

Advanced Capabilities for Emergency Response Operations (ACERO)

Lynne Martin
Wildland Fire Airspace Management sub-project

What are these aircraft doing?





How about these aircraft?





Small Uncrewed Aerial System (sUAS)



Developing the Uncrewed Aerial System Pilot kit (UASP-kit)

Lynne Martin
Wildland fire Airspace Management (WAM) sub-project

Why did we want to help?

Wildland firefighting is dangerous and risky

- It can be hard to see
- The fire can make its own weather

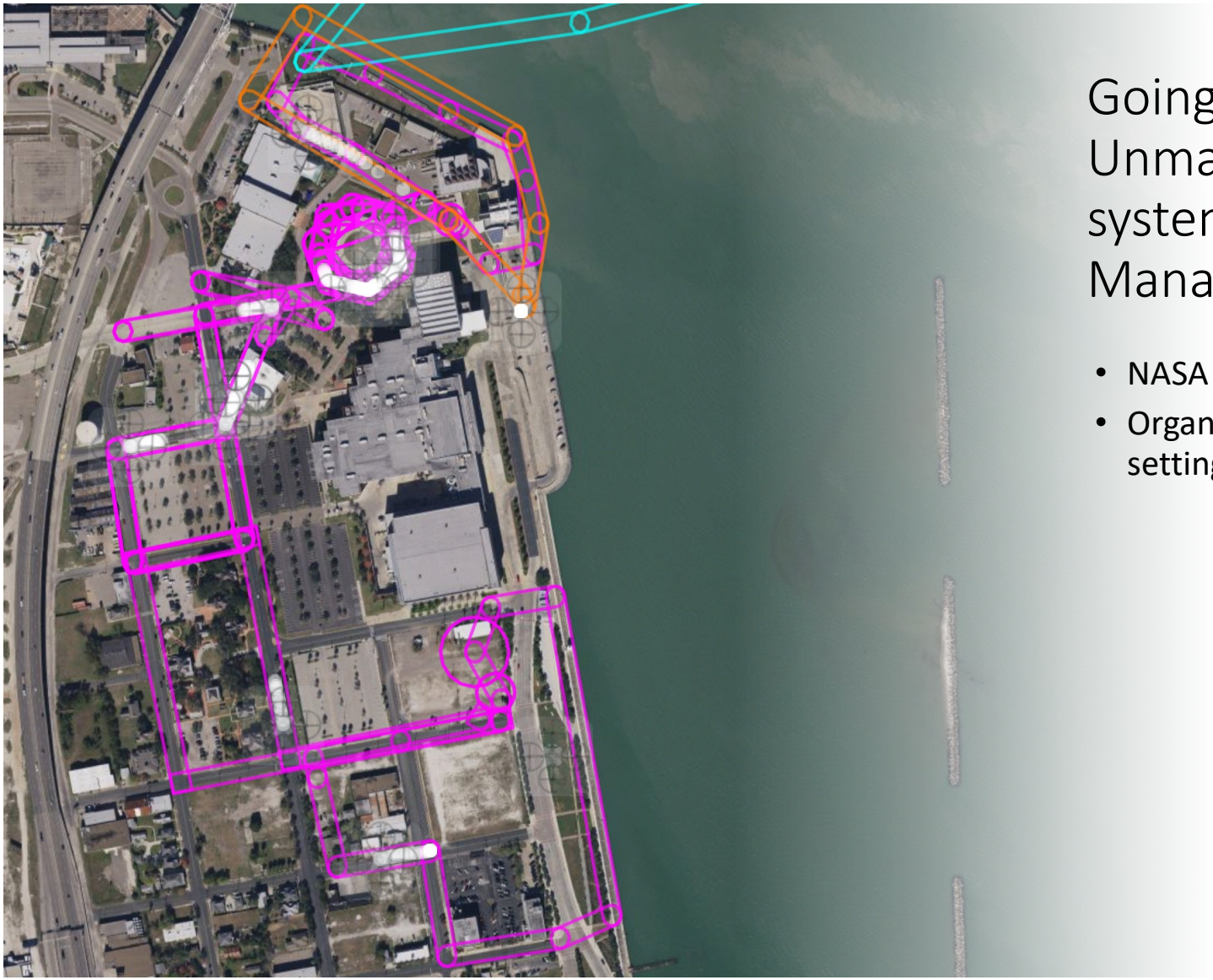
On the ground:

