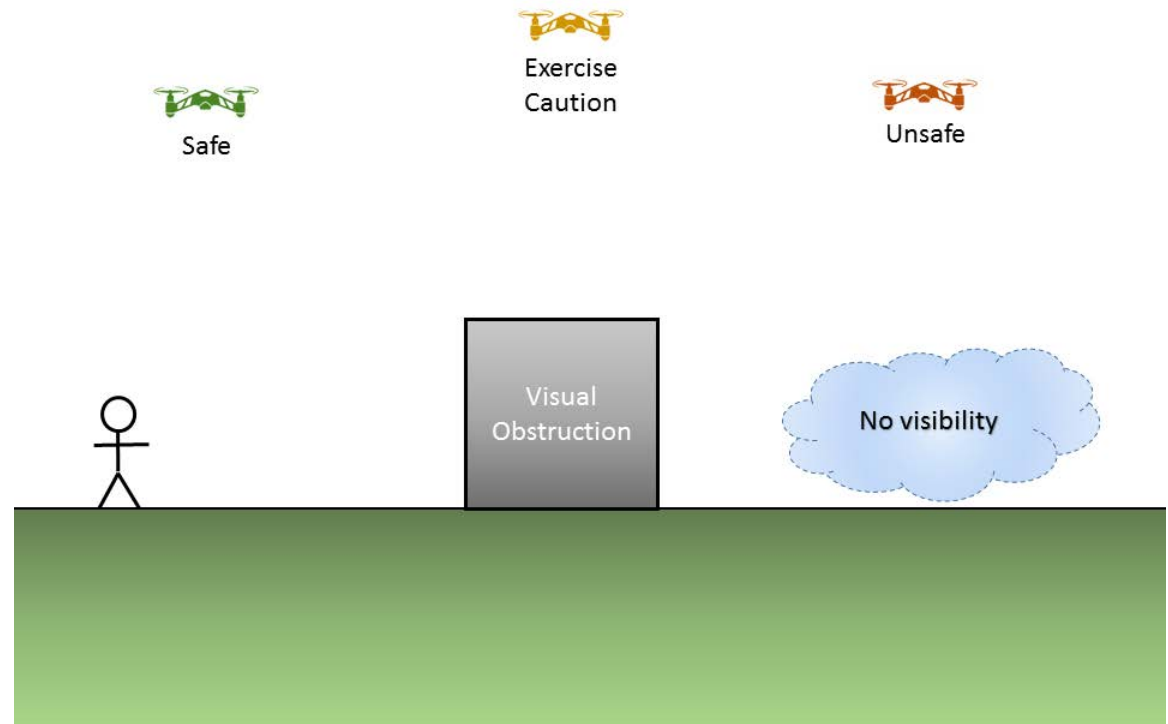
Visual Line of Sight

- If you can't see the sky around the aircraft, it's unsafe



Visual Line of Sight

- If you can't see the ground below the aircraft, it's unsafe



Common Violations

- Operation over human beings (14 CFR 107.39)
- No person may operate an SUAS over a human being unless he/she is
 - Directly participating in the operation
 - Located under a covered structure or inside a stationary vehicle that can provide reasonable protection from a falling SUAS

