

SACRAMENTO POLICE DEPARTMENT - 2320
UNMANNED AIRCRAFT SYSTEMS BASIC PILOTS COURSE – 20275
POST Certification II / Reimbursement Plan NA / 40 hours
EXPANDED COURSE OUTLINE

Statement of Purpose: The purpose of this course is to provide officers with the skill and expertise to properly and effectively utilize UAS platforms. This training will instruct personnel on how to support operations in the field all while considering safety and FAA regulation.

I. Introduction

- A. Classroom Familiarization
 - 1. Facility Rules
 - 2. Break Areas
- B. Course Breakdown and Schedule
 - 1. Course Topics
 - 2. Course Schedule
- C. Part 107 review

II. Law enforcement Use of UAS

- A. UAS v. Drone
 - a. Proper Nomenclature
 - b. Difference between LE use and military
- B. Break down of UAS history with LEA
 - a. Videos showing use
 - b. Agencies utilizing UAS
- C. Mission examples
 - a. Types of missions UAS are being utilized for
- D. COA vs Part 107 flying
 - a. TBVLOS
 - b. Waivers
- E. Policy
 - a. What things to consider in a UAS policy
 - b. Video retention
- F. Video Discussing home built UAS

III. NOTAMS

- A. Objectives
 - 1. Understand The FAA Notice To Air Missions system (NOTAM)
 - 2. Be able to file a DRONETAM message for an operation
 - 3. Be able to request a NOTAM for a COA Operation
- B. How to file NOTAM
 - 1. When are NOTAMS required
 - 2. COA specifics regarding NOTAMS
 - 3. www.1800wxbrief.com
- C. Filing NOTAM
 - 1. Make up username
 - 2. Walk through an example NOTAM
 - 3. Have each person file a NOTAM for the next day's flying location

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4. Pilots must successful file NOTAM before they can move to hands on portion

IV. Legal Environment

A. Case Law

1. 4th Amendment
2. Florida v. Riley (1989)
3. People v. McKim (1989)
4. People v. Anchorage (2020)

B. Penal Code

1. 647(j)(1) PC
 - a. How to apply this

C. Civil Code

1. SB 142 Jackson Civil Law
 - a. Applies to civil law only

D. FAA Enforcement

1. Regulatory only
2. Enforces Part 107 rules
 - a) Discuss 107 / recreation regulations
 - b) How to investigate
 - c) FAA vs FBI roles
3. Recreational pilots now need "TRUST" Certificate
 - a) How to obtain

E. Learning Activity – Students will be given scenarios and they will discuss their legal authority to intervene and discuss how law or FAA regulation applies

F. Search warrant language

1. Why search warrants should be utilized

V. Visual Observers

A. Who is a Visual Observer?

- a. Member of the flight crew
- b. Job includes:
 - i. Watching aircraft
 - ii. Knowing location, heading, altitude and attitude
 - iii. Inform pilot of hazards
 - iv. Maintain clear lines of communication with pilots
 - v. Identify potential hazards (trees, lights, aircraft, animals)
 - vi. Handle radio traffic

B. Why is a Visual Observer needed?

- a. Maintain visual line of sight as required
- b. Lets pilot focus on searching or other aspects of operation

C. What is a flight crew?

- a. Incident Commander
- b. Remote Pilot

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- c. Visual Observer
- d. Additional Flight crew / scene security
- e. Pilot first, Law enforcement second

D.

VI. Checklist

- A. Video for checklist importance
- B. Discuss what should be in a checklist
 - 1. Pre-flight
 - 2. Post-flight
 - 3. Emergency procedure
 - a. Tower numbers
 - b. Alternate landing
 - c. Lost link
- C. Checklist v. Challenge Response

VII. Aircraft Limitations

- A. Discuss Common UAS and their uses
 - 1. Indoor v. Outdoor
- B. Aircraft Limitations
 - 1. Batteries
 - 2. Wind
 - 3. Weather
 - 4. Altitude

VIII. Night Operations

- A. FAA Part 107.29 – Daylight operations
- B. Night Time and Civil Twilight
 - a. Night definition
 - b. Civil twilight definition (with graphic)
 - c. Website for civil twilight (www.timeanddate.com)
 - d. Night operations quiz
- C. Visual sensory at night
 - a. Day time visual target is the center of the view
 - b. Nighttime is off center
 - c. Mechanics of the eye
 - d. Types of visual scanning
 - e. Visual Illusions,
 - i. Autokinesis and Fixation
 - ii. Relative -Motion Illusion
 - iii. Reversible Perspective Illusion
 - iv. Ground light confusion
 - v. Flicker Vertigo
 - vi.
 - f. Aircraft lighting
- D. Site survey

