STATEMENT

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This nation does not have a wildland fire problem. It has a wildland management leadership problem.

Chairman Tiffany and Members of the Subcommittee,

Thank you for the opportunity to testify on this critical issue. My name is Dan Munsey, and I serve as the Fire Chief and Fire Warden for the San Bernardino County Fire Protection District — the largest fire district in the United States, covering over 20,000 square miles, an area larger than New Jersey, Connecticut, Delaware, and Rhode Island combined.

I bring over 30 years of fire service experience, including the last five as Fire Chief. I am a director on FIRESCOPE, which provides guidance on the Incident Command System (ICS) and Multi-Agency Coordination. I also serve as President of the California Metro Chiefs Association, representing some of the nation's largest fire agencies, and previously chaired the International Association of Fire Chiefs (IAFC) Technology Council, supporting the leadership of more than 1.1 million firefighters nationwide.

San Bernardino County's geography spans coastal valleys, rugged mountains, and vast deserts. Nearly 80% of our land is public, with federal land comprising the majority. Our 2.2 million residents live in 66 communities, many of them isolated and surrounded by federal forests — including the San Bernardino National Forest and parts of the Angeles National Forest. As a result, our agency routinely responds to all-hazard emergencies that originate on federal lands, and our local communities are equally impacted by threats that start there.

Despite what headlines may suggest, the root cause of today's uncontrollable wildfires is not merely hot weather, drought, climate change, steep terrain, negligent utilities, or arson. These are contributing factors, but the core problem is insufficient leadership and investment in proactive land management and wildfire prevention.

Simply put, this nation does not have a wildfire problem; it has a land management problem. Without consistent, coordinated management of both public and private lands, catastrophic wildfires will persist. Unfortunately, technology that can prevent and mitigate fires has been slow to adopt, particularly within federal wildfire agencies.

Last year, San Bernardino County faced two major wildfires burning simultaneously, the Line Fire (43,978 acres) and the Bridge Fire (56,030 acres). These fires demonstrate how communities in the wildland-urban interface can either be protected or left vulnerable, depending on how we leverage innovation and modern technology to improve forest health and prevent wildfires.

The Current Status of United States Wildfire Agency Technology

You may be surprised to learn that the everyday technology most Americans take for granted is still unavailable to firefighters working for the United States Forest Service, Bureau of Land Management, National Park Service, and Fish and Wildlife Service.

For example, on your smartphone you can instantly locate family and friends, receive real-time hazard alerts, get immediate weather updates, video call anyone, collaborate in the cloud, use satellite connectivity, and fly drones that stream live video to the internet. In stark contrast, a federal firefighter does not have real-time tracking of resources, neither vehicles nor dismounted crews. They often rely on outdated paper maps with rough estimates of a fire's perimeter, lacking live situational awareness of fire behavior or proximity to critical infrastructure. Even weather forecasts are provided as printed reports in

an Incident Action Plan, produced hours before each operational shift. Communication still depends on Very High Frequency (VHF) land mobile radios, a voice-only technology invented in the 1930s.

I strongly support and appreciate President Trump's June 12, 2025, Empowering Commonsense Wildfire Prevention and Response Executive Order, which acknowledges these technology gaps. Specifically, Section 3(b)(i) directs agencies to "develop a comprehensive technology roadmap", a critical step forward that must include meaningful collaboration with local government agencies to build a safer, more efficient wildland fire management system.

Investing in proactive wildfire prevention and community resilience delivers proven returns by dramatically reducing costly suppression and recovery expenditures. For instance, a USDA Forest Service study found that wildfire prevention education in Florida saved up to $35 for every dollar invested. Broader federal reviews confirm these savings range from $5 to $38 per dollar spent. By prioritizing coordinated, cross-jurisdictional prevention strategies and adopting modern detection, planning, and response technologies, we can protect lives, property, and natural resources — while using taxpayer dollars more effectively.

