# Best Practices for Small Unmanned Aerial Systems for Hurricanes

## Surprises

- Photogrammetric mapping is not a priority during the response phase (but is later in recovery)
- Even if you can stream over 4G, still need a county/local expert embedded with the team because the missions require their expertise in real-time; do not have time to return and refly a mission because the remote expert noticed something and needed a different viewing angle.
- Flights are short (8-13 minutes) and line of sight; expert sees what they need to see and wants to move to the next area. Can't spend an additional 20 minutes flying a mapping mission when the maps won't be used for another week or two.
- A social worker should follow in a separate car to can answer questions from citizens and diffuse any public perception issues. People come over to see who is flying the UAV and always know someone who truly needs help, care
- There may be a high density of manned aviation flying low and fast, as well as a TFR; take advantage of UHF radios and ASB tracking systems to spot
- Be aware that UAS haven't been as helpful for documenting waterline on houses and buildings because of viewing angle of UAV and trees blocking houses
- State and local regulations, including privacy laws and right of entry, still apply during the response.
- Requests for any assets or deployments for municipalities and counties follow incident command, so the "Air Boss" (director of Air Operations Branch) will determine whether to use UAS or manned aviation assets and assign missions. Self-deployment is a no-no, working for a sheriff who has not coordinated with the Air-Boss is a no-no (just like flying a helicopter without coordinating would be).

## Data Management

- high resolution imagery from a single 20 minute flight can run around 2GB Won't be able to upload image sets to the cloud in the field, will have to courier data to where there is fast internet
- Recommend a summary slide of each flight so can find data later
- Enforce your chain of custody procedures as the data may be used later

## Most Common Missions during Response Phase (updated with data from Harvey, Irma)

- **Inspection of critical infrastructure:** dams/levees, bridges, key buildings, pipelines, sewage plants
  - Initial will involve structural experts on the field team to see if immediate threat to public safety or mitigation needs
  - Later imagery for desktop evaluation of all critical infrastructure does not require expert
- **Debris/wind damage/flood assessment**
  - Experts will have key or "spot" areas to look at, not interested in entire region
  - Also look for the unexpected: who's flooded? where? how bad? any roads open? And... what's that sheen on the water and where is that hazmat leak coming from? Are those propane tanks floating away?
  - the majority of flights will be visual assessment where experts will want to see in real-time and direct data gathering, not mapping
- **Strategic situation awareness**: Primarily for informing Inform the Public about the flood, impact on them or their relatives; put videos on YouTube
- **Tactical situation awareness**: Embed with ESF1, 8, 9... For tactical situation awareness-- Transportation, US&R, and other fields teams can carry very small UAS to pop up and look to see if roads are passable or alternative routes

## Less Frequent Missions

- Identify stranded livestock
- Provide oversight or spotting for swift water rescue
- Carry water bottles to trapped people but this can be dangerous since UAS aren't designed for delivery. A better approach might be to deliver a lightweight high strength fishing line that would be tied to a rope, etc., to solve the delivery problem
- Document land use and drainage issues to be resolved later
- Use for volumetric estimations of debris after the flood recedes (counties have usually have already contracted with ground teams)