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IX. FAA Enforcement

- A. Part 107 Vs Hobbyist
 - a. How to obtain 107
 - b. How to obtain Hobby certification, TRUST
 - c. Aircraft Registration
- B. Challenges of enforcement
 - a. Local Law enforcement
 - b. Federal Law enforcement
- C. Enforceable sections
- D. LEAP
- E. Report Writing
- F. Non-Complaint individuals

X. DJI Pilot Settings

- A. Home Screen
- B. Unlocking NFZ (No Fly Zone)
- C. Flight Record Syncing
- D. Aircraft warnings
- E. Craft location and flight information
- F. Ready to go Banner
- G. Map toggle
- H. Setting Dots
- I. Craft Settings
 - a. Home Point
 - b. Flight Modes
 - c. Return to Home Altitude
 - d. Max Flight Altitude
 - e. Max Distance
 - f. Signal loss
 - g. Stop motor
- J. Sensor settings
 - a. Obstacle avoidance
 - b. Radar chart
 - c. Vision Positioning
 - d. RTH obstacle Check
- K. Controller settings
 - a. Controller Calibration
 - b. Stick Mode (Mode 2)
 - c. Remote control Screen Intro
 - d. Charging Mode
 - e. Button customization
- L. Aircraft Battery
 - a. Smart Return to home
 - b. Low battery warning
 - c. Critical RTH
 - d. Battery details

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- M. Gimbal settings
 - a. Gimbal mode
 - b. Camera forward / down
 - c. Adjust gimbal
 - d. Gimbal auto calibration
- N. General settings
 - a. Measuring units
 - b. Temperature units
 - c. Motor Beep
 - d. Device Name
- O. Compass calibration
 - a. How to calibrate
- P. Camera Settings
 - a. Video record
 - b. Shutter / exposure
 - c. Video format
 - d. Video Size
 - e. Screen display
- Q. IR / Visible
- R. Pilots required to show proficiency in working through aircraft interface

Day 2 – Basic flying introduction

XI. Site safety brief / set up

- A. Set up training site
- B. Ensure NOTAM is in place
- C. Discuss safety measures while in training area
- D. Talk about VO/Pilot ques, have students give examples
- E. Confirm airspace
- F. Ensure NFZ certificates imported to aircraft
- G. Discuss and demonstrate aircraft function test after take off
- H. Discuss power management, having aircraft charging when not in use
- I. Discuss flying techniques, smooth is fast, gentle stick inputs

XII. Drills

- A. Line drill
 - a. 5 cone linear pattern, fly at eyelevel, cones approx. 10 feet apart, fly in straight line stopping directly above each cone. Work with observer to get as close as possible. Do both visually and with camera view only
 - b. Objective: Slow precision flying, special orientation, tripod mode, direct location hovering, learning aircraft movement
 - c. Pilots must show proficiency in skill before moving to next drill
- B. Box Drill

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- a. Make a square with cones approx. 20 feet apart. Fly from point to point, stopping and hovering over each corner. Turn 90 degrees and go to next corner. Continue multiple reps clockwise and counterclockwise. Do both visually and with FPV.
 - b. Objective: Slow precision flying, special orientation, tripod mode, direct location hovering, learning aircraft movement
 - c. Pilots must show proficiency in skill before moving to next drill
- C. Line drill and Box drill repeated laterally
- a. Utilizing the above cone patterns, fly laterally in the box cone patter, both directions.
 - b. During the linear pattern fly at a 45-degree angle between the opening space between the cones making a 90 degree turn when in line with the cone and fly 45 degrees in the opposite direction. Do this forward and back then repeat by sliding at a 45-degree angle.
 - c. Pilots must show proficiency in skill before moving to next drill
- D. Smooth transitioning
- a. In box pattern place cone in middle and have pilots conduct smooth circular orbits focusing camera on center point. Go in both directions.
 - b. Using linear cones conduct flights visually only. Do a smooth slalom pattern through the openings in the cones forward and back. Conduct with camera after visual only
 - c. Pilots must show proficiency in skill before moving to next drill
- E. Transition drill
- a. Set up a cone down range behind cover, Pilot will fly down range simulating looking for suspect. Locate suspect, maintain visual and coordinate with secondary UAS to take over observation
 - b. Objective: utilize FPV camera to fly and locate suspect, maintain visual, and coordinate with responding UAS to avoid collision and maintain constant visual.
 - c. Conduct this transition multiple times with all VO and pilots.
 - d. Training alternative: Have pilots on station conduct orbits prior to be relieved
 - e. Pilots must show proficiency in skill before moving to next drill
- F. Patrol ready deployment
- a. From a patrol ready deployment position (UAS in box), remove from box, prep, checklist and deploy down range. This is a timed event to add stress. Each person will go individually