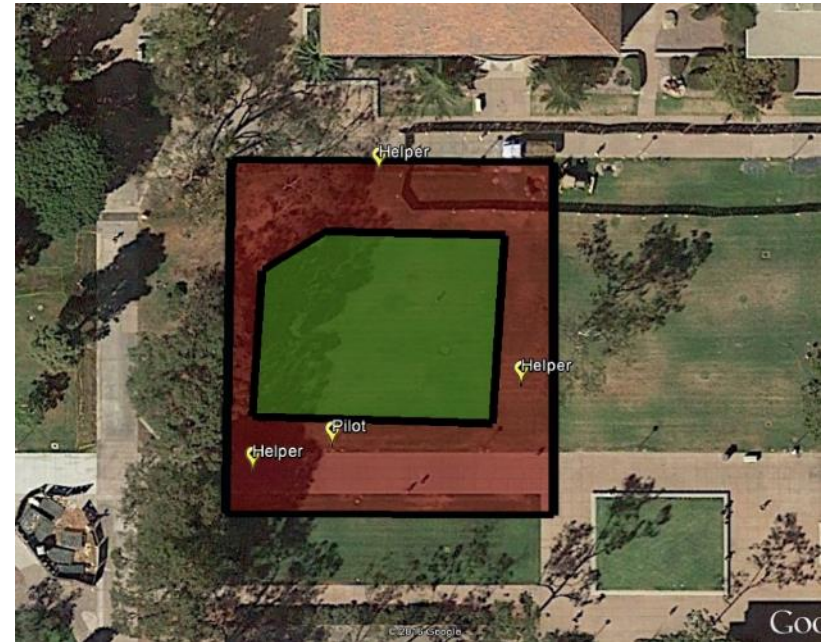
Operation over Human Beings

- PPE and prior notice does not absolve your operators responsibility to comply with 14 CFR 107.19 (c) or 14 CFR 107.39.



Safety Guidelines

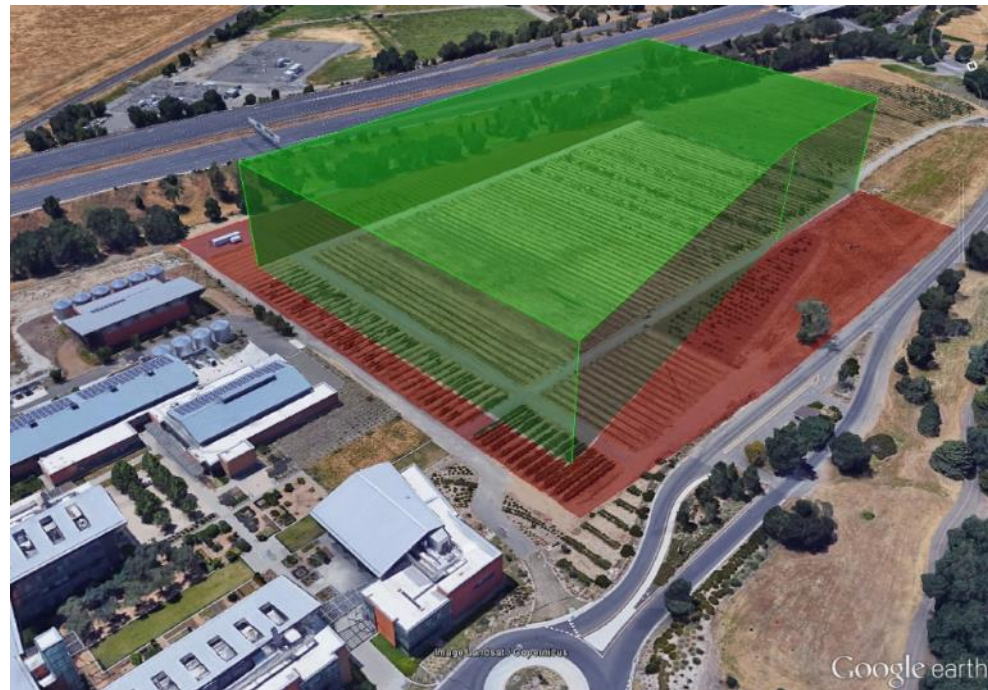
- Incorporate visual observers and supporting ground crew
 - Maintain situational awareness of intruding traffic (including pedestrians)
 - Maintain focus on the mission, not answering questions for onlookers



Drone Presentation Demo in public quad – UC Santa Barbara

Safety Guidelines

- Plan for operational safety buffers
 - Good rule of thumb – $\frac{1}{4}$ of flight altitude
 - Extra space near busy roads or intersections