- The ground has lots of things to fall over and can be steep

And for aerial firefighting

- The airspace can be busy





Going back in time: Unmanned aerial system Traffic Management (UTM)

- NASA UTM project 2015-2019
- Organizing sUAS in urban settings

Walkthrough demonstrations

- We described our UTM-like ideas and showed them while aircraft were flying in training sessions overhead

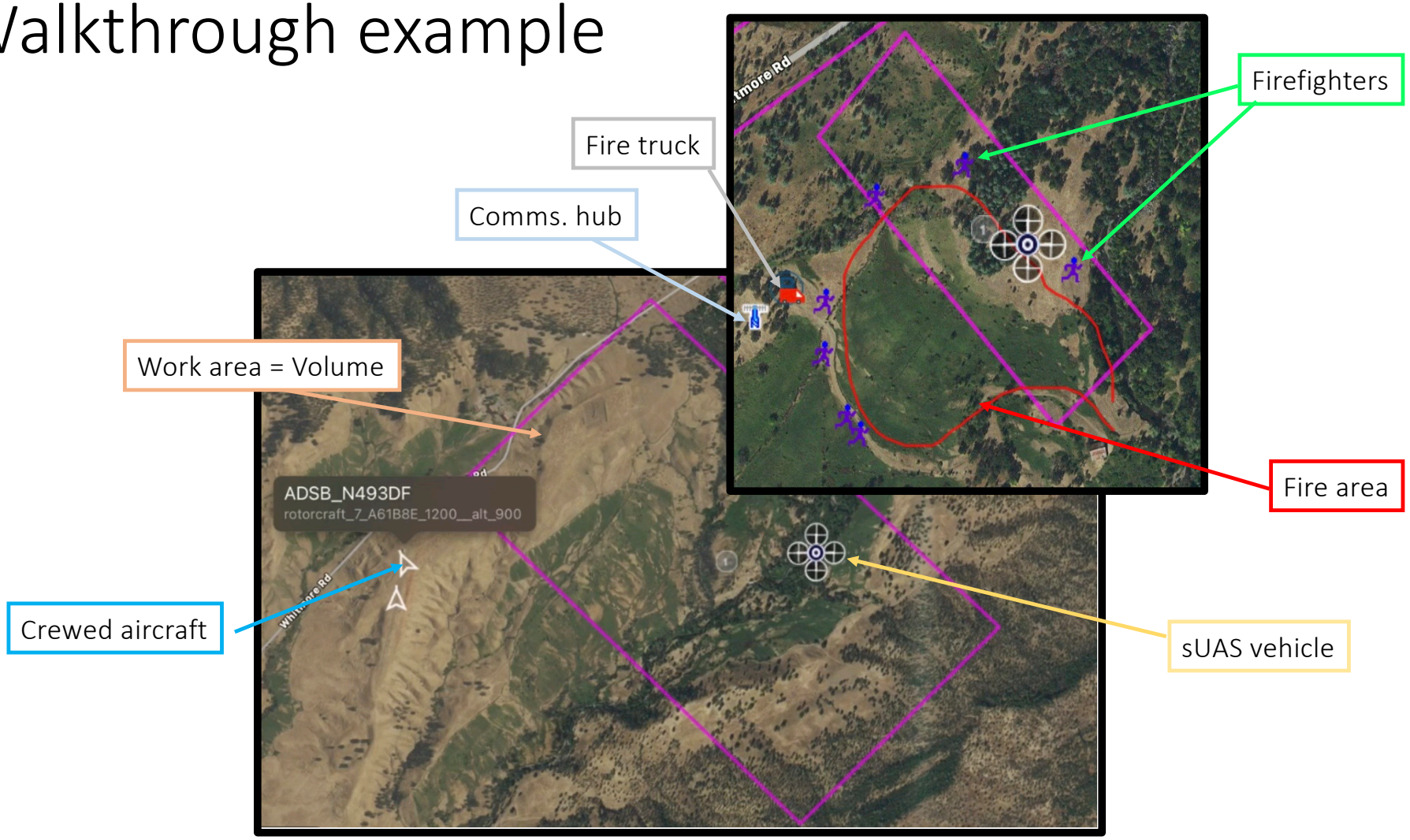




