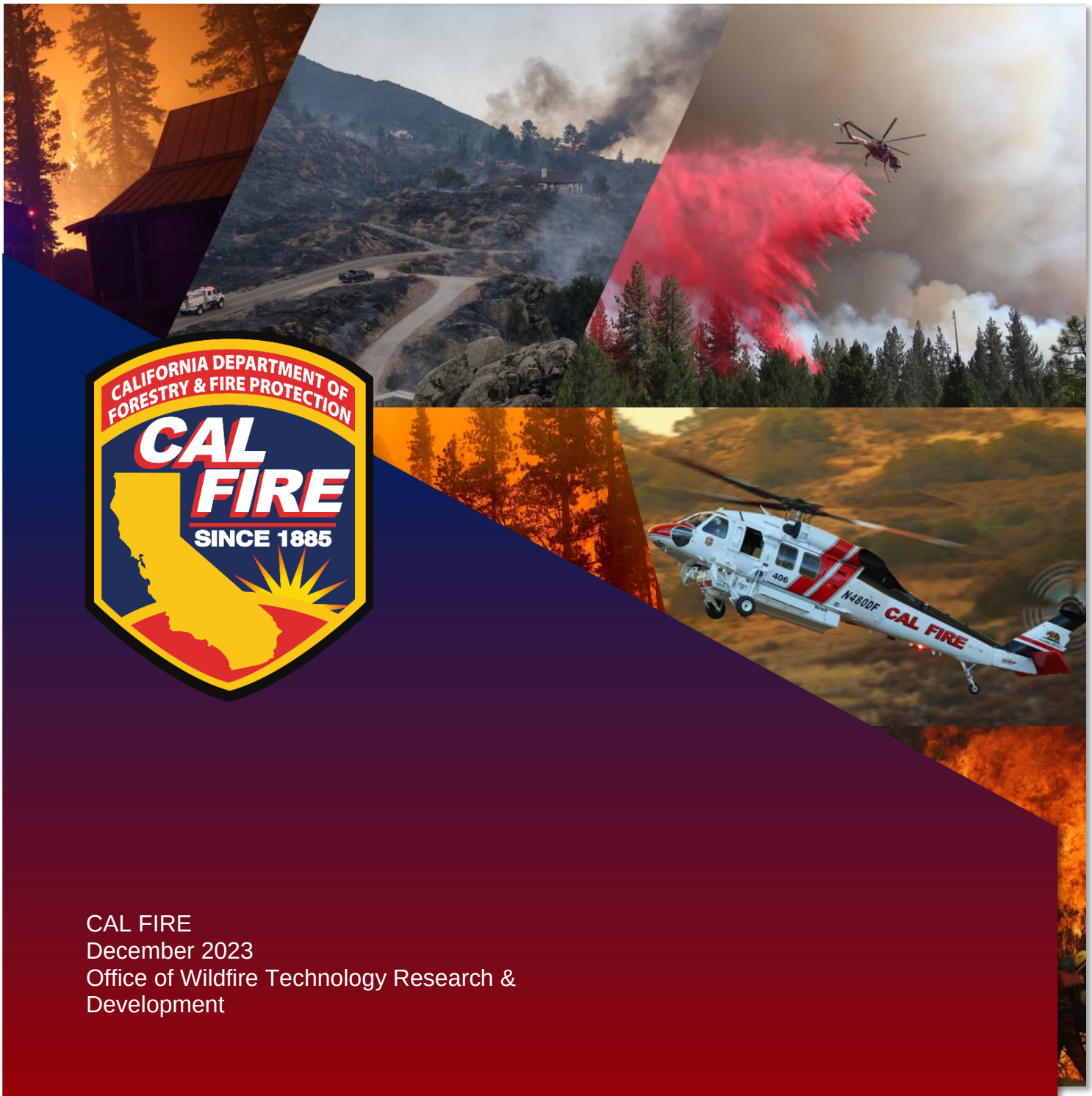
CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION (CAL FIRE)
OFFICE OF WILDFIRE TECHNOLOGY RESEARCH AND DEVELOPMENT

2023 Annual Report



CAL FIRE
December 2023
Office of Wildfire Technology Research & Development

Table of Contents

Executive Summary

The Office of Wildfire Technology Research and Development (OWTRD) or “Office” was established by Senate Bill 109 in 2021 to serve as the central organizing hub for the State government's identification of emerging wildfire technologies. The Wildfire Technology Research and Development Review Advisory Board (Advisory Board) was also created to provide findings and recommendations in an annual report, with the first report due to the Governor’s Office and the Legislature by January 1, 2024.

In 2023, the Office prioritized recruitment, hiring, and training of personnel, and created a bespoke database and management system to support its work. The Office conducted internal outreach within CAL FIRE and external outreach with federal and local agencies, private vendors, academic institutions, and other relevant entities to raise awareness of its mission and identify priority areas of focus related to emerging technologies.

Current focus areas include last-mile connectivity, dismounted firefighter location, enhanced situational awareness, firefighter health and safety, and data availability and integration. The Office conducted evaluations and field tests in these areas, including in Jackson Demonstration State Forest in Mendocino County, and expects to work with the Advisory Board to fine-tune these focus areas in the coming year.

The Office developed business processes for capturing, screening, and evaluating prospective emerging technologies, including a publicly available web-based form. Evaluation involves determining if proposed solutions are ready for evaluation in real or near real-world environments. The Office's intent is not to purchase technology but to gather, coordinate, evaluate, and disseminate information to others in the wildfire industry.

Moving forward, the Office will continue to build upon its foundational processes and focus areas in collaboration with the Advisory Board, informing product development and innovation by communicating the specific needs of the wildfire industry to entities developing emerging technologies.

Legislative Mandate

The Office of Wildfire Technology Research and Development (OWTRD) was established within the California Department of Forestry and Fire Protection (CAL FIRE) by Senate Bill 109 (Dodd, Ch. 239, Stats. 2021) to serve as California's central organizing hub for identifying emerging wildfire technologies. The OWTRD has developed a balanced multimodal research and development program designed to identify, research, test, and evaluate emerging technologies and tools designed to improve the State's preparation for, and response to, wildfires within the State. Senate Bill 109 also established the Wildfire Technology Research and Development Advisory Review Board (Advisory Board). The Advisory Board is required to submit its findings annually to the Governor and Legislature beginning in January 2024 and every year thereafter until the scheduled date of repeal, January 1, 2029.

Wildfire Technology Research and Development Review Advisory Board Members

- Secretary of the Natural Resources Agency, or their designee.
- The Director of the Office of Emergency Services, or their designee.
- The Director of the Department of Forestry and Fire Protection, or their designee.
- One representative from academia involved in the field of wildfire research and technology development (Appointed by the Governor).
- One representative from the private wildfire response science, engineering, and technology industry (Appointed by the Governor).
- One representative from local government (Appointed by the Governor).
- One member of the public employed as a first responder (Appointed by the Governor).
- One member who is appