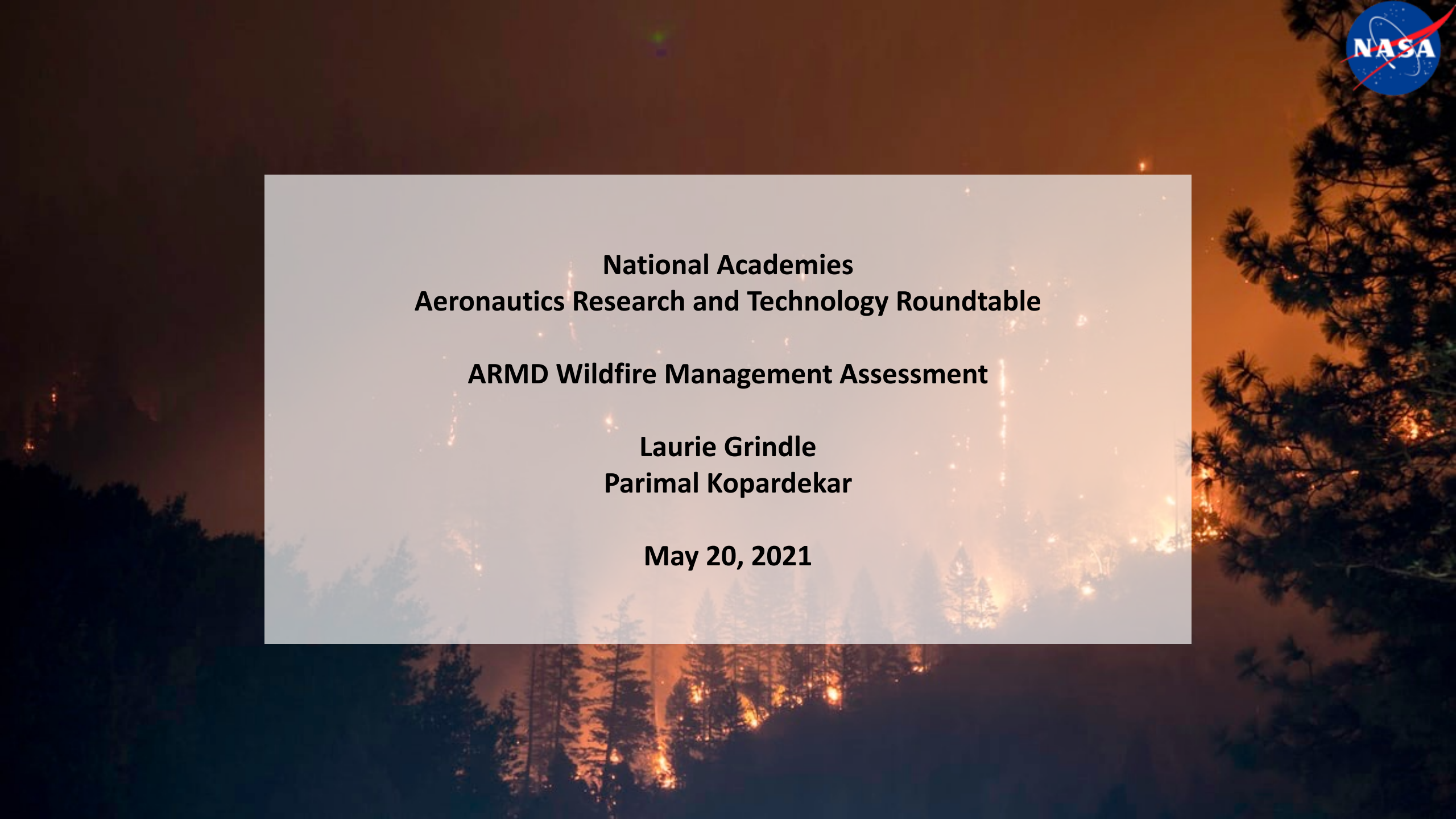


National Academies
Aeronautics Research and Technology Roundtable

ARMD Wildfire Management Assessment

Laurie Grindle
Parimal Kopardekar

May 20, 2021

Wildfire Management Assessment Goals & Activities

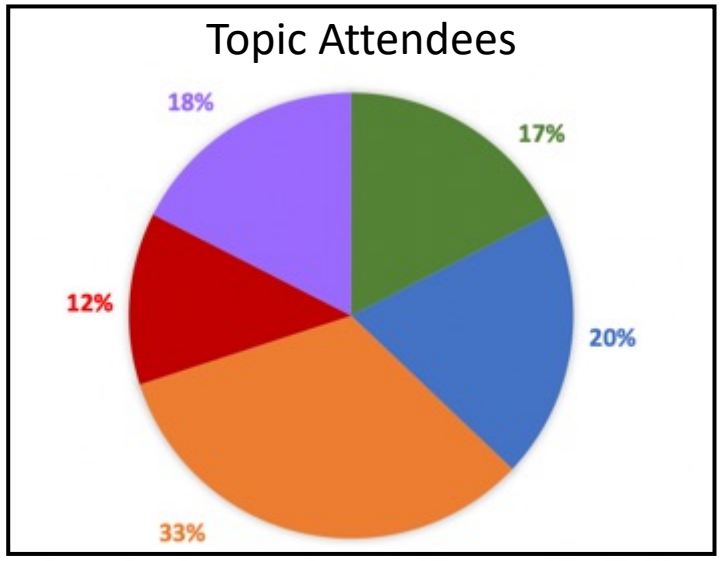
- Background
  - Wildfires are a growing problem as a result of climate change
  - Current aerial wildfire fighting is limited in its operations (VMC, daytime, low wind, manual)
  - Aviation plays a key role in wildfire management, but could NASA aid in its advancement?
  - Opportunity for comprehensive NASA impact (aeronautics, science, and space)

- Wildfire Management Assessment Team
  - Stood up to listen to the wildfire community and identify their needs/gaps
  - Work internally to NASA to assess what we could provide to address those gaps right away and longer term

- Approach
  - Conduct internal ARMD inventory assessment
  - Engage discussion with SMD and STMD
  - Engage discussion with wildfire community leaders (CAL FIRE, USFS, others)
  - Wildfire Management Assessment RFI: https://nari.arc.nasa.gov/wildfiremgmt
  - Conduct an information-gathering workshop with the wildfire community – held May 13
  - Develop plans and implement activities for near, mid, and far-term
  - Identify potential cost sharing partners

Workshop Goals, Objectives, and Approach

- Understand the comprehensive needs of 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
  - Spans near-term (< 3 years), mid-term (3 – 7 years), and long-term (10+ years) needs
  - Needs will reflect the various agencies and roles that are involved in wildfire management
- Breakout sessions are the means to gather needs and hear directly from the wildfire community