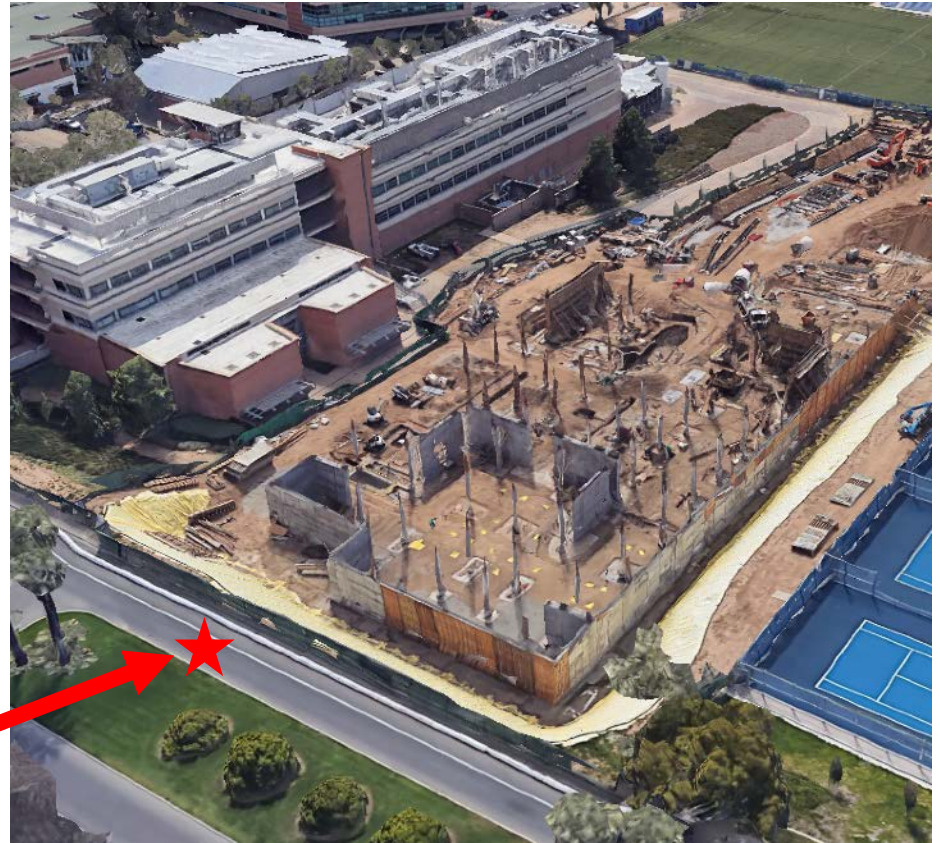


UC Davis Demo – Fully loaded S1000 in front of donors and senior administration

Safety Guidelines

- Road Safety
 - Avoid causing distractions and causing secondary accidents
 - Place support crew for emergency retrieval

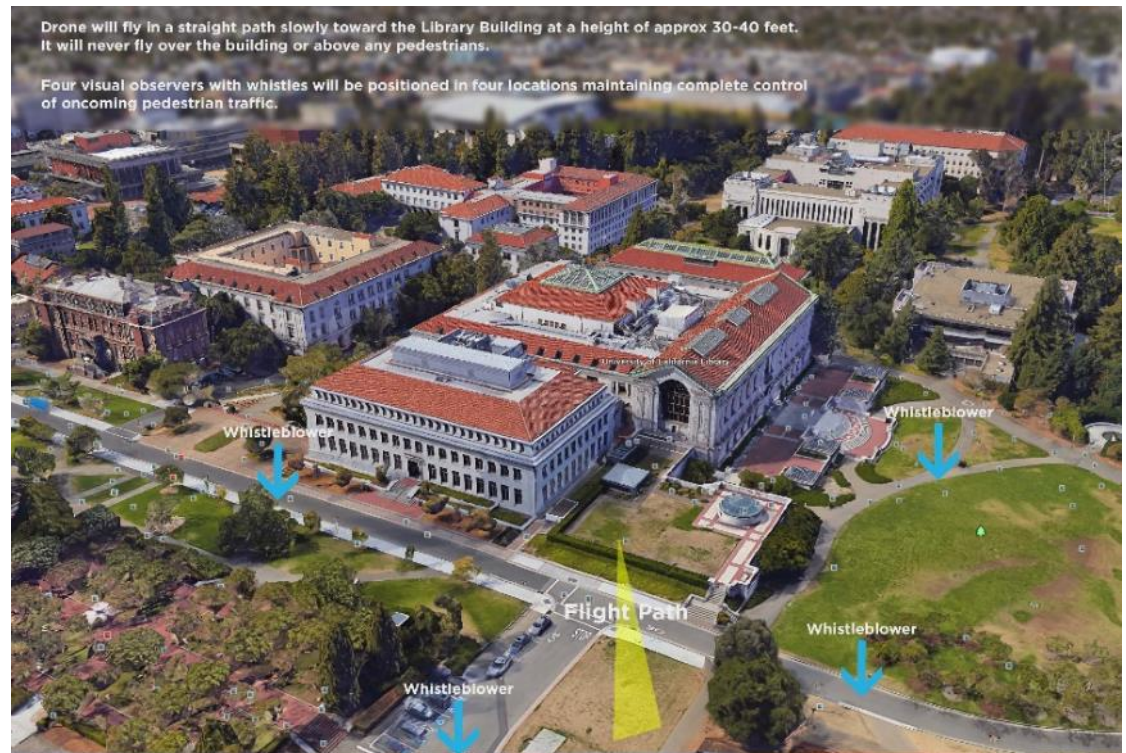
Place support on
the other side of
the fence



