Unmanned Aircraft Systems in the University of California

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Center of Excellence on Unmanned Aircraft System Safety

Summer 2017
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.

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

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Droning in the UC

• Nearly every campus has a ‘Drone Lab’

• Largely Engineering groups
  • Using drones to look methane leaks
  • Wildlife counts (seals, roosting cranes, etc)

• Increased interest in Environmental, Agricultural, Archeological, and Ecological research groups

• Journalism, Facility Management, Publicity/Multimedia groups
Other Drone Activities
Why are we flying drones?

% of Flight Time

- Research - Env.: 38%
- Research - Ag.: 26%
- Testing or Flight Instr.: 22%
- Class Curriculum: 26%
- Campus (Media, Facility): 5%
- Research - Other: 4%
UAS Usage Trends

UC UAS Usage by Flight Activity

- Building Inspection or Surveying
- Civil Engineering Research
- Testing or Flight Instruction
- Outdoors - Class
- Indoors - Class
- Filming for the University or Publicity
- Environmental Research
- Digital Archeology
- Demonstration
- Agricultural Research
- Aerospace Research
Where are we flying drones?

Maps courtesy of the new UC Drones Dashboard – available to UC Administrators
Top 10 Unique Requests

1. Window Washing – UC Davis Medical Center
2. Filming for Olympics 2024 Bid – UCLA
3. Launching off research boats – UC San Diego
4. Fire Damage Assessment – UC Merced
5. Earthquake Shake Testing – UC San Diego
6. Water Sampling – UC Santa Barbara & Davis
7. Drone Racing in Stadium – UC Berkeley
8. Checking out Drones for HW – UC Santa Cruz
9. Operating next to airport runway – UC Davis
10. Commencement Ceremonies – UCSB, UCSC, UCM
Usage is changing shape

Research

Engineering

Field Work

Environmental
Agricultural

Day-to-Day

Facility Inspections
Surveys
Construction
Film & Media
Promotion
This introduces some risks...

- 85% of recorded UAS activity in 2017 was flown by operators with less than 1 year of recorded flight experience.

- Many UAS issues are related to ‘other’ issues:
  - Field Safety
  - Export control
  - Insurance
  - ‘Jurisdiction’
  - Procurement

New User Requests (2017):

- 34% Legal (Model)
- 30% Illegal (UAS License)
- 18% Illegal (Other)

Regulatory compliance rates for new requests is disappointingly low.

UAS users are typically... inexperienced, not connected to other campus units, and misinformed on UAS regulations.
How do we fix?

Coordinating and funneling UAS operations
Drone Regulations*  

*subject to change at any time
Drone Regulations - US

Unmanned Aircraft

- Model Aircraft
  - Part 101
  - Section 333
- Non-Recreational
  - Public Agency Operation
  - Part 107
Drone Regulations

Model Aircraft
• Recreation Purposes
  • For ‘Fun’
• Specific Educational Purposes

Unmanned Aircraft System
• Everything else
• Needs a license* (P107)

The separation between regulations is defined by **PURPOSE**, not entity.
Recreational Purposes

• Cannot receive money or compensation

• Cannot be used in furtherance with a business or official duty regardless of compensation

• Must be operated within a community-based set of safety guidelines and within the programming of a nationwide community-based organization

If it is plausible that someone would pay for a UAS to do it, then it is not recreational
Model Aircraft Regulations

• Flown within visual line of sight
• Operated in accordance with a community-based set of safety guidelines
• Does not interfere with manned aircraft
• When flown within 5 miles of an airport, the operator must provide prior notice to the airport operator and air traffic control tower.

• May not fly over people
• May not operate closer than 25 ft to non-participants
• May not fly higher than 400 ft within 3 miles of an airport
• Special guidance for FPV operations
Educational Purposes

• “A student may conduct model aircraft operations in furtherance of his or her education at an accredited educational institution.” – FAA, May 4th, 2016

• This applies to UC students in
  • Traditional Coursework
  • Art/Media/Film Classes
  • Naturalist or outdoor classes with curriculum
  • Senior Projects

• It does not apply to
  • It does not apply to research for credits (undergraduate or graduate)
  • It does not apply to work for credits
Drone Regulations - US

- Unmanned Aircraft
  - Model Aircraft
  - Non-Recreational
    - Part 101
    - Section 333
    - Public Agency Operation
    - Part 107
Small Unmanned Aircraft (14 CFR 107)

- The pilot must have remote pilot certificate with a small UAS rating.
- Under 400 ft AGL*
- May fly only during daylight*
- Visual line of sight*
- No flying over people*
- Flights near airports will require prior airport authorization
SUAS License (RPIC Cert. with SUAS Rating)

- License for SUAS operations under Part 107
- Indicates knowledge of the rules of the road

How to Obtain:
- Pass an Aeronautical Exam at an FAA computer testing site ($150)
- Exam is 2 hrs, 60 questions with a passing score of 70%
- The study material is provided free-of-charge from the FAA
- The exam packet is freely available (30-50% of the test)

No Drone Experience Needed: Ownership of a license does not imply that the operator is trained, skilled or experienced!
Recreational vs Part 107

**Recreational**
- Individual recreation
- Coursework
  - Includes Senior Projects*
- Recreational club activities
  - Drone Racing
  - Drone Demos
  - Drone Photography

**Part 107**
- Research projects
- University business
  - Promotional Filming
  - Facility Management
- Commercial activity
- Club activity where SUAS is providing a service
  - Drone filming a club event
  - Drone delivery

If it is plausible that someone would pay for a UAS to do it, then it is not recreational