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- b. Important to simulate body camera is on, this is to follow policy and potential document any issues that might occur from deployment.
 - c. Objectives: add stress to deployment, emphasizes check list and procedure. Make sure UAS recording is on
 - d. Alternate training additions: utilize PA to make announcements
 - e. Pilots must show proficiency in skill before moving to next drill
- G. NIST Training
- a. Now that the pilots have some flights under their belt have them conduct the NIST course.
 - b. Conduct this for time to show improvement through training week
 - c. Pilots must show proficiency in skill before moving to next drill
- H. Mavic mini through trees
- a. Utilize the mini to fly below tree branches and through tree trunks (or other low hanging obstacles
 - b. Objective: makes pilots fly slow and read instruments. Learns proximity
 - c. Alternate Training: utilize M2E after runs with mini
 - d. Pilots must show proficiency in skill before moving to next drill
- I. Multiple Suspects
- a. Objectives: work with VO to safely navigate obstacles, conduct slow methodical search, become familiar with PA and making announcements.
 - b. Note: If single pilot does not locate all three suspects, they need to coordinate relief aircraft.
 - c. Pilots must show proficiency in skill before moving to next drill
- J. Return to home function testing and familiarity
- a. Conduct return to home function testing. Show how return to home function operates. Demonstrate it. Make sure RTH altitude is set correctly.
 - b. Conduct RTH function after relaunching from a perch to demonstrate home UAS re-establishes its RTH function from the perch point
 - c. Conduct the above drill but then demonstrate how to set new home point from remote
 - d. With three suspects hidden, pilots will use UAS and VO to fly down range and locate suspects. When suspects are located utilize PA to make announcements for suspect to surrender
 - e. Pilots must show proficiency in skill before moving to next drill

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K. Long Range Search

- a. Utilizing a down range VO and a VO next to the pilot conduct a long range search of a suspect. The VO's shall communicate via radio to help the pilot avoid obstacles and bring the aircraft into position to search. Once the suspect located utilize the PA to make surrender announcements
- b. Objective: Familiarize pilot with flying FPV and listening to directions from VO for safe flight. This will assist in training for TBVLOS
- c. Pilots must show proficiency in skill before moving to next drill

L. Sensor testing

- a. Utilizing a solid object show and test how the sensors work in P – Mode and in tripod mode.
- b. Pilots must show proficiency in skill before moving to next drill

XIII. Drills and Exercises (Day 3)

- a. Confirm Notam has been done. If not walk through as a class
- b. Go over LAANC authorization and request waiver for flight area
- c. Conduct safety brief, identify hazards, launch primary and secondary locations
- d. Remind pilots on function test and announcing launch
- e. Check on any questions from overnight

B. Suspect hidden

- a. Hiding 3 suspects beyond the initial visual of the operator, hide three cones that challenge operator to overcome the physical challenges and locate the three suspects
- b. Objectives: Operators should practice slow and methodical search methods. Communicate with their VO to avoid obstacles and search high low as if they are searching from the ground
- c. Pilots must show proficiency in skill before moving to next drill

C. FLIR familiarity

- a. Conduct open air flights to become familiar with the FLIR functions and how to switch through them and the visual overlay
- b. Objective: Become familiar with FLIR functionality, talk about MX overlay, and that the FLIR is a fixed focal point lens
- c. Pilots must show proficiency in skill before moving to next drill

D. Suspect searching continued

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- a. Utilizing the NIST equipment, hide the buckets in different locations, ask pilots to identify the specific numbers in the buckets that need to be located.
- b. Hide stimulus at different levels to force pilots to change altitudes and angles
- c. Ensure pilots don't tell VO where locations are so you don't have to move cones.
- d. Objective: Utilizes angles, VO and terrain to locate suspect.
- e. Pilots must show proficiency in skill before moving to next drill

E. Perching Drill

- a. Utilizing the Mavic Mini pilots will practice working with their VO to perch on a fixed object. This will take slow precision flying to safely place the aircraft in a position to utilize the camera to gain intel and extend the battery life.
- b. Things to consider: if landing on a metal object, might not be able to take off. The pitch of the roof is a factor in the ability to land and take off.
- c. Objective: to be able to safely land and utilize the camera for an extended period and be comfortable in that skill
- d. Talk about home point resetting
- e. Pilots must show proficiency in skill before moving to next drill

F. Destructive Device search / 927 package

- a. Utilizing mock IED's have pilots fly a specific area searching for the devices. Once they are located attempt to gain as much info as possible to provide to EOD resources.
- b. Objective: Conduct a grid search to locate items and then provide intel to responding resources
- c. Pilots must show proficiency in skill before moving to next drill

G. Pilot flying via VO

- a. Have pilot facing away from craft, let VO launch through verbal cues only. VO will have pilot fly to predetermine location and then return to land. All by VO direction
- b. Objective: this will assist with VO and pilot communication, trust and flight by instruction
- c. Pilots must show proficiency in skill before moving to next drill