- And asked experts what they thought of our new STEReO work

STEReO = Scalable Traffic Management for Emergency Response Operations

Walkthrough example





UAS Pilot needs

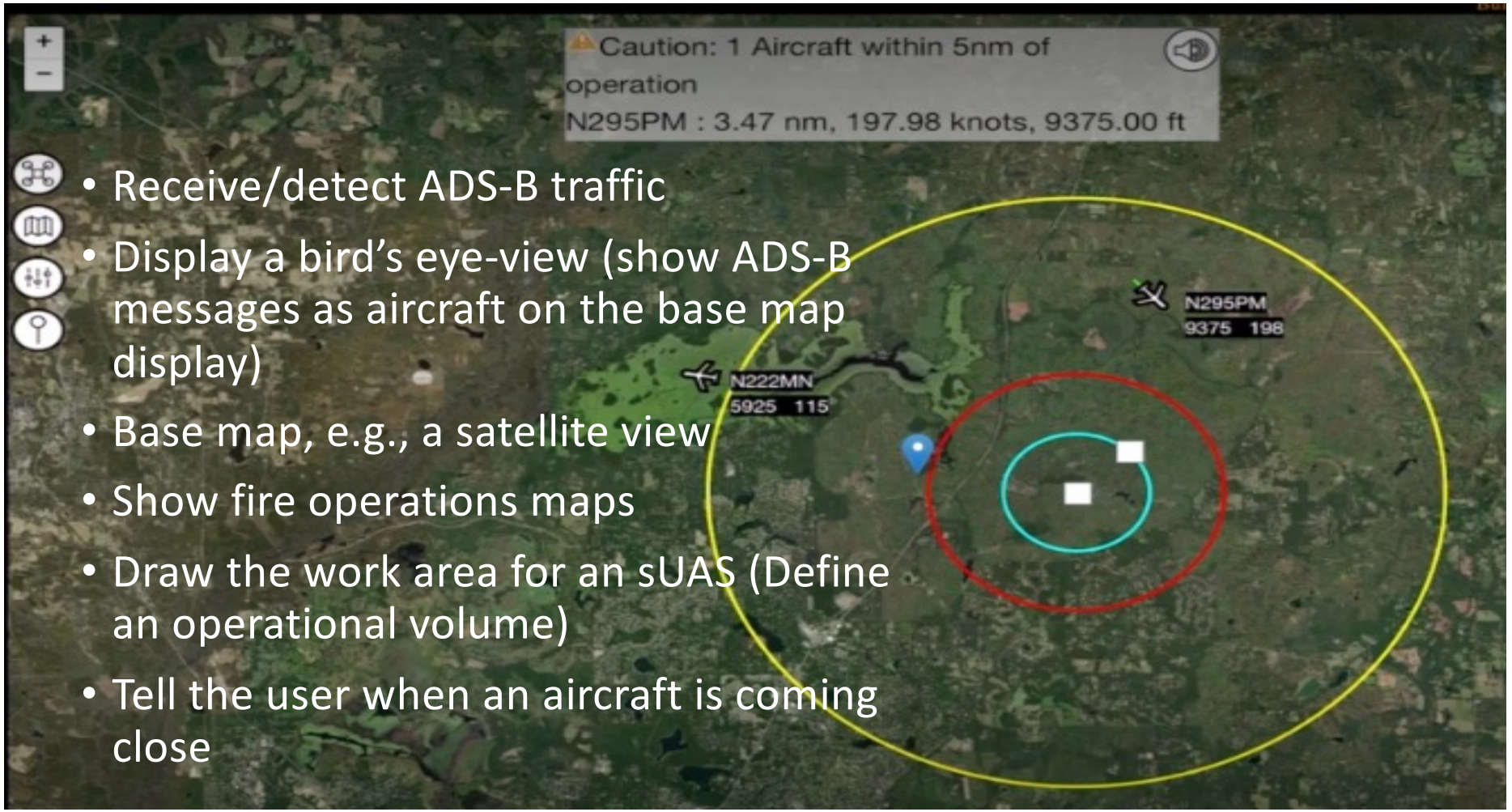
- Something to give UAS pilots an awareness of the airspace they are working in (local airspace)
- Has to work if there is no cell phone connections (off the grid)
- Has to work with its own power source
- Has to be portable
- Has to be easy to use



