

Initial testing of the Uncrewed Aerial System Pilot kit (UASP-kit) in operational settings

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Wildland Fire Fighting

Problem: Wildland fire operations aren't easy:

- Conducted under adverse conditions
- Involve numerous organizations
- Limited or no communication and infrastructure
- Manual coordination to deconflict/use airspace
- Challenges with timeliness of information

The approach? Safe procedures with few technological advances

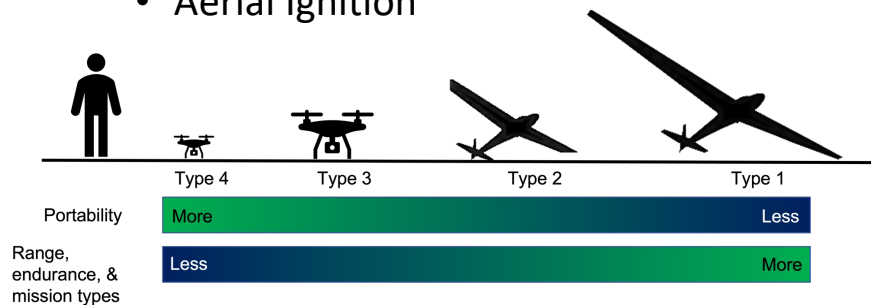
CAL FIRE Aerial Supervision Academy 2020
Redding, CA



UAS in Wildland Fire Fighting

Dirty, dull, or dangerous

- Situational awareness/IR/mapping
 - Real-time situational awareness
 - Spot fire detection
 - Videography or mapping
- Aerial Ignition



Aerial Ignition Academy 2022



McCash fire, September 2021
Klamath National Forest



UAS in Wildland Fire Fighting

- Complex airspace over a wildland fire
- Complex working environment
- UAS pilot (UASP) must ensure safety of flight and deconfliction
 - Coordinate and deconflict airspace
 - Maintain awareness of their airspace
 - Maintain line-of-sight with the UAS
- Different challenges for prescribed fire



Human/System interaction research: Developing the UASP-kit

Overall aim: Improve user situation awareness of the airspace

UAS operators have a limited view of airspace

- On the ground, in the woods with trees all around you
- Want a birds-eye-view of airspace
- Hard/impossible to measure in the field
- Development cycle must **nurture trust climate**



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Unmanned Aircraft System Pilot Kit (UASP-kit)

- ground-based 'technology-enhanced awareness' of the airspace
- self-contained & portable
- NASA prototype

#1 – needs to work offline

UASP-kit display & functions

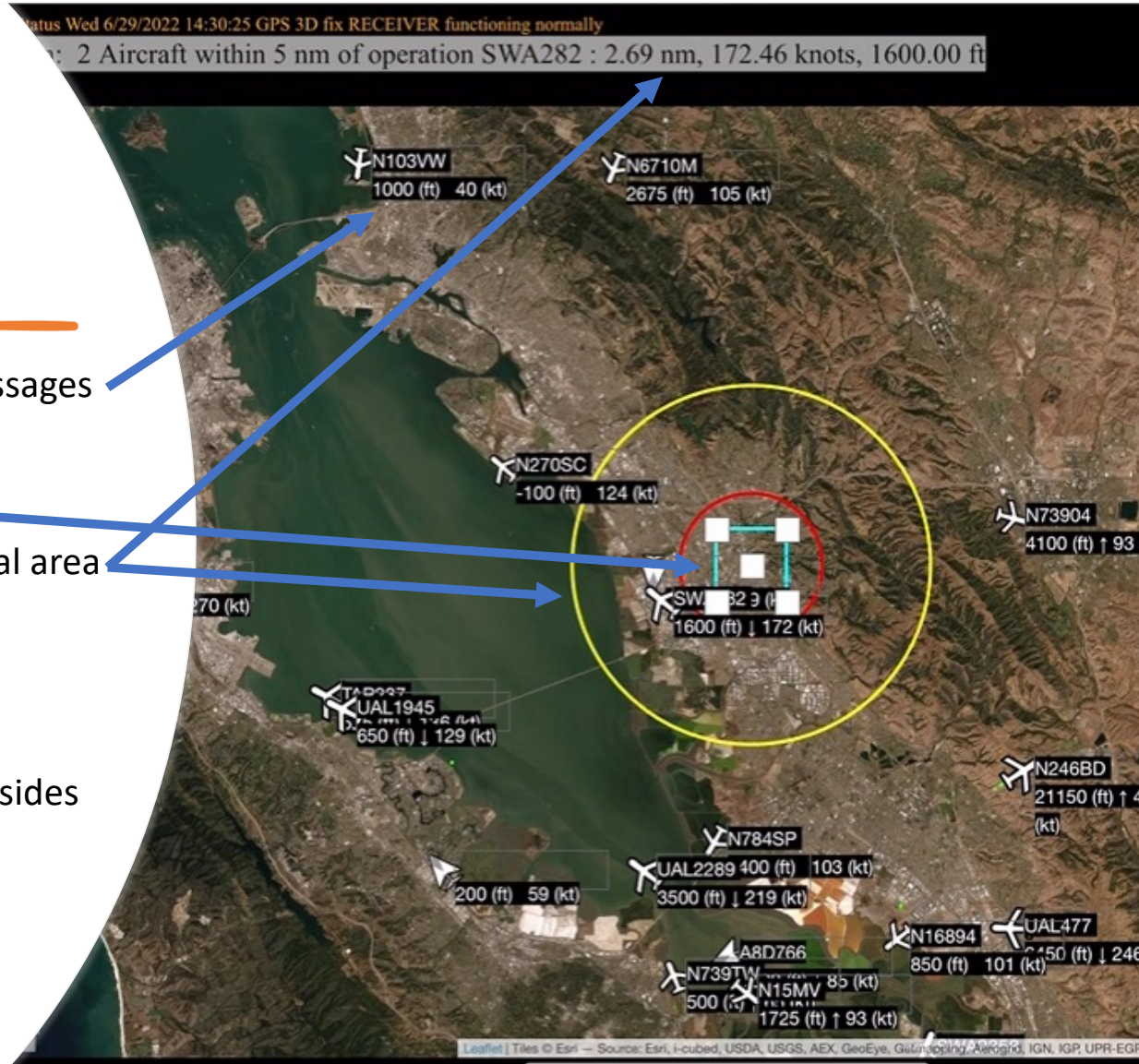
- Display aircraft positions from ADS-B messages
- Define a UAS operational area
 - When, where, altitude ceiling
- Alerting based on proximity to operational area
- Import and display georeferenced PDFs (GeoPDF)
 - Incident/fire maps are geoPDFs
 - geoPDF = maps that work offline (besides printed ones)