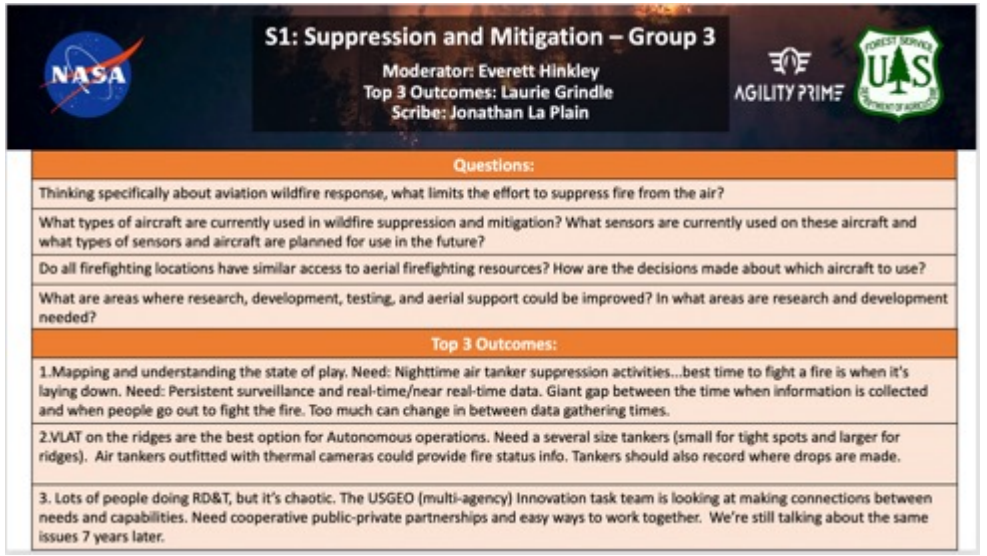
Planning for Fire Season

Prediction Modeling and Challenges

Aerial Fire Surveillance

Suppression and Mitigation

Post-Fire Remedial Efforts

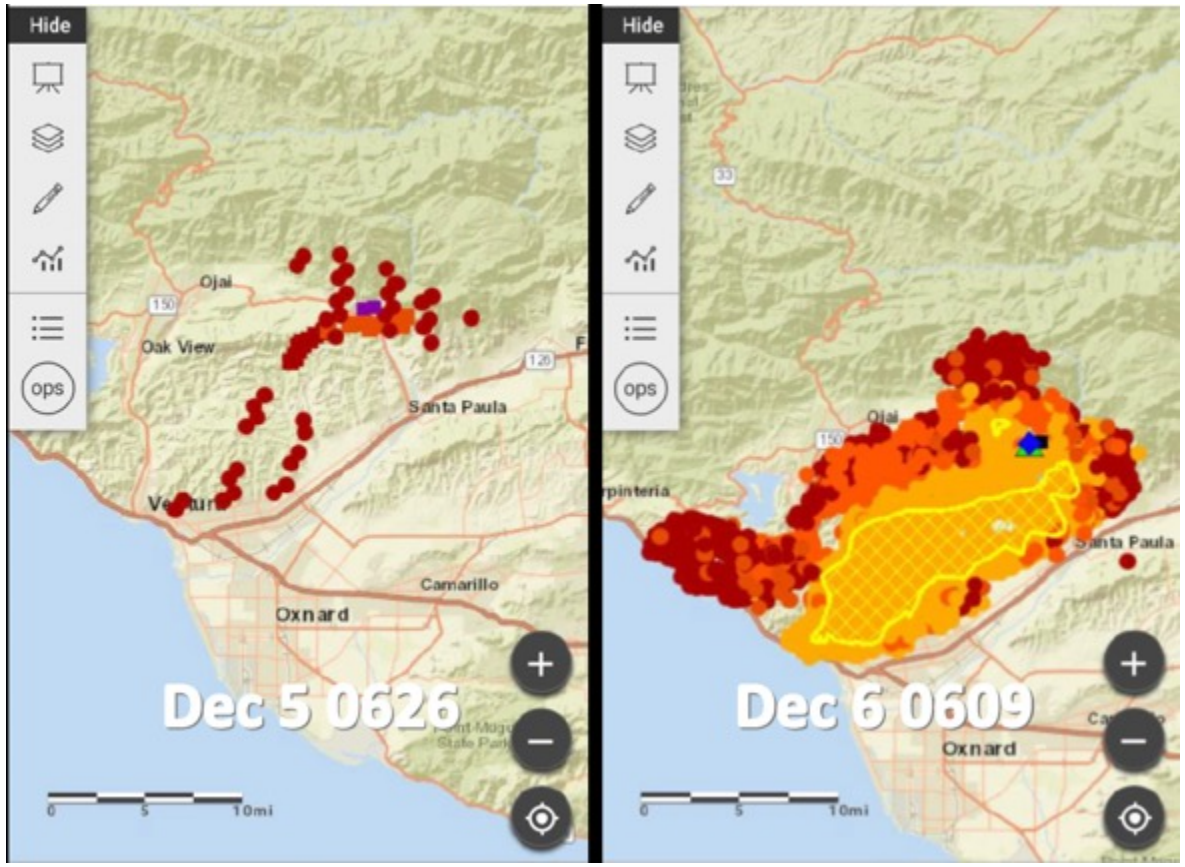


S1: Suppression and Mitigation – Group 3

Moderator: Everett Hinkley
Top 3 Outcomes: Laurie Grindle
Scribe: Jonathan La Plain

