

Using UAS in SAR

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Class Objective

- Introduce tactical and operational concepts of drone use in mountain search and rescue missions.
- Questions/Discussion:
 - Who is already using drones in their SAR team?
 - How extensively are you using UAS and in what roles?
 - Who has pondered using UAS for SAR and what vision/roles are you thinking of?
 - What made you chose to attend this class?
 - What are you hoping to learn?
 - Who here is typically part of their team's command staff?
 - How do you envision the use of UAS in your ICS environment?

Quick Review of Previous Class

- Make your drone operations match your actual missions.
- Follow all FAA regulations, typically based on Part 107 certified pilots.
- Start small and build up your drone team.
- Start with easy successes and use good PR to expand the team.
- Integrate all drone operations with your incident command system.
- Work closely with your Agency Having Jurisdiction (AHJ).
- Explore a wide range of funding options.
- Insure your drones for crashes.

Our UAS Mantra:

Don't adapt your mission to your drones.

Adapt your drone operations to match the missions you actually have.

Remember: You are an asset not the star.

Our General Class Outline (Open to discussion & interests)

- Mission Types and Use Cases
- UAS Mission Planning
- Lost Person Behavior & Search Optimization
- Operational Coordination
- Debrief with Actual SAR Mission Video
- Q&A, Wrap-Up, What's in the next class today.

Mission Types and Use Cases

- Missing person search (wide-area and pinpoint)
- Patient assessment
- High-angle reconnaissance and terrain assessment
- Ground team support
- Avalanche and snow field operations
- Challenging terrain: mudslides, cliffs, water (swiftwater, surf, floods, lakes/ponds)
- Overwatch and communications relay
- Night operations and thermal use (with video examples)

UAS Missions: Missing Person Search

- Always use best practices including Lost Person Behavior.
- Hasty search
 - Fly immediately to the PLK
 - Search trails
 - Sweep cliff ledges and bottoms
 - Search ridges and canyon bottoms
- Expanded (wider area) search: expand the hasty search margins
- Grid & mapping searches = last ditch effort
- Evidence search: ski tracks, avalanches, clues, etc.

UAS Missions: Patient Assessment

- Health Status
 - Is the person jumping up and down waving?
 - Is the person guarding a body part?
 - Is the person unresponsive?
- Situational Status
 - Is their location stable?
 - Do they need a litter?
 - What gear do ground teams need?
 - What is the easiest access route?
- Patient Mental Status
 - Universal relief on seeing the drone, “I knew I was found.”
 - Less likely to keep wandering off and away

UAS Missions: Terrain Assessment

- Position
 - Stable & safe?
 - Any safety hazards?
 - What gear/resources/travel options are needed?
- Access
 - Is there a clearly better route to the patient?
 - Act as a beacon in the sky over the patient.
- Egress
 - What rescue options are there?
 - Do “obvious” routes cliff out?
 - Trees, brush, washouts, etc. blocking the route?
 - Are there hazards above or below for litters, etc.?

UAS Missions: Ground Team Support

- Provide accurate GPS location of subject
- Advise what gear must be hauled in
- Act as a “beacon in the sky”
- Night illumination
 - Patient assessment
 - Patient egress

UAS Missions: Avalanche and Snow Ops

All the below can be done while teams are enroute!

- Rapidly check for ski, sled, snowboard tracks in/out of avy path
- Search avy path for clues (gloves, hands, equipment, etc.)
- Rapidly check for nearby hang fire (cornices, avy paths, etc.)
- Assess routes in/out for field ops
- Beacon searches being tested by several teams

RECCO on drone,
development seems to
have stopped in 2016.
Image from Facebook.



UAS Missions: Challenging Terrain

- Safe and rapid searches in cliffs
- Searching in high avalanche conditions
- Search inaccessible areas (Marin sea cliffs)
- Mudslides
- Water Searches
 - Swiftwater searches
 - Surf rescue, can look down on high waves
 - Flood area search
 - Lakes and ponds
 - River gorges



Drone search of the Ogden River at night. Possible passenger from overturned car. (Actual rescue mission.)

Image: Sheri Trbovich

UAS Missions: Situational Awareness

- Command Overwatch
 - Reduces radio traffic dramatically
 - IC can anticipate needs in advance
 - Command can respond rapidly if something goes wrong.
 - Awareness for PIO
 - Awareness for AHJ, Sheriff, etc.
- Possible communications relay
 - Several projects underway to bounce messages
 - Mesh networking

Live UAS
image
feed.



Actual
mission
image.

UAS Missions: Night Operations

- Thermal camera is a must
- Spotlight and low light optical cameras help
- Patient locator beacon in the sky & GPS
- Illumination for patient assessment
- Illumination for egress
- Illumination for complex operations
- Pre-scope egress routes
- Night flying does take practice!

Night dive team recovery operation illuminated by the drone spotlight. (Actual mission.)

Image: April Wood, WCSSAR



Mission Planning: Risks

- Ground team risks
 - Can evaluate the scene and access in advance
- Flight risks, environmental
 - Power lines in the dark
 - Cliff faces
 - Trees
 - Ridgeline winds
 - Weather and visibility
- Flight risks, pilots
 - Cold hands and body
 - Distractions → Sterile Cockpit

Mission Planning: Flight

- Launch site
 - Clearly marked and controlled
- Egress and return flight
 - Obstacles (trees, powerlines, etc.)
- Airspace Deconfliction
 - Egress/return: one flies “north” the other “south”
- Loss of signal
 - Move flight operations
 - Fly higher (hard to get close, need optical zoom)



Mission Planning: Batteries

- Ground support team helps!
- Keep a supply of batteries charging
- High altitude = shorter life
- Hovering = shorter life
- Cold = shorter life
- Inefficient flight routes = shorter life

Notice that nothing extends battery life!



