

Best Practices to Reduce Fatigue in Small Unmanned Aerial Systems Pilots

Fatigue is a Real Problem, Just Like with Manned Aviation

- **After only a day at one deployment (Hurricane Harvey), pilots showed a level of fatigue impairments equivalent to those of alcohol intoxication at 0.05%, which is above the legal limit for manned aviation pilots (0.04%).** A 2019 human-robot interaction study sponsored by the National Science Foundation of 16 experienced pilots at Hurricane Harvey, Kilauea volcano, and Hurricane Michael showed that all pilots showed fatigue early in the deployment- even with regular shifts and sleep- and never really recovered. See “Human-robotic interactions (HRI) during natural disasters: Operator states assessments and improvements for effective HRI” by Peres, Mehta, Murphy, Nuamah, and Zhu, Applied Human Factors and Ergonomics Conference 2019.
- **Fatigue increases the possibility of human error**, either data that could be gathered from the sUAS is lower quality or lost, data takes longer to gather, the sUAS might violate regulations, have a collision or crash, etc.
- **Sources of fatigue have many causes:** lack of sleep or tiredness from traveling to the disaster, disrupted sleep schedules and surroundings during the deployment, wearing personal protection equipment such as gas masks or protective clothing, the physiological stress of being at a disaster, long days (or nights), etc.
- Clearly more research is needed that can inform standards and procedures, but fortunately there are things you can do now!

Before the Deployment ...

- Have squads that are truly trained and experienced *for disaster conditions*
 - Even better if they have worked together and thus are more comfortable backing each other up and noticing and alerting on problems

Incident Command/Team Leader During Operations ...

- Team leader sets (and follows) a shift schedule
 - if there is the possibility of night flights, hold a squad in reserve
- Team leader/Air Branch: give new missions or sensors only to the most experienced pilots; perform a risk analysis on paper, but maybe it will turn out that it's not worth it, especially as the risks increase with fatigue
- Remember the “8 hours bottle to throttle rule” and that alcohol interferes with restorative sleep
- Team leader includes reminders in daily briefings and after action reports

Squads and Pilots In the Field ...

- Within a squad, alternate sorties with pilots to change up cognitive demands
 - Ex, Pilot 2 is a Visual observer on sortie 1, then the Pilot 2 is the pilot on sortie 2, etc. This gives a rest by changing up the grind
- Each squad perform quality control after each sortie- make sure you got the data!
- Pilots use verbal rehearsals, verbal protocols (formal checklists), sterile cockpits- it is easy to get slack due to normal use but when we're tired, we really need these extra steps!
 - Also... Team leader and Safety Officer should remind pilots to do this, especially as the deployment continues
- Empower safety officer/visual observer to step in (really need the VO to be a trained pilot so that can see when assistance)
 - Also, remind everyone else to adhere to sterile cockpits