# Wildfire Mitigation R&D

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# Outline

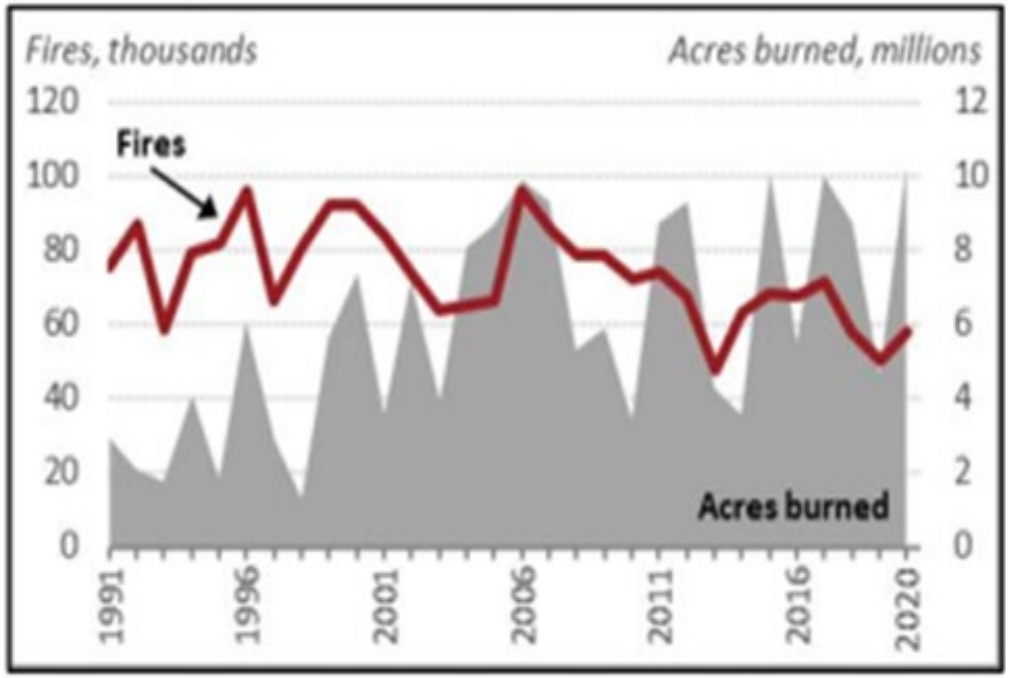
- Wildfire Impacts
- Needs Assessment and Current State-of-the-Art
- Approach
- Key Areas of Impact
- Risks
- Summary

# Wildfire Impacts

- Total suppression costs
  - 5-year average $2.351B
  - 10-year average $1.910B
- 10-year average
  - 20,510 fires
  - 1,048,649 acres
- 2020 Statistics
  - 58,950 fires and 10,122,336 acres
- **2021 Statistics (as of 8/2/21)**
  - **34,014 fires, and 3,079,748 acres**

https://fas.org/sgp/crs/misc/IF10244.pdf
https://www.nifc.gov/fire-information/statistics

**Annual Wildfires and Acres Burned**
**(1991-2020)**




**Source:** NICC Wildland Fire Summary and Statistics annual reports.
**Note:** Data reflect wildland fires and acres burned nationwide, including wildland fires on federal and nonfederal lands.

Wildfires contribute to climate change and climate change increases likelihood of wildfires

# Needs Assessment Workshop

**NASA ARMD, in collaboration with SMD, STMD and US Forest Service, conducted a workshop to understand the state-of-the-art, needs, and opportunities to improve wildfire management**

- Identify the needs and challenges of stakeholders at various decision cycles from planning, prediction, detection, tracking, mitigation, suppression, and post-fire remedial efforts
- 154 attendees from other government organizations, academia, industry, and NASA

**Main Findings**

- Lack of persistent surveillance for fire detection and tracking
- Lack of persistent communications
- Lack of persistent aerial operations particularly under poor visibility
- Lack of airspace technologies to enable multiple types of aircraft operating simultaneously
- Lower aircraft safety record than other areas of aviation
- Lack of adequate coordination among multiple government agencies
- Need a clear plan to mature research for operational use in the field

Findings offer insights where NASA SMD and ARMD research and development could make a significant impact

# Current Wildfire Management Operations and Challenges

**Detection Tracking,  Surveillance, and Prediction**

- Surveillance - infrequent satellite or aircraft observations (satellite every 4 hours)
- Fire detection accuracy is not precise enough for effective targeting
- Few models for tracking and predicting fire progress, many are unreliable
- Better sensing is needed, difficult to observe through cloudy conditions
- Data and model fusion is limited