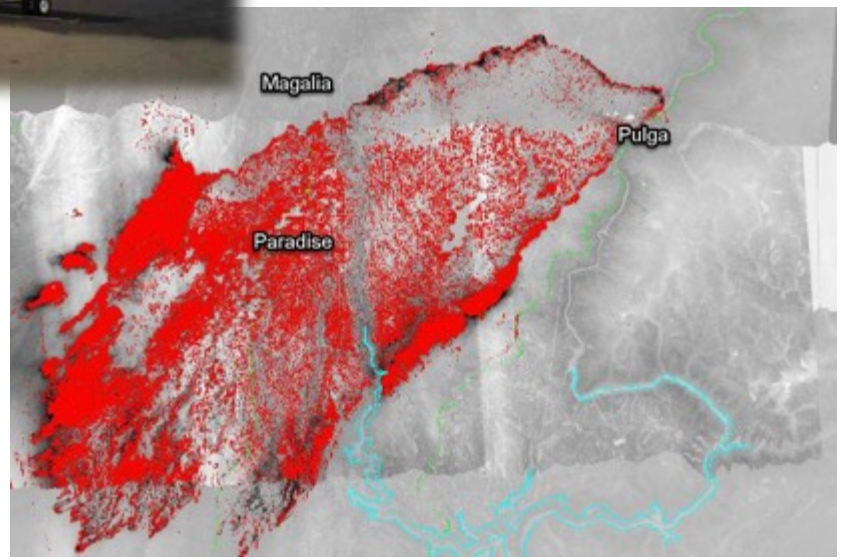
Questions:
Thinking specifically about aviation wildfire response, what limits the effort to suppress fire from the air?
What types of aircraft are currently used in wildfire suppression and mitigation? What sensors are currently used on these aircraft and what types of sensors and aircraft are planned for use in the future?
Do all firefighting locations have similar access to aerial firefighting resources? How are the decisions made about which aircraft to use?
What are areas where research, development, testing, and aerial support could be improved? In what areas are research and development needed?
Top 3 Outcomes:
1.Mapping and understanding the state of play. Need: Nighttime air tanker suppression activities...best time to fight a fire is when it's laying down. Need: Persistent surveillance and real-time/near real-time data. Giant gap between the time when information is collected and when people go out to fight the fire. Too much can change in between data gathering times.
2.VLAT on the ridges are the best option for Autonomous operations. Need a several size tankers (small for tight spots and larger for ridges). Air tankers outfitted with thermal cameras could provide fire status info. Tankers should also record where drops are made.
3. Lots of people doing RD&T, but it's chaotic. The USGEO (multi-agency) Innovation task team is looking at making connections between needs and capabilities. Need cooperative public-private partnerships and easy ways to work together. We're still talking about the same issues 7 years later.

Known Challenges Confirmed Through Workshop



- Satellite-based fire detection
- Only 4 fire snapshots per day
- Some stakeholders augment with military data

National Infrared Operations Program (NIROPS)