Optional

if you do have...

an internet connection = base map (satellite view)

enough GPS satellites = display your current location



Methods

Spring prescribed burn training

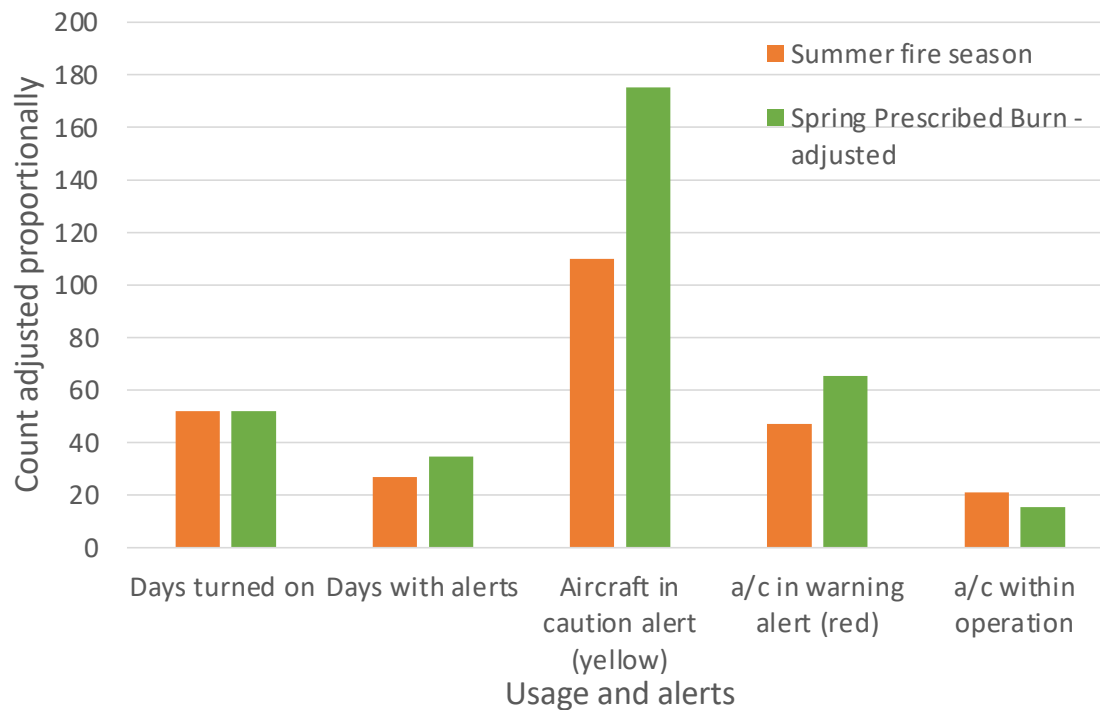
- Aerial Ignition Academy, Florida
- 1 week classroom 2 weeks field practice conducting live burns
- 4 groups of 6 trainees and 2 instructors
- Researchers shadowed 3 of these groups
- UASP-kit demonstrated to and used by 3 groups
- Collected log data and in-person feedback