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- A. Daily Safety Brief
 - a. Discuss no fly areas
 - b. Ensure NOTAM is complete
 - c. Address weather and airspace issues
 - d. Answer any questions from previous day
 - e. Ensure all flights have been uploaded thus far

- B. Emergency /Alternate landing
 - a. Instructors will identify an alternative landing site. Pilot will fly 200 feet up and 500 feet away from the secondary landing site. Instructor will give them one minute to descend to the alternate landing spot that is marked with a landing pad.
 - b. Objective: The idea is to simulate an aircraft flying into the UAS operating area and the pilot will fly away from the manned aircraft to make distance and descend.
 - c. Alternative training: in addition to the horizontal decent pilots will conduct an immediate decent as well coming straight down from their current aerial position.
 - d. Pilots must show proficiency in skill before moving to next drill

- C. Orientation recover
 - a. Instructor will Fly pilots aircraft away and turn off display. They will then give remote back, 2 second forward movement, 90 degree via memory, 2 seconds forward, and then should be able to recover at that point and fly back
 - b. Objective: to gain pilot confidence in learning aircraft orientation and practice reverse orientation
 - c. Pilots must show proficiency in skill before moving to next drill
 - d. Alternatives:
 - i. Pilot faces away from aircraft during recovery and VO instructs on reverse orientation
 - ii. Instructor will fly aircraft away and place in disoriented position at altitude and pilot will have to recover using only display

- D. Lost Aircraft search
 - a. Instructor will hide pilot's aircraft so they must use the motor beep function to locate aircraft. This is a quick drill but help run through the function test of this capability
 - b. Pilots must show proficiency in skill before moving to next drill

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- E. FLIR test During day
 - a. Have pilots fly over area where they could potentially locate hot spots during the day. This will help them work through all the functions of the FLIR and prepare them for nighttime use. This will also help show how ground heat effects abilities
 - b. Pilots must show proficiency in skill before moving to next drill
 - c. Objective:
 - i. Utilize operators' skills to become familiar with FLIR options
 - ii. Learn and experience what FLIR looks like during the day to compare to nighttime operations
- F. Search rooftop for evidence
 - a. Place a training firearm/ training IED on the roof of a location to simulate a suspect discarding evidence or an IED. Have them search the roof looking for any items
 - b. Pilots must show proficiency in skill before moving to next drill
 - c. Objective:
 - i. Conduct slow methodical searching, utilize VO to assist with movements
 - ii. Practice for TBVLOS flying
- G. Field Slow search
 - a. In a tree area conducted a slow search for a discarded item or IED.
 - b. Pilots must show proficiency in skill before moving to next drill
 - c. Objective:
 - i. In a controlled environment become familiar with slow flying
 - ii. Practice understanding what the sensors are telling the pilot and letting them visually confirm so they understand how they work
 - iii. Prepares pilot for TBVLOS flight
 - d. Alternative: conduct in low light situation to build on skills and teach capabilities of sensors
- H. Leap frog search (multiple craft)
 - a. Simulating a search for multiple suspects the first pilot will launch, he will hold on the first suspect they find. A second UAS will launch and continue where the first left off. When the second suspect is found the third pilot will launch to locate the final suspect and complete the search.
 - b. Pilots must show proficiency in skill before moving to next drill
 - c. Objective:

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- i. Slow search, looking for suspect
 - ii. Coordinate additional UAS's and Pilots
 - iii. Identify Airboss to help coordinate response
 - d. Alternative: Fly same mission at night utilizing spotlight
 - I. FLIR during night
 - a. Conduct multiple searches for persons hiding in multiple ways, in trees, bushes, under coverings.
 - b. Run this drill multiple times so officers can work through functions and different masks on the FLIR
 - c. Pilots must show proficiency in skill before moving to next drill
 - d. Objective:
 - i. Officers will learn basic FLIR skills and prepare for deployments in the field
 - J. NIST at Night
 - a. Conduct NIST Training utilizing spotlight
 - b. Compare to daytime test time
 - c. Pilots must show proficiency in skill before moving to next drill
 - K. End of Day
 - a. Ensure all data is uploaded to DJI
 - b. Ensure all data is uploaded to third party tracking vendor
 - c. Demonstrate Axon Air
 - d. Address any equipment issues
 - e. Training debrief
 - f. Issue certificates

XV. Review

A. Final Review Of The Course

1. Instructors Will Give a Final Review of UAS operations
2. Students will be Given an Opportunity to Ask Any Question They Have about the Course.

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Student Learning: Students will have to demonstrate course and material competency by successfully passing drills, exercises, and verbal quizzing during practical scenarios.