Construction site at UC Riverside – proposal reviewed 6/28/2017

Designing Flight Paths

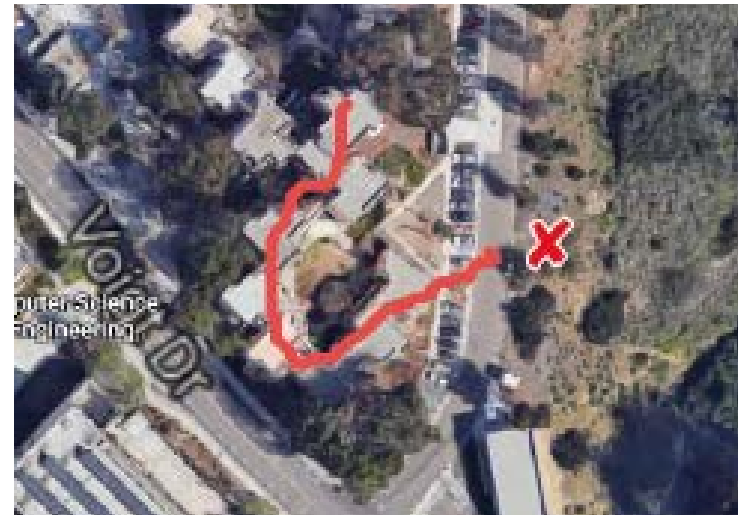
- Pre-plan specific shots and approaches when operating in public areas



Planning a UAS flights for campus media – UC Berkeley

Privacy & Operations in Public

- Opinion on SUAS usage varies dramatically
- Avoid the perception of invasion of privacy
- Act professional
- Follow 'Good Neighbor' guidelines

