NASA
Aeronautics Research Mission Directorate (ARMD) Wildfire Management Workshop

WRAP UP

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Wrap Up

- Common themes of needs
  - Persistent surveillance
  - Systems level approach for figuring out type of aircraft to match needs
  - Common operating picture
  - Consistent communication
  - Real-time or near real-time data
  - Better coordination and data sharing across (federal, state, and local governments)
  - Standards for data integration
  - Artificial Intelligence (AI) and Machine Learning (ML)

S1: Planning for Fire Season – Group 2

Moderator: Cheryl Quinn
Top 3 Outcomes: Chuck Johnson
Scribe: Richard Walsh

Questions:
Agency Coordination: How are new technologies tested and introduced into pre-fire season/planning operations today and how might this be better supported in the future?
Where are the opportunities to improve planning across multiple agencies?

Top 3 Outcomes:
1. Establish an interagency process template for States and Federal entities to establish rapid agreements and associated training/understanding to support wildfire activities. The CalFire processes were cited as a model for this.
2. DoD and NASA understand how to assess situations and develop tactics/strategies. Neither are members of National Wildfire Coordinating Group (NWCG)…formalize partnership with DoD and NASA. This will help collaboration on physic-based modeling, other advanced computing techniques, and data collection/distribution techniques.
3. There is a requirement for timely and actionable real-time information (real-time wind/weather predictions and real-time detection, tracking, and prediction of fires). Information collection could also include predictive efforts such as monitoring tree mortality. Rothermel model needs to be updated based on today's wildfire challenges. Collaborate on data collection techniques and advanced computing techniques could be beneficial. Consider leveraging other similar real-time processes and data solutions for disasters such as volcanoes, earthquakes, floods, etc.

S1: Aerial Fire Surveillance – Group 1

Moderator: Raj Malhotra
Top 3 Outcomes: Parimal Kopardekar (PK)
Scribe: Alan Hobbs

Questions:
What are typical challenges for aircraft that conduct fire surveillance operations? When is the aircraft surveillance better than satellite surveillance? Are there specific capabilities of aircraft and satellite you would like to have that don't exist today?
What is the ideal range for aircraft for conducting surveillance of fires? What are the typical sensors (including their weight) installed on surveillance aircraft?
Under what conditions (e.g., wind, visibility, day/night, altitude) do surveillance aircraft and their operations need to be conducted?

Top 3 Outcomes:
1. ML/AI solutions for differentiating fire and combining data sets for better/reliable information (no or little AI/ML on camera collected information) - operationalization capability is lacking (multi-view, multi-perspective)
2. Common operating picture (integrated information, intel operator to figure out who to send – operationalization of the product – geospatial information integration) - getting data off to users in real-time (amalgamation of concurrent systems) - 57 data systems (Abigail Wolf made data maps – willing to share), data standards, need a coalition of partners to ensure integrated data distribution – drop sensors, real time information flow is challenging (communications), policies, procedures, workflows don't exist (not storage, display, and integrated perspective)
3. Wide area surveillance damage assessment, aircraft offers advantage (getting under weather), small drones for surveillance (US made), most pyroluminous clouds – all weather conditions – systems engineering approach to recognize how to bring forward all aerial and space assets, hyperspectral/multi-spectral sensor, persistence (fire guard, long endurance, goes – system of systems solutions)

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.

S1: Post-Fire Remedial Efforts – Group 2

Moderator: Michael Liquori
Top 3 Outcomes: Vincent Ambrosia
Scribe: Julia Bradley

Questions:
Data Management: What are the main uses of data during wildfire recovery, damage assessment, and remediation determination? What data is required to support remedial efforts? What are the key challenges for data use in post-wildfire damage assessment and stabilization?
Should note the source of data when answering the question. Data sources include airborne, satellite, and ground-based platforms.
Is there a need for developing a standard for data and integration?
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. Fire Burn Severity layers are key BAER Teams to support recovery assessment and model debris flow probability layers to effect hazard notifications to region / communities. These layers are derived from EO data (Landsat and Sentinel), but timeliness of both can be problematic given their orbit schedule and cloud cover issues. Can we use other data to support those immediacy needs of data (contract aerial imagery services, other sensors with similar spectral bands to allow consistent Burn Severity algorithm development? Need "standards" for airborne acquisition of Burned Area data, so that Landsat / Sentinel and other spectral data (aircraft-acquired) can be "harmonized" and consistent.
2. Most post-fire assessment and remediation plans are distributed for fire management use; needs to be a public-facing "dashboard" to allow communities to be informed of post-fire issues, such as road closures, damage to infrastructure, sensitive area (keep out zones), flood erosion potential areas, infrastructure damage. Fire-affected communities could understand the recovery or mitigation plans underway that will affect them
3. Each BAER team (from different agencies) provide their remediation assessment reports to distributed services…need to coalesce those services for data continuity.