Fingerless gloves help!

Image: Sheri Trbovich

Mission Planning: Remote Operations

- Radio communication to ICP
- Need safe and easy drone pack
- Battery management
 - Enough batteries for mission?
 - Battery charging? (Jeep, snowcat, etc.)
- Must be a smaller drone if hand carried
- StarLink or cell service is helpful
- Can hand launch in tight spots

Hand launch in
the field.
Image: Rob Clark



Mission Planning: Team Structure

- Building a team is inexpensive:
- Pilot(s)
- Visual Observer(s)
- Technical Specialist (Ground support)
 - Search using larger monitor
 - Landing Zone security
 - Battery maintenance
 - Tech Support (generators, WiFi, HDMI, etc.)
- Air Commander
- Dedicated radio comms person

Search Optimization: Lost Person

Behavior

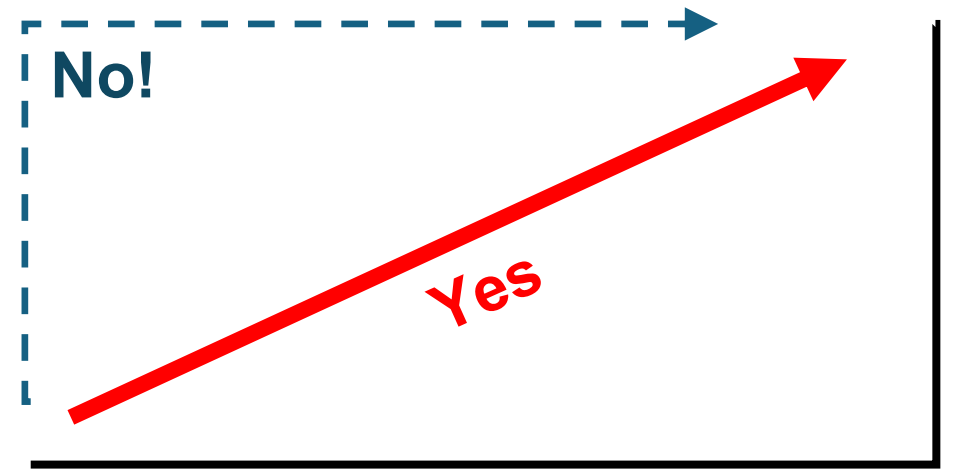
- Use best practices for ground searches
- Always start at LPK
- Use Lost Person Behavior
 - Hikers
 - Children
 - Despondents
 - Elderly
- High priority locations first
- First search locations for live finds
- Then search locations of possible fatalities

Silver search (fatality).
Image: Kyle Nordfors



Search Optimization: Flight planning

- Use Lost Person Behavior to assign drone search areas
- Try to determine flight paths that optimize time-on-task
 - Diagonal flight path vs. straight-up-then-horizontally-over path for departure and approach
- Drone position:
 - Too close and it is slow to search
 - Too far and the subject is hard to see
 - Pick a medium distance (several hundred feet) and use the zoom on points of interest.



Search Optimization: Drones & Search Theory

- PODs are poorly defined for drones
 - Several groups are working on this.
- Practice searching for real people
- Practice in multiple terrains
- Practice day and night ops
- Practice with thermal
- Viewing obliquely is better than viewing from directly above (larger visual target = higher POD)
- Practice looking for clues (packs, etc.)

Operational Coordination: Ground Teams

- Train, train, train with the rest of your SAR team(s)!
- Drone noise is a serious issue, best to stand off by several hundred feet.
- Practice the mission types listed earlier with actual ground teams involved.
- Isolate flight operations from incident command (sterile cockpit) with single point of contact between the two
- ASK the ground teams for feedback

Operational Coordination: Animals

- K9 teams
 - Some dogs will attack the drone!
- Horse teams
 - Some horses will spook
- Work with these teams to get the animals habituated to the drone in flight.

Operational Coordination: Data Sharing

- Live data feed
- Remote searchers
- PIO
- AHJ (sheriff, etc.)
- Archive the videos
 - Evidence
 - PR
 - Training

Operational Coordination: National Airspace

- The drone team should be in charge of helicopter operations from the ground
- Drone pilots are familiar with FAA regulations and flight dynamics and can easily communicate with helicopter pilots (UAS pilots should take the MRA helicopter courses!)
- Helicopter pilots and Remote Pilots need to coordinate airspace
- If in doubt, land the drone before helicopter is in the area
- Use LAANC to get FAA Flight Authorization if needed
- Flight over private property is totally legit

Debrief with Real SAR Mission Video

- Analysis of what worked what didn't
- Review of decision-making and drone utility

Q&A and Wrap-Up. How to learn more.

- Thoughts?
- What do you plan to do with this information?
- What's in the next class?
 - Maximizing UAS for SAR Operations
 - Advanced strategies and tools
 - Future expansion and possibilities
- You can reach out to us at:
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