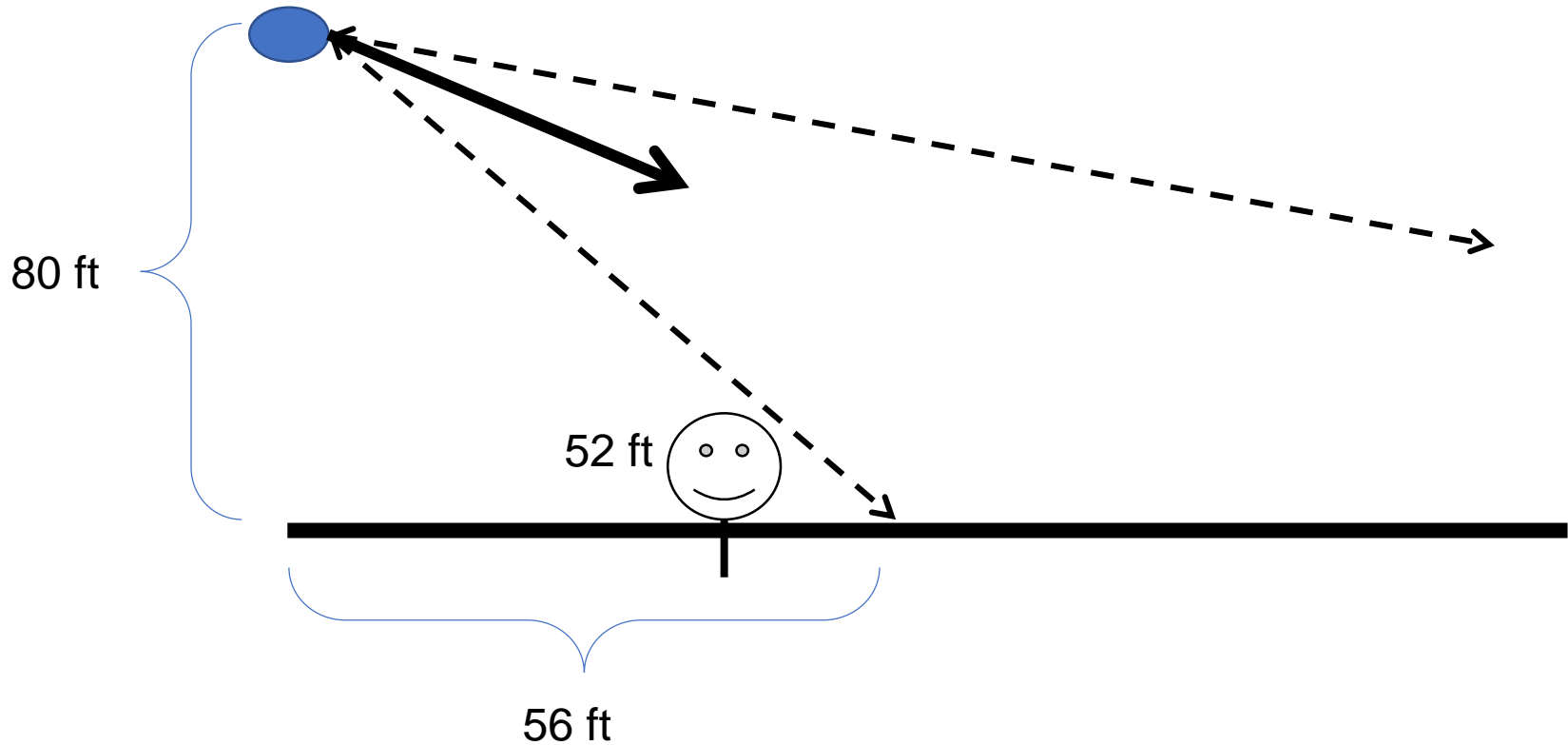


Dorm inspection at UC San Diego

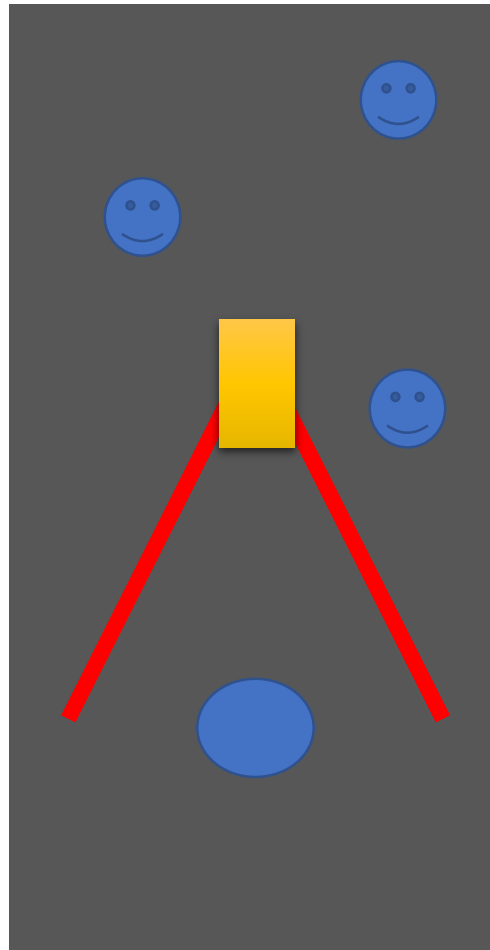
How to get crowd shots legally

- Large Crowds
 - Angle the camera and fly with a 50 ft buffer
 - Establish Drone Zones
- Moving sequences
 - Angle the camera forward and follow
 - Use a wedge formation
 - Follow off to the side

Example – Following at 80 ft



Example – Following at 80 ft



With a little choreography, you can create sweeping crowd shots without violating any federal regulations

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For more information



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Please sign up for the UC UAS Listserves if you'd like to be kept in the loop of the latest developments

Other Presentations:

UAS Safety Management System
SUAS Remote Pilot Certificate Exam
Drones for Student Clubs
Drones for Researchers
Drones for Staff