S2: Prediction Modeling and Challenges – Group 2

Moderator: George Whitesides
Top 3 Outcomes: Jay Fletcher
Scribe: Melinda Gratteau

Questions:
Identify data, analysis, and modeling needs by users/roles, e.g., researchers, planners, forecasters, firefighters, aerial firefighting pilots, incident commanders, virtual air boss, etc.
What areas do you recommend for improvement as related to prediction models, data, analysis, and presentation?

Top 3 Outcomes:
1. Need data at a higher spatial and temporal resolution (100m, 15-30min update) to be relevant to fast moving fires. Data needs to be integrated across sources and users.
2. Need to know where the fire is, where the firefighting assets are, and where the public is to be able to assess risks and make operational decisions. However, there are privacy issues associated with using mobile-phone data or social media to determine where people are.
3. It is a challenge for modelers to understand the requirements of operational people and to get technology into field operations. Researchers want to be able to validate their technology in real world conditions, but fire fighters are rightfully concerned about testing low TRL technologies in life-threatening conditions.

S2: Aerial Fire Surveillance – Group 1

Moderator: Raj Malhotra
Top 3 Outcomes: Parimal Kopardekar (PK)
Scribe: Alan Hobbs

Questions:
How are wildfires detected today; what are the methods of surveillance? What's the biggest challenge around detection, e.g., sensor fidelity/sensitivity, false positives/negatives, sensor size/weight/power/cost.
What are different types of aircraft used in surveillance? How can that be improved?
Would it be useful to use larger autonomous, unmanned, or remotely operated aircraft which can operate day and night, and under low visibility (e.g., instrument meteorological conditions)
What are the opportunities to improve communication and coordination as the fire is detected during aerial flights? What type of communications and streaming capabilities are needed for surveillance aircraft?

Top 3 Outcomes:
1.Detection: Satellite, aircraft, and cameras (designing geostationary payload for school bus size detection) pixel dwell time
2. King Air and Citation at NIROP – 15000 ft and can see spot fire 8 inch diameter (not enough spatial resolution for MAPA) - designed and targed for moving fires. Two more King air available. Colorado multi mission a/c and others are also doing it – small UAS – need persistent surveillance
3.Small drones – integrated airspace operations is a challenge, people operating radios at different frequencies

S2: Suppression and Mitigation – Group 3

Moderator: Everett Hinkley
Top 3 Outcomes: Vincent Ambrosia
Scribe: Richard Walsh

Questions:
What are limitations of current operations (e.g., visual conditions, wind, daytime only, etc.)?
Would it be useful to use larger autonomous, unmanned, or remotely operated aircraft with retardant dropping capability which can operate day and night, and under low visibility (e.g., instrument meteorological conditions).
What are barriers to 24X7 aerial firefighting?

Top 3 Outcomes:
1. Current suppression mitigation operations (aerial) are limited by fire weather conditions (turbulence, visibility) and other elements (night / low-visibility flights, terrain, etc.); these necessitate improving developments of platforms and autonomous flight decision systems to allow 24/7 operations.
2. Since UAS fire suppression A/C may be of limited use now (due to platform design, build-out, and FAA certification time-lines), the team suggests a “spiral” development phase, where “augmented guidance (ie. Heads-up displays for pilots) or optionally piloted (augmented flight ops) be the first stage of development (on manned platforms) while new UAS platforms are brought into operational context. These incremental technology developments on manned A/C can then be test-bedded and moved to autonomous ops in the spiral development stage.
3. Rather than focusing on “large” UAS Suppression (retardant drop) A/C, the focus can be on smaller platforms (rotorcraft (K-Max-class?) to support initial attack (IA) retardant dropping. These platforms may be more maneuverable and provide more rapid support in IA ops.