The UASP-kit



First functions of the UASP-kit



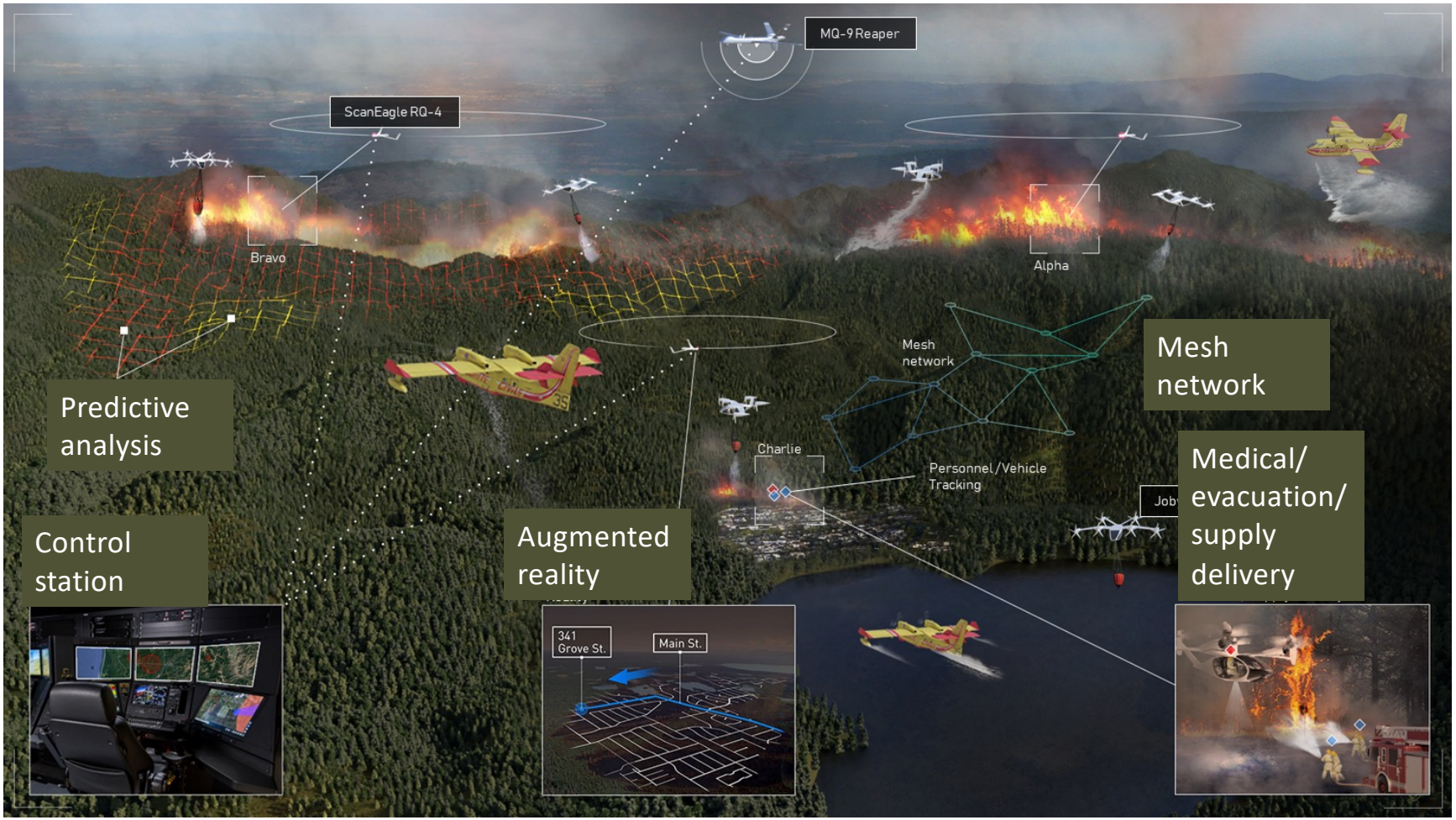
- Receive/detect ADS-B traffic
- Display a bird's eye-view (show ADS-B messages as aircraft on the base map display)
- Base map, e.g., a satellite view
- Show fire operations maps
- Draw the work area for an sUAS (Define an operational volume)
- Tell the user when an aircraft is coming close