**Aerial Suppression Support**

- Duration of aerial firefighting limited to daylight, clear visibility (4-6 hours/day)
- Airspace operations is manual and workload intensive; only a few aircraft allowed at a time
- Not able to accommodate drones in the same airspace as other aircraft
- Lower aircraft safety record in aerial firefighting than other areas of aviation

**Multi-Agency Planning**

- Multi-agency collaboration for resource and technology roadmap does not exist
- Current focus on tactical firefighting, low investment in R&D and strategic planning

# Key Areas of NASA Impact

## Inter-agency unified concept of operations

- Support development interagency concept of operations to ensure consistency of operational priorities, technology adoption, and programmatic alignment for national needs

## Airspace management for near 24x7 continuous operations

- Airspace operations system-in-a-box for common situational awareness
- Enable simultaneous and coordinated operations of diverse vehicles

## Sensing, data fusion and models integration for better prediction (with SMD)

- Increase access to reliable surveillance data and fire prediction models for in-time decision-making for planners and firefighters
- Develop advanced sensor fusion and fire prediction models

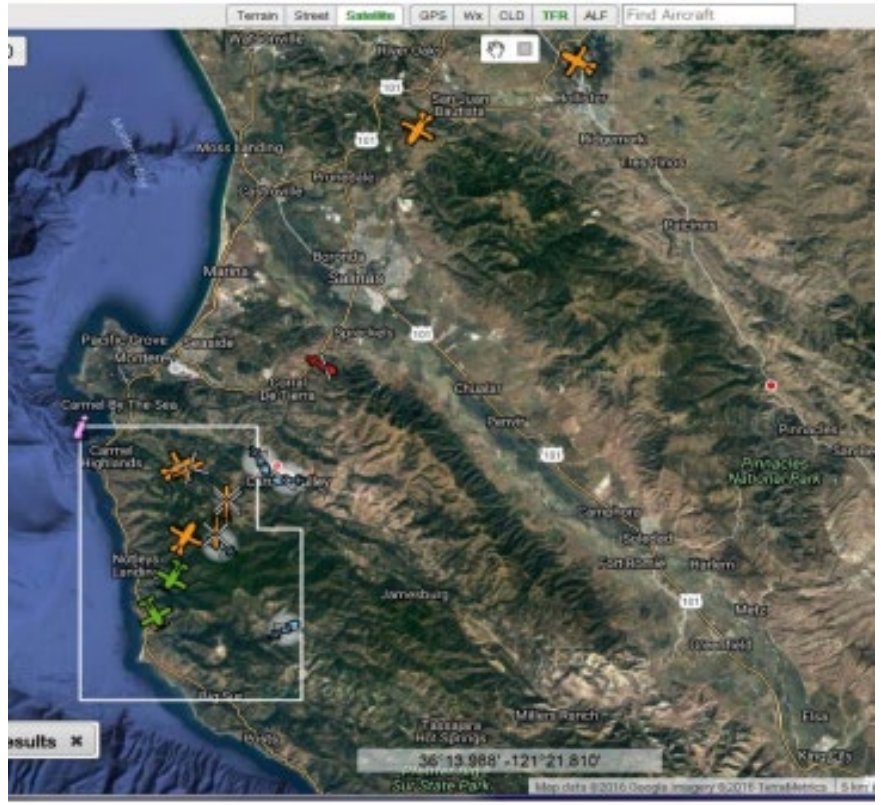
# Key Areas of NASA Impact

**Aircraft capabilities for safe operations in adverse environments**

- Expand operational envelope with aircraft technology for terrain avoidance and aircraft state management

**Persistent, integrated, diverse manned and unmanned airspace operations**

- Integrated system requirements, design and prototype for persistent surveillance and operations with multiple diverse vehicles for increased aerial response to wildfire




NASA's prior research in airspace, aircraft, sensing, surveillance, communications, and data management is highly relevant

# Summary

- Wildfires will continue to be an increasing risk to the environment and our communities. Each year, wildfires are becoming more frequent and devastating and the cost of suppression is quickly outpacing budgets for those operations

- NASA has had significant engagement with the wildfire community. This will be at risk if follow on engagement and technology development is not funded

- Ongoing ARMD efforts will further objectives in air traffic management, UAS/UAM operations, and in-time safety assurance that will benefit the wildfire use case but not directly address to the wildfire community needs

- Sensor and surveillance capabilities will continue to be employed in disaster response

Without a cohesive, multi-organizational approach, only modest improvements to wildfire response will be possible