The Current State of Local Government Firefighting Technology

For many years, local government fire agencies have equipped their firefighters with advanced technology to respond to wildfires safely and efficiently. This includes a range of Common Operating Picture (COP) platforms that display real-time information such as the precise location of fire equipment through Automatic Vehicle Location (AVL), current fire perimeters, the locations of homes and other structures, and known or emerging hazards.

Local agencies also use COPs to plan, track, and share information about fuel treatments and fuel breaks. These systems display detailed fuel models, showing spatial arrangement, continuity, and loading; all critical for identifying future treatment areas and selecting advantageous terrain to control wildfires.

In addition, local government firefighters have real-time access to current and predictive weather forecasts, fire behavior modeling that shows potential fire growth and spread, and up-to-date information on community infrastructure and demographics to support effective evacuations and suppression strategies.

Modern COPs also integrate data from robotics and sensors, providing real-time visual feeds and situational data that enhance firefighter safety and improve the efficiency of operations.

In San Bernardino County, our Fire District funds the use of Intterra, a COP that enables multi-jurisdictional fuel planning and real-time information sharing for both the Angeles National Forest (ANF) and the San Bernardino National Forest (SBNF). We do this because the U.S. Forest Service's budget does not currently allow for procurement of this type of interagency software. As a result, ANF and SBNF are the only two national forests in the country using an interagency COP with live AVL tracking for their vehicles. This system improves response times, enhances firefighter safety, and supports the coordinated, proactive planning needed to prevent wildfire spread and protect communities.

What Technologies Are Needed to Improve Forest Management and Prevent Wildfires

At a high level, the technology needed for effective land management hinges on the coordinated application of four key elements:

1. Vegetation and fire spread modeling

2. Land use planning across local, state, and federal governments
3. Effective fuel management
4. Early detection, rapid and organized response, and extinguishment of emerging fires

If any one of these components is weak or absent, the risk of large, uncontrollable wildfires increases dramatically.

A major challenge is that no single agency has authority over all land management efforts—there is no unified leadership. Federal, state, and local agencies often operate independently, with differing policies and objectives for land management and fire suppression.

In reality, the responsibility for coordinating these diverse efforts frequently falls to local governments, which often manage the smallest portions of wildlands. Despite limited jurisdiction, they must align disparate agencies, reconcile conflicting policies, and drive cohesive, inter-agency action toward shared land management and wildfire prevention goals.

Vegetation and Fire Spread Modeling

Traditional desktop software used by federal wildfire agencies lags behind the real-time capabilities of modern, cloud-based fire and vegetation modeling systems. These legacy tools primarily rely on historical data rather than current, high-resolution information collected in real time to model fuels and fire spread.

In contrast, modern platforms such as Technosylva (Wildfire Analyst, fiResponse), FlameMapper, FireSim (FireSafe AI), Ember, and Vibrant Planet's Land Tender deliver live, high-resolution risk analyses, continuous vegetation monitoring, and dynamic scenario planning. Leveraging cloud computing, live weather feeds, and advanced remote sensing, these systems run thousands of fuel and fire analyses daily. They not only predict fire danger in real time but also empower policymakers and land managers to identify and prioritize "mitigations that matter."

The distinction between outputs and outcomes is critical. Outputs refer to tangible products, such as constructing a fuel break, while outcomes measure the actual benefits or changes achieved, like the percentage reduction in fire spread due to that fuel break. Mitigations that matter focuses on these meaningful results, emphasizing hazard reduction and risk decrease.

To optimize wildfire prevention investments, the federal government must prioritize fuel modeling and fire behavior software that emphasize outcomes over outputs. This shift will enhance fuel management decisions and ensure more effective use of public funds.

Local, State, and Federal Government Land Use Planning

For too long, local, state, and federal agencies have operated with stovepiped priorities, leading to siloed land management planning. This fragmentation results in disjointed mitigation efforts and inefficient resource use.

While Common Operating Platforms/Pictures (COP) technology exists to enable collaboration among communities and government agencies, its widespread adoption remains limited. Tools like LANDFIRE, IFTDSS, WFDSS, and newer platforms such as Technosylva and Vibrant Planet offer powerful capabilities for cross-jurisdictional wildfire risk planning. However, their use is often isolated within individual agencies rather than integrated across landscapes and ownership boundaries.