Summer fire season

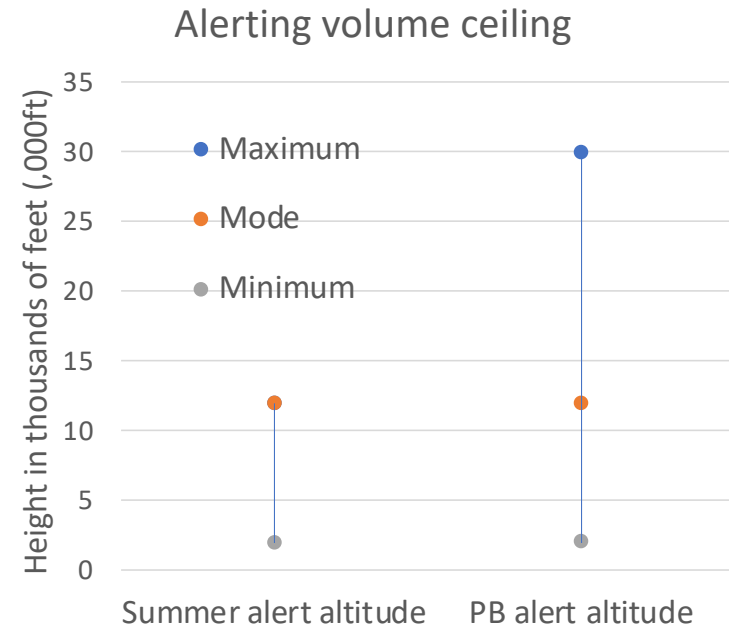
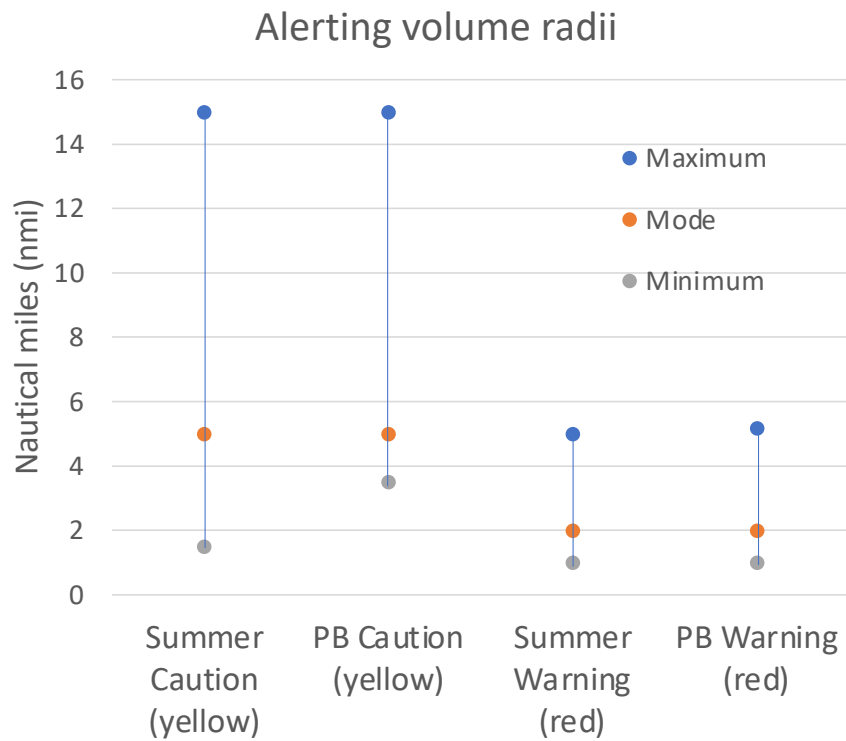
- 5 UASP-kits in the field for USFS and CAL FIRE to use
- Users changed with their work rotations
- Teams likely to be 2-person
- Use at user discretion
- Missions varied (area survey, IR, controlled burn, prescribed burn)
- Collected log data and feedback through phone interviews

UASP-kit usage



- UASP-kit was turned on for 27 prescribed burn flight days and 52 summer firefighting flight days
- Alerts on 50% of summer days and 66% of prescribed burn days
- More aircraft (proportionally) locally flying by (yellow) during prescribed burn, this reverses for aircraft very close in, inside the operation, to more aircraft during summer fire season

Alerting



PB = prescribed burn

Usability and feedback

- Easy to use
- Like the alerting

Many suggestions, including:

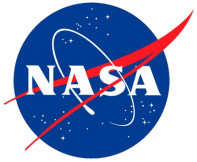
- Give more information in aural alert
- Reduce start up time
 - “Takes too long to get going”
- Improve our training materials
 - User guide was difficult to follow if no training was received
 - Improve general awareness of our UASP-kit tool



Summary

- UASP-kit was introduced during proficiency training and then used independently by UASP in the field
- UASP reported that the UASP-kit was useful
- It could support sUAS pilots' situation awareness
- Many suggestions for additional functions
- Confirmed that UASP-kit is used differently for different missions
 - Are there specific functions to support these different missions?
 - How do we assess that the UASP-kit adds value?





Thank you!

Questions?

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