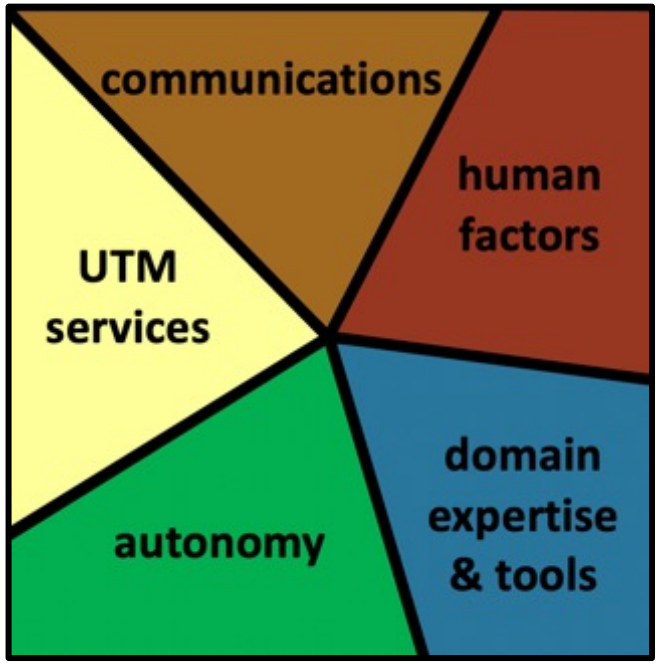
- Only 1 aircraft currently operational
- Provides infrared images of fires from aerial platform
- Single nightly snapshot of fire perimeter

Wildfire Management Assessment Next Steps

- Consolidate and analyze the needs, challenges, and barriers to wildfire management from:
  - RFI
  - Workshop Breakout Sessions
  - Additional Wildfire Management Challenges Feedback form: https://nari.arc.nasa.gov/armd-wildfire-workshop/
- Assess potential NASA technologies and capabilities to address those needs
  - Identify the next steps and potential obstacles to their implementation
- Identify opportunities for collaboration with other government agencies, academia, and industry to address needs and improve state of the art in wildfire management
  - Planning another RFI to engage industry, academia, and other stakeholders
  - Considering a working group or other joint activity for ARMD in collaboration with STMD/SMD and other agencies

Potential ARMD Technologies/Capabilities - Current Activities

- Scalable Traffic Management for Emergency Response Operations (STEReO)
  - NASA developed Unmanned Aircraft Systems Traffic Management (UTM) concept and technology to enable large-scale small unmanned aircraft operations in the same airspace as other manned aircraft operate
  - STEReO builds on UTM and focuses on emergency operations such as wildfire
  - Initial proof of concept was also shown together with JAXA's Disaster Network (D-NET/UTM) program
  - Combining NASA technologies and partnerships to transform current-day emergency response operations
  - Recently completed testing in collaboration with Cal Fire and USFS where manned and unmanned aircraft operated in the same airspace.
    - Live NASA sUAS vehicles, as well as piloted CAL FIRE aircraft
    - Simulated NASA sUAS vehicles exercising functions of autonomy
    - STEREO provided a common situation awareness and operating picture to ensure safe operations (including on mobile device)



Potential ARMD Technologies/Capabilities - Initial Reflections from Workshop

- Persistent Surveillance by aerial assets
  - Systems approach for surveillance of fires
  - Combination of satellite, manned aircraft, unmanned aircraft cameras, and local reports
- Analyze different types of aircraft and their capabilities to address increasing aerial firefighting needs
  - From VMC to increasingly IMC and night-time conditions
    - Movement towards 24X7 persistent operations including autonomous aircraft
  - Identifying that the type of aircraft used meet the needs
    - Narrow locations to mountain ridges
- Persistent and reliable communication regardless of location
- Methods to ensure safe operations under GPS degraded and communication challenged environment
- Common situation awareness and integrated airspace operations
- Data and models to accurately predict fire trajectory and support firefighter decision making
- Integration of current data and models related to location of fires
  - Many data and models but not unified and integrated
- Testing efficacy of various retardants under variety of wind conditions

Wildfire Management Collaboration Opportunities

- Agility Prime
  - Autonomous eVTOL aircraft
  - Command, control, and communication
  - Holds a firefighting use case stakeholder integration meeting/working group
- GoFly Wildfire Challenge
  - Currently fund raising
  - Exact focus is being decided
- California Wildfire Management Efforts
  - Wildfire Management Proposal - Anthropocene/Peter Shannon
    - Philanthropists are interested in changing the state-of-the-art
    - Governor's office is keen on resiliency, firefighting, and overall well being of forests
  - Keck Institute for Space Studies Workshop - George Whitesides
    - Real Time Detection and Tracking of Fires that Matter
    - Looking for private investments to support additional detection and tracking efforts