To effectively reduce wildfire risk, greater investment is needed to build shared planning capacity and create incentives for multi-agency collaboration. These tools must be user-friendly and accessible to all stakeholders, including community members and fire safe councils, to produce meaningful, *mitigations that matter* outcomes that truly lower fire danger.

Effective Fuel Management

Modern technology exists to effectively manage vegetation fuels. The industry is on the cusp of deploying robots and remote-controlled vehicles powered by AI to tackle hazardous fuels more safely and efficiently. For example, BURNBOT uses robotic masticators and mobile tracked incinerators to perform precision fuel treatments and controlled burning in conditions that are too dangerous or labor-intensive for human crews.

In parallel, cloud-based planning platforms like Vibrant Planet's Land Tender help land managers identify and prioritize the right areas for these advanced tools to operate, using high-resolution vegetation data, scenario modeling, and multi-agency coordination to ensure that mechanical and prescribed treatments deliver maximum risk reduction where it matters most.

While remote-controlled mulchers and aerial ignition drones are poised to become common tools in fuel management, BurnBot represents a unique next step: a robotic unit that performs safe, enclosed prescribed burning directly on the ground with minimal smoke and escape risk. This innovative approach fills a critical gap in year-round fuel reduction near communities and infrastructure. Emerging technologies like drones, AI detection networks, and advanced masticators complement this by enabling agencies and utilities to plan, ignite, and maintain treatments more effectively.

Early Detection, Response, and Extinguishment of Incipient Fires

The widely accepted wildfire suppression goal is to keep 90% of fires at 10 acres or less. What often goes unmentioned is that this target is already being met fairly consistently. The real challenge lies in the remaining 10% of fires, those that exceed 10 acres and have recently become some of the most destructive wildfires in the United States history.

In San Bernardino County, we have set an ambitious vision: to keep 90% of wildfires confined to a mere 10 by 10 feet, a goal as bold and transformative as President John F. Kennedy's 1961 commitment to land a man on the moon.

Achieving this vision requires a fundamental shift toward early wildfire detection, leveraging cameras, sensors, satellites, and AI and early control using advanced aerial technology, including unmanned systems and autonomous robotics.

The roadmap for such breakthroughs is becoming clearer. The XPRIZE Foundation, renowned for incentivizing innovative solutions to global challenges, is sponsoring two wildfire-related competitions. One challenges teams to detect all fires within one minute across vast landscapes, larger than entire states or countries, and then precisely characterize and report data with minimal false positives within ten minutes. The second competition, an Autonomous Wildfire Response track, tasks teams with detecting and autonomously suppressing a high-risk fire in a 1,000 km², environmentally complex area within ten minutes, without disturbing decoy fires.

These outcome-focused, technology-driven goals exemplify the direction the federal government should pursue. Simply increasing budgets, workforce size, or firefighter training has not kept pace with

increasingly destructive wildfires. The future depends on non-human technologies that enable earlier detection, faster response, and extinguishment while fires are still small and manageable.

Early Detection

A report from the Betty and Gordon Moore Foundation (August 24, 2023) highlights the critical value of reducing wildfire response times. It states that cutting response times by just 15 minutes could reduce the frequency of large, uncontained fires by 3 to 7 percent. Such an improvement could generate between $3.5 billion and $8.2 billion in economic benefits for California alone.

Achieving faster wildfire detection requires a comprehensive technology ecosystem, including satellites, ground-based cameras and sensors, aircraft, aerial drones, and other advanced detection tools. Yet, federal wildfire agencies largely rely on traditional methods, aircraft and lookout towers, that have been in use for over a century. Modernizing detection capabilities is essential to capitalize on the potential economic and safety benefits of faster response.