Field testing





Our next steps: Wildland fire Airspace Management





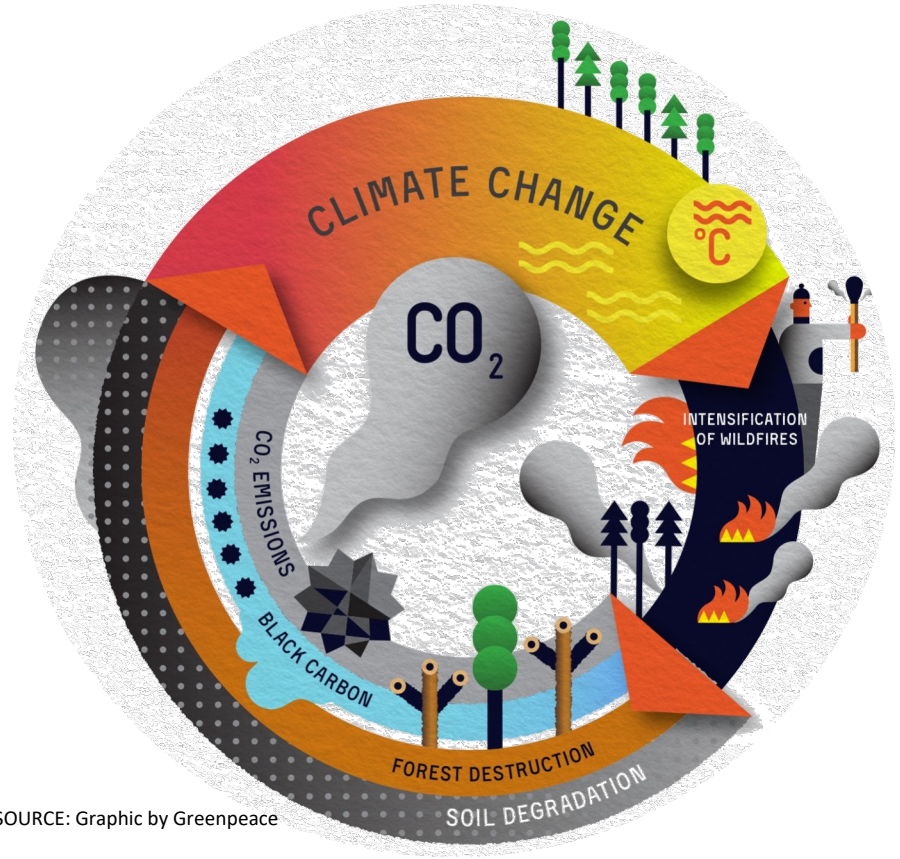
Thank you!

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NASA Ames Research Center

Many thanks to the USFS and CAL FIRE for their support

Wildfires and Climate Change: A Growing Problem



SOURCE: Graphic by Greenpeace

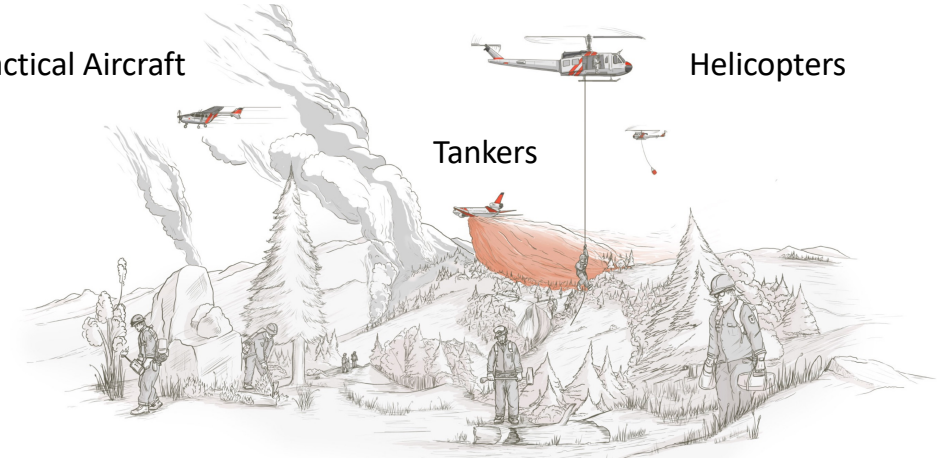
- **Increasing Wildfire Severity**:
  - Longer Fire Seasons (6-8 months long)
  - More Acres Burned (2020 wildfire season killed more than 30 people, destroyed some 8,500 structures, and torched 4 million acres of land)
- **Current Cost of Suppression**: costs in the United States have spiked from an annual average of about $425 million from 1985 to 1999 to $1.6 billion from 2000 to 2019
- **Economic Impact of Wildfires**:

