

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

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**Overview:** The objective of this project is to develop innovative research that can transform wildfire management by enabling operational wildfire spread prediction and situation awareness for firefighters using a team of unmanned aircraft systems (UAS).

## Key Problems and Significance

- Fire sensing and wind estimation using a team of UAS.
- Advanced data assimilation to enable data-driven wildfire simulation for operational wildfire spread predictions.
- UAS coordination and path planning algorithms governing UAS autonomy.
- Support teamed human-UAS collaboration.

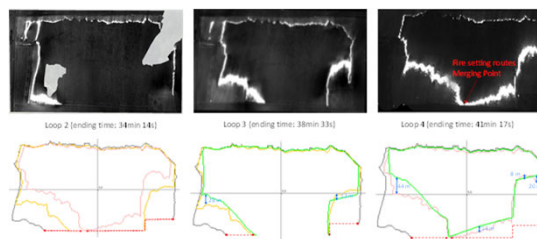
## Scientific Impacts

- The UAS-based fire and wind sensing fills the critical gap of real time data collection and data assimilation for operational wildfire spread prediction.
- The multi-UAS autonomy algorithms allow UAS to effectively collect the most useful information about dynamic wildfires and to ensure safety of firefighters.
- The project provides new ways for humans to direct UAS' autonomy and new approaches of using UAS to ensure human safety in challenging environments.

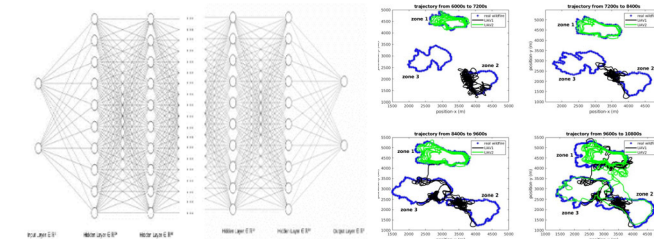
## Project Progress: 1. UAS platform and fire sensing



## 2. Fire spread simulation using UAS data



## 3. Path Planning based on NN and Q-Learning



## Broader Impact – Impact on Society

- Urgent need of advanced technologies for operational wildfire spread prediction and situation awareness for firefighters and people in and near wildfire areas.
- Benefit wildfire management and other civilian and defense emergency response applications where humans and UASs increasingly work together.

## Broader Impact – Education and Outreach

- Wildfire-UAS Field Trip program
- Annual outreach workshop series.
- New courses and learning materials.
- Open data repository hosting wildfire and UAS data. [https://cusl.ku.edu/index.php?title=Flight\\_Log](https://cusl.ku.edu/index.php?title=Flight_Log)
- Web-based prescribed fire simulation <http://firesim.cs.gsu.edu:3000/>

## 4. Workshop and Outreach