Satellite

Satellite technology plays an increasingly important role in wildfire detection and monitoring, but it is primarily effective for identifying moderate to large fires. Current systems struggle to detect small or low-intensity fires due to limited resolution, scale, and accuracy—issues that have resulted in numerous false positives and a corresponding lack of trust.

For example, NASA's MODIS and VIIRS sensors offer global thermal hotspot detection with spatial resolutions of 1 kilometer and 375 meters, respectively, and provide multiple daily passes. However, their resolution limits the ability to pinpoint smaller ignitions.

Geostationary satellites like NOAA's GOES deliver near real-time updates every few minutes—essential for tracking rapidly growing fires—but with a coarser spatial resolution of approximately 2 kilometers. Many wildfire agencies rely on these satellites in conjunction with tools like NASA's FIRMS and the U.S. FireGuard program to detect new ignitions and monitor fire progression.

Despite these capabilities, satellites face inherent challenges. Heavy cloud cover, dense smoke, and low-intensity or small fires reduce detection accuracy. To improve wildfire response, the fire service urgently needs access to higher-quality Earth-orbiting satellites that provide enhanced geographic coverage, higher resolution, and advanced sensors capable of accurately detecting smaller and lower-intensity fires.

Aerial Drones/UAV

Sustained aerial unmanned drones offer promise to monitor large areas and landscapes. These are High-Altitude Pseudo-Satellites (HAPS) or HALE UAVs (High-Altitude Long-Endurance Unmanned Aerial Vehicles), most proposed to use solar panels to remain aloft for long duration. HAPS fly in the stratosphere (approx. 50,000–70,000 feet) above weather and commercial air traffic. Airbus Zephyr, one of the most mature solar HAPS platforms has demonstrated persistent Earth observation, but not yet deployed operationally for wildfire detection at scale, has established that it can be flown for 64 days continuously.

Most other UAV offer moderate persistent flight of 23 hours to near 100-hours. While these UAV fly at lower altitudes (12,000-20,000 feet), recent FAA regulation changes have helped the industry become

more established and viable. While not widely deployed, moderate persistent UAV's offer the ability to change course, carry a wide variety of sensors and camera payloads, and allow agencies to monitor critical fire hazard areas during high-fire danger periods.

Terrestrial Camera Systems

AlertWildfire and Pano AI operate collaborative networks of high-definition pan-tilt-zoom (PTZ) cameras, often mounted on mountaintops or towers throughout the Western United States, with the primary goal of rapid wildfire detection and monitoring. Pano AI is an automated, AI-driven commercial platform that delivers real-time, verified fire alerts directly to emergency managers. It is especially valuable to utilities and municipalities aiming to detect ignitions quickly and reduce liability. AlertWildfire, by contrast, is a publicly accessible camera network that depends largely on human observers—dispatchers, firefighters, and even local residents, to spot smoke, control cameras, and visually confirm fires. While extremely helpful for situational awareness, it is less automated than Pano AI.

Currently, the federal government has not invested in any wide-scale regional camera systems. However, several national forests have independently permitted camera installations on their infrastructure to support regional detection networks scanning federal lands for wildfires. The expansion of the use of terrestrial camera systems augmented with AI detection is critical to the early detection of wildfire.

Ground Based Sensors

Modern wildfire detection is evolving well beyond traditional lookout cameras and satellites. Networks of ground-based sensors, such as gas detectors, lightning strike monitors, power line fault sensors, heat and flame detectors, and live fuel moisture sensors, can identify ignitions within minutes and alert responders even before a visible smoke column appears.

Gas and smoke sensors, like Dryad Networks' Silvanet or OroraTech's air quality nodes, detect combustion gases and fine particulates almost immediately after ignition. Heat and flame point sensors, adapted from industrial fire safety systems by companies like Det-Tronics and Honeywell, sense infrared or ultraviolet radiation from open flames near critical assets.

Specialized networks like the Fire Neuro Network track lightning strikes, one of the leading causes of wildfires, to pinpoint high-risk ignition sites in remote areas. Combined with local weather and live fuel moisture sensors, these systems improve risk assessment and support more accurate fire behavior predictions. Together, these non-camera sensors complement satellite and AI-enabled camera networks, creating a layered, faster, and more reliable detection system that helps agencies and utilities respond before small ignitions grow into catastrophic wildfires.