$450 Billion	$100 Billion	$14 Billion
Cost of long-term health exposures related to US wildfires from 2008 to 2012, according to an EPA report	Overall cost of 2017 California wildfire season, estimated by Headwaters Economics	Headwaters estimate of the cost of fire suppression and insurance claims for property loss in the 2017 wildfire season

- **Societal Impact**: Disruptions to business, taxes, and tourism; residents left with soaring medical bills; and polluted air, soil, and waterways

Challenges for Wildland fire Operations

Aircraft are critical tools in managing wildfires



On Aug. 23, 2020 CAL FIRE used 95 aircraft to support California wildland fires

Aircraft uses for wildland fire management

- Deploy smokejumpers and rappelers to a fire
- Transport firefighters, equipment and supplies
- Supervise air tactical operations
- Provide reconnaissance of new fires, fire locations, and fire behavior
- Drop fire retardant or water to slow down a fire so firefighters can contain it
- Ignite prescribed fires

CHALLENGES

- Unmanned aircraft systems offer new opportunities to transfer risk from emergency responders
- Existing airspace management techniques are manual and cannot accommodate the demand for new types of aircraft (e.g., unmanned aircraft)
- Aerial firefighting is limited to acceptable conditions (no night operations)
- Monitoring and remote sensing missions are only conducted before/after aerial firefighting, or from satellite assets (orbiting every 4 hours)
- Lack of reliable and resilient data communications for quick information dissemination to support effective decision making

Technical Focus: Airspace Management

Challenge

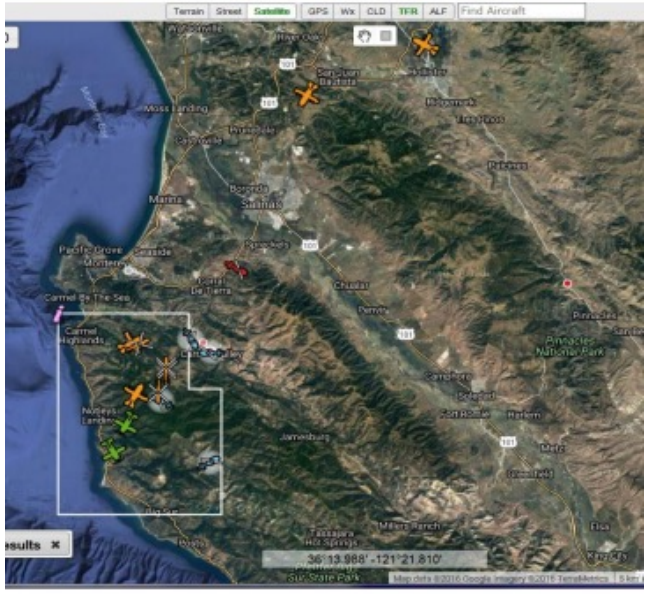
- Existing airspace management process very manual and slow
- Awareness of aircraft operations conducted by visual monitoring and radio communication (e.g., Airboss watches airspace from an aircraft)
- Unmanned systems are not easily integrated into operations
- Operations are limited by visibility and Airboss workload

Solution: Scalable Airspace Management Systems

Goal: Develop capabilities to support enhanced planning, monitoring, and deconfliction of aircraft operations supporting wildfire missions

- **Lead:** Develop an aircraft operator and Airboss toolkit that supports a portable airspace management system (e.g., UTM-in-a-box)
- **Leverage**: UAS Traffic Management (UTM) industry to operationalize airspace services and capabilities
- **Collaborate**: USFS and CAL FIRE to determine emergency responder needs and requirements

Benefit: Emergency responders can safely increase the scale of their aerial response to meet the needs of the operation



Key Deliverable: Portable Airspace Operations-System-in-a-Box to support safe and scalable wildfire operations