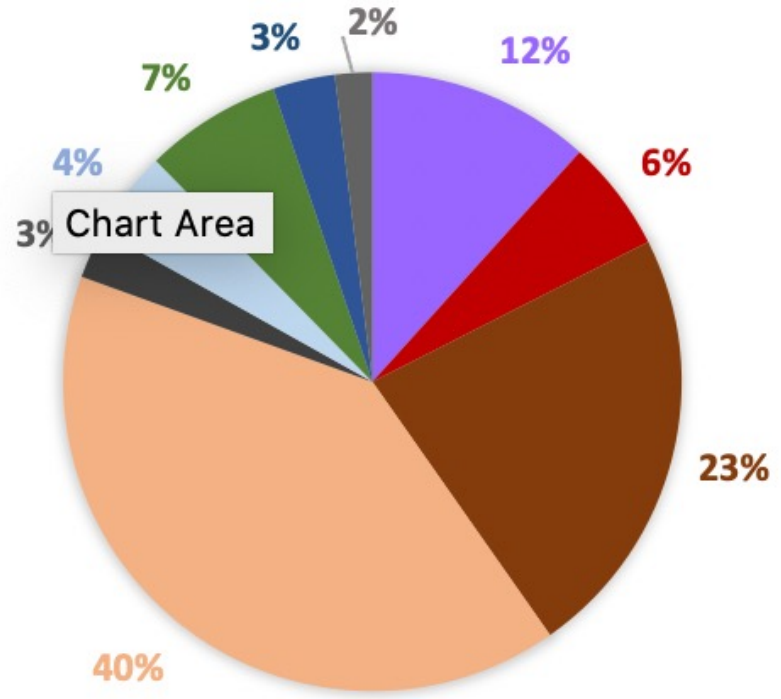
Summary and Discussion

- Summary
  - Wildfire Management Assessment is an opportunity to bring the larger community together to improve the state of the art in wildfire management
  - Intend to look for opportunities to collaborate within NASA and with other government agencies, academia, and industry

- Discussion
  - Looking for some feedback on how you view this as an opportunity to solve the growing wildfire problem in the context of public/private partnerships and even a market
  - Are there creative ways to look at this and monetize this so we can bring technologies and industry that knows how to innovate and solve problems to the table?

Backup Slides

Workshop Attendee Organizations



- Academia
- DoD/ DHS
- Industry
- NASA
- Other
- State & Local Municipality
- USFS
- USGS
- USRA

S1: Suppression and Mitigation – Group 3

Moderator: Everett Hinkley
Top 3 Outcomes: Laurie Grindle
Scribe: Jonathan La Plain

Questions:
Thinking specifically about aviation wildfire response, what limits the effort to suppress fire from the air?
What types of aircraft are currently used in wildfire suppression and mitigation? What sensors are currently used on these aircraft and what types of sensors and aircraft are planned for use in the future?
Do all firefighting locations have similar access to aerial firefighting resources? How are the decisions made about which aircraft to use?
What are areas where research, development, testing, and aerial support could be improved? In what areas are research and development needed?
Top 3 Outcomes:
1.Mapping and understanding the state of play. Need: Nighttime air tanker suppression activities...best time to fight a fire is when it's laying down. Need: Persistent surveillance and real-time/near real-time data. Giant gap between the time when information is collected and when people go out to fight the fire. Too much can change in between data gathering times.
2.VLAT on the ridges are the best option for Autonomous operations. Need a several size tankers (small for tight spots and larger for ridges). Air tankers outfitted with thermal cameras could provide fire status info. Tankers should also record where drops are made.
3. Lots of people doing RD&T, but it's chaotic. The USGEO (multi-agency) Innovation task team is looking at making connections between needs and capabilities. Need cooperative public-private partnerships and easy ways to work together. We're still talking about the same issues 7 years later.