

# Collaborative Autonomy and Safety for Teamed Human – Unmanned Aircraft Systems in Fast Evolving Wildfire Environment: Year 3 Summary

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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

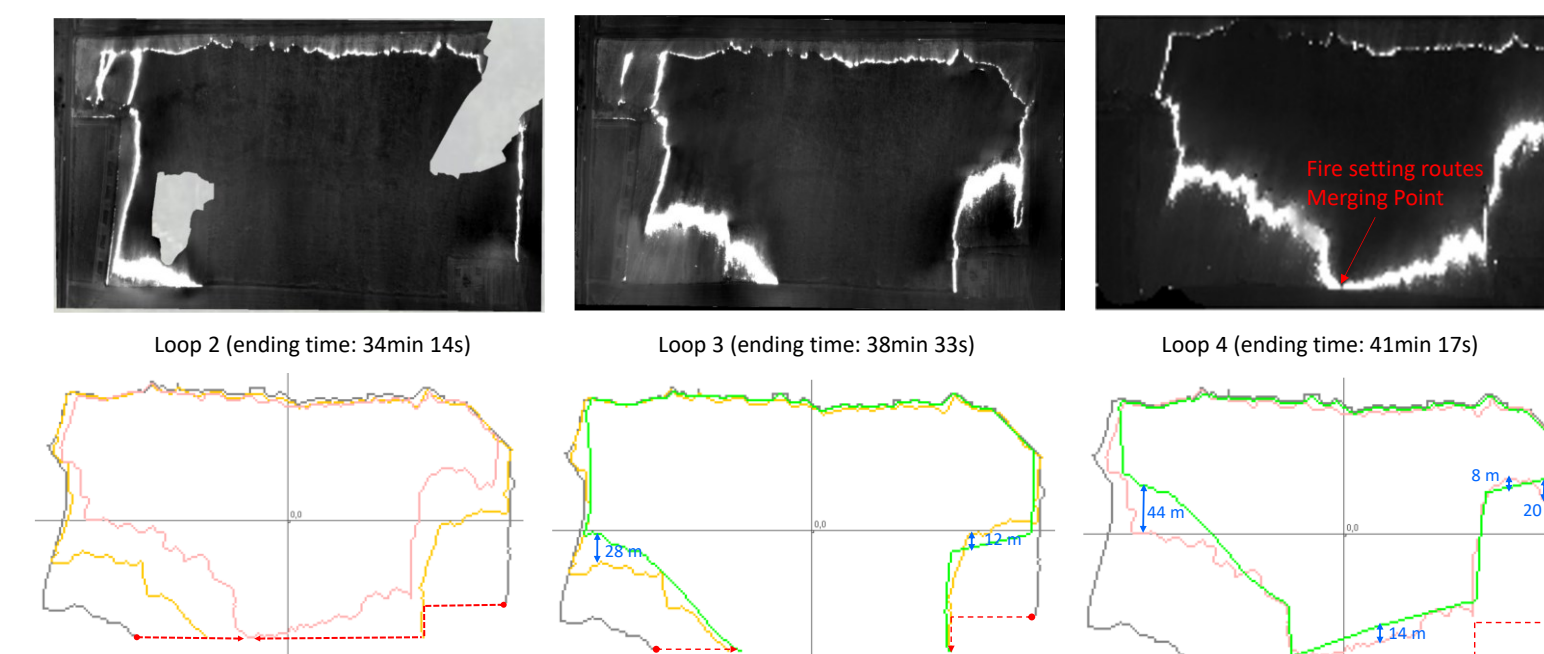
- The UAS-based fire and wind sensing fills the critical gap of real time data collection and data assimilation for operational wildfire spread prediction.
- The multi-UAS autonomy algorithms allow UAS to effectively collect the most useful information about dynamic wildfires and to ensure safety of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

## Progress in Year 3:

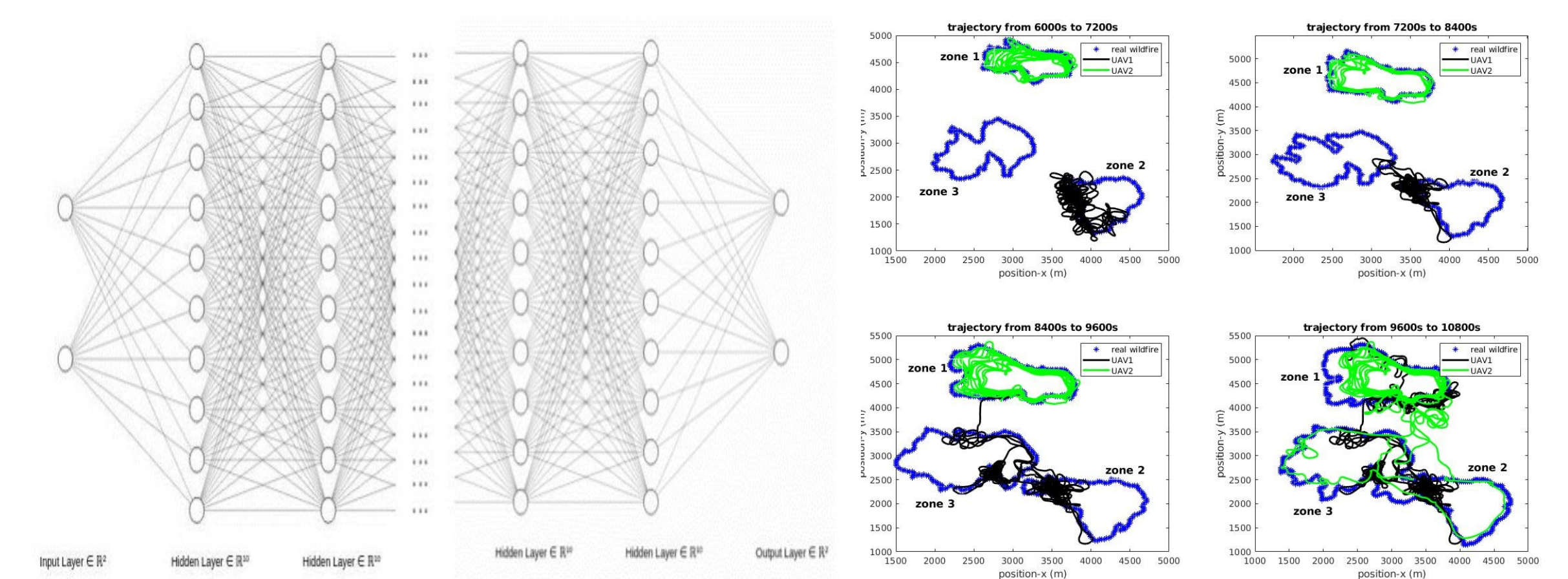
### 1. UAS platform.



### 2. Prescribed fire sensing and fire spread simulation.



### 3. Path Planning based on Neural Network Model 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 and share with research community.
- Web-based wildfire simulation portal open to the public.

### 4. Workshop and Outreach