See the Cheat Sheet for more examples
Other UAS Regulations

- Public Agencies have access to a special type of authorization for public purposes
  - Certain types of research, law enforcement, search & rescue

- Section 333 Exemptions are out-dated
  - Certain exemptions allow flights over people, so some film & media may continue to use until they expire in 2018
UC UAS Policy (being finalized)

- All UC UAS operations must be in compliance with all applicable regulations and rulings of the appropriate aviation agency.
- All UC UAS operations must receive advanced approval by Systemwide Designated UAS Authority or Designated Local Authority.
- All UAS operations on UC property must receive advanced approval by Systemwide Designated UAS Authority or Designated Local Authority.
- All UAS must operate in a manner than ensures public safety, right to privacy, civil rights and civil liberties.
- All UAS operations must be reported.
System vs Campus Roles

**System**
- All flights must be legal and pre-approved
- All flights must be reported
- Everyone must have insurance, even 3rd party users
- Oversight must be done in 14 days
- Designated system authority develops guidelines, training programs, and manages systemwide authorizations with aviation authorities
- Provide support to ease implementation

**Campus**
- How are flights approved?
  - Who approves them?
  - What are the terms of approval?
  - How long are approvals good for?
- Who should be notified of on-campus UAS activity?
- How much insurance? (above minimum)
- How are flights reported?
- Are there specific fly-zones or no-fly-zones?
- Natural Reserves and Field Stations
Steps to flying a drone in the UC system

Coordinate and Report
Flight Requesting

• The Review Process focuses on:
  • Legal Compliance
  • Common Safety Issues that can be identified in pre-planning
    • Mitigation strategies for moderate to high risk operations
    • Coordination with local entities
    • Planning for crowd mitigation
    • Airspace deconfliction
  • Privacy and proximity to non-participating persons
  • Can consider previous recorded flight experience

Most off-campus requests are done in minutes, and many will be allowed for automatic approvals after the 1st review. Operations on UC property usually require some coordination unless pre-approved.
Why would we say “No” and how often does it happen?

• The FAA only cares about ‘airspace’

• Privacy issues – unintentional

• University Business
  • No drones during major events – Commencement, Picnic Day
  • Prioritize University Business

• Unnecessary Risks
  • Risks to campus
  • Risks to research
“Legal” ≠ “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 itself 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.
How often do we fly on UC Property?

UAS Flight Locations

- Locations not on UC property are split between public land (state or county parts) and private property

- Very few records of UC UAS flights on private property without property owners permission
On-Campus UAS Activity (in 2017)

By % of Flight Hours

- 84%
- 16%

- There are known gaps in 3rd Party Accounting
  - This includes contractors, film crews, as well as UC students operating for non-recreational purposes

- Records on recreational use is sparse and incomplete and not included in this data set
Who are the UC Drone Pilots?

- Of recorded UAS activity
  - 100% UC UAS pilots have SUAS licenses (UC purpose)

- 70+ recorded SUAS pilots
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
The Rise of the Drone Criminal?

- Don’t get distracted by looking for drone ‘criminals’
- Intentional use to invade privacy, smuggle contraband, etc are relatively minor on campuses
- Unintentional issues are much more common.

- Focus on education rather than punishment
- Law Enforcement should address eminent threats to safety, or other ‘disturbing’ situations
The Future of Unmanned Aircraft Systems

UC Policy

Regulations

Technology

Public Acceptance
Current Status

• Part 107 made it a lot easier for legal Class G UAS usage
• Registered SUAS outnumbered registered manned aircraft
• Over 50,000 SUAS certificates issued – August 2017
  • 5,554 in CA
• Airspace Authorization is the #1 complaint of P107 users
  • Takes too long, doesn’t make the airspace safer, airport towers make arbitrary decisions
• Part 107 introduced ‘waivers’ but outside of night time operations, no one can get one.
UAS Identification and Tracking

• Goal
  • Identify, categorize and recommend available and emerging technology for remote identification and tracking of UAS
  • Identify the requirements for meeting the security and public safety needs
  • Evaluate the feasibility and affordability of available technical solutions

• Deadline October 31, 2017
Other UAS rules

• Taylor vs Huerta – Model Aircraft do not need registration

• Legislative Actions
  • ‘Drone Aircraft Privacy and Transparency Act’
  • ‘Drone Federalism Act’
  • ‘Drone Innovation Act’
  • ‘Safe Drone Act’
• Creates a non-profit air traffic operational control agency
• Users of air traffic serves are assessed a fee
• Add a fee specific to recover the costs of the regulation and safety oversight of UAS
• FAA must create a rulemaking committee for the implementation of Unmanned Traffic Management
• Creates a new risk-based permitting process
• Creates an sUAS air carrier certificate for delivery services
• Allows FAA to require registration for model aircraft
• Defines a community-based organization
• Members of a community-based organization may teach flight classes under model aircraft regulations
• No flying within 500 ft of an amusement park
The Future of Drone Regulations

Credit: Eric Delucien, UCSD
UC Center of Excellence on UAS Safety

• Cannot condone violating regulations
• Will advocate for appropriate regulations
• Keep the UC ready to make immediate transitions to new UAS regulations
• The UC must stake its claim on the airspace it needs
• Short term battles are a distraction, the end-goal is making sure the UC system is ready for Unmanned Traffic Management
How do I get started?

1. Buy drone ($500-$1500)
2. Get drone license ($150)
3. Register drone with FAA ($5)
4. Register drone with UC
5. Find a safe location
6. Submit a flight request
7. Wait for review
8. Fly
9. Submit Records
10. Goto Step 5

Coordinate and Report
Center of Excellence on
Unmanned Aircraft System Safety

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