In San Bernardino County, we are piloting a partnership with the Fire Neuro Network (FNN) to detect and assess hazardous lightning strikes. Lightning accompanied by significant rainfall rarely starts fires, so we have installed ground-based lightning receptors throughout our jurisdiction. When a strike is detected, its precise location is determined, and an AI model analyzes weather conditions, fuel moisture, topography, and satellite imagery to predict whether ignition is likely. This approach allows us to deploy resources more quickly to potential ignition points—improving our ability to contain fires while they are still small.

In most jurisdictions, the use of sensors is almost non-existent. Deploying sensors to detect wildfire is critical to ensuring early detection of wildfire on federal lands.

Early Response

Traditionally, wildfire response has depended on fire crews receiving a report of a fire and then traveling, often over rough terrain and poor access roads, to reach the ignition point with fire engines and equipment. With advancements in artificial intelligence and robotics, this model is beginning to change. AI can now be trained to recognize wildfires, model fire behavior in real time, and help determine the most effective suppression strategies.

For example, companies like Rain are pioneering autonomous aerial wildfire suppression by retrofitting helicopters with AI-driven systems capable of detecting ignitions, modeling fire spread, and autonomously deploying water or retardant to suppress fires before they grow out of control.

In addition to response, AI is transforming wildfire prediction and preparedness. Advanced models can forecast where and when new fires are most likely to start and recommend when to increase staffing or pre-position firefighting resources in high-risk areas, helping agencies respond faster and more effectively to emerging threats.

National Mutual Aid System (NMAS)

The National Incident Management System (NIMS) framework currently falls short when it comes to consistent resource ordering and deployment. Fire engines, crew capabilities, staffing levels, and training standards vary widely across states and regions. Some states have well-developed, standardized resource ordering systems, while others are lacking.

For years, the International Association of Fire Chiefs (IAFC) has emphasized the need for a national resource ordering system, known as the National Mutual Aid System (NMAS). Standardizing equipment, training, and crew capabilities, and integrating these standards into a modern system that uses real-time technology to request, deploy, and track resources, is critical to ensuring a more effective and coordinated wildfire response nationwide.

A “Common” Common Operating Picture

A unified national Common Operating Picture (COP) for wildfire and all-hazard incidents does not currently exist. Instead, agencies across the country use a patchwork of different COP platforms that are often siloed and rarely interoperable. Many agencies, including most federal wildfire engines, lack any COP technology to track the real-time location of vehicles, personnel, and equipment or to display even basic incident details such as fire size and location.

Without a shared COP, agencies cannot coordinate effectively, respond efficiently, or maximize their collective capabilities. Developing a national COP, along with clear interoperability standards for agencies that continue using other third-party COP vendors, is essential. This would ensure seamless information sharing and situational awareness at local, regional, and national levels, ultimately improving response and community safety.

Closing

In summary, addressing the wildfire crisis demands a bold shift from fragmented, outdated practices to coordinated, technology-driven solutions that produce meaningful outcomes. Modern tools already exist to detect fires earlier, model risk more accurately, plan fuel management strategically, and deploy resources faster and more safely. However, without unified leadership, clear standards, and sustained investment, these tools will remain underutilized and siloed across agencies and jurisdictions.

We must break down institutional barriers by developing a national Common Operating Picture (COP), adopting interoperable resource ordering systems, and expanding the use of advanced detection technologies, AI, and autonomous response capabilities. By doing so, we can move beyond measuring success by outputs alone and instead deliver “mitigations that matter”, actions that measurably reduce fire spread, protect communities, and save lives and billions in economic losses.

It is time to align our policies, budgets, and innovation efforts to match the scale of this challenge. With decisive leadership, strategic partnerships, and a shared commitment to outcomes, we can build a safer, more resilient future for our forests, our communities, and our nation.