Collaborative Autonomy and Safety for Teamed Human – Unmanned Aircraft Systems in Fast Evolving Wildfire Environment

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Challenge

- Transforming wildfire management by enabling operational wildfire spread prediction and situation awareness for firefighters using a team of UASs.

Solution

- Cooperative fire and wind sensing and advanced data assimilation.

- Multi-UAS coordination and path planning in fast-evolving wildfire env.

- Human-directed autonomy to support teamed human-UASs collaboration.
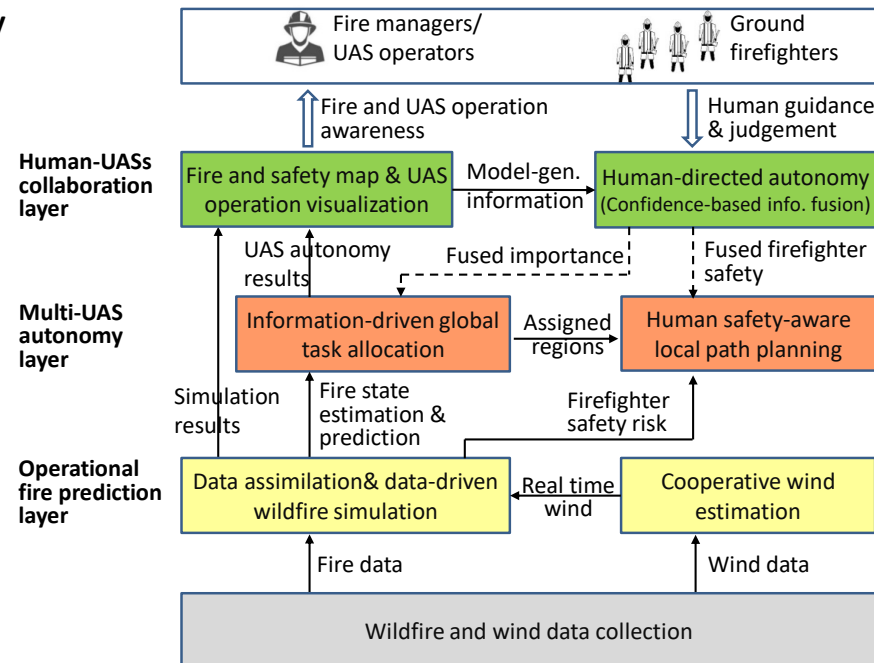
Scientific Impact

- Fill the critical gap of real time wind and fire data collection.

- New information-driven multi-UAS coordination and safety-aware path planning algorithms.

- New approaches of human-directed autonomy for human-UAS collaboration.

Broader Impact:

- Transform wildfire management through human-UASs collab.

- Education programs and outreach workshops.

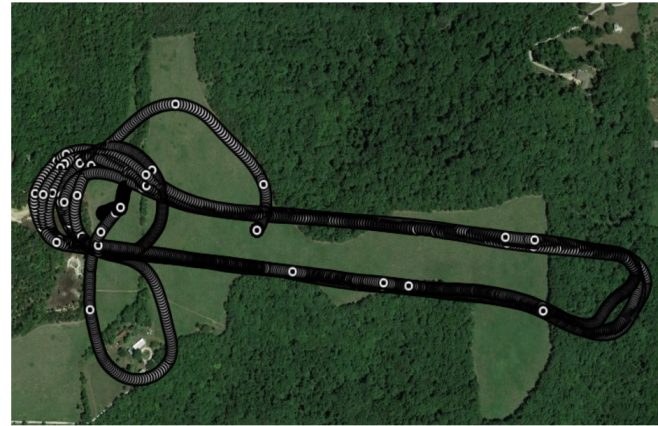## UAS Prescribed Fire Monitoring Experiment

Fig.1. GPS trajectory of KHawk UAS flight 1.

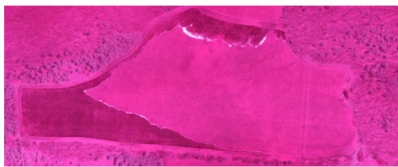**Fig.2.** GPS trajectory of KHawk UAS flight 2.

Fig.3. Ortho aerial map of the fire field during the burning, (left) RGB; (right) NIR+Red.

A prescribed burn was held on April 8th 2019 over a grassland at Baldwin City in Kansas, which is managed by Kansas Biological Survey (KBS). The land is about 400 meter long and 660 meter wide (30.5 acres).

KHawk UAS Platform

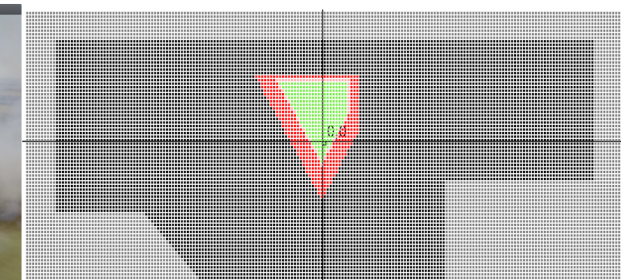**Fig. 4.** KHawk Zephyr3 UAS and KHawk Zephyr 55 – Thermal UAS.

Fig. 5: (left): picture of the prescribed fire towards the end of the burning (the picture was taken from east of the fire area). **(right)** simulated fire shape corresponding to the real fire shown on the left. Preliminary work show that simulation results roughly match the real fire over time. More comprehensive analysis is under way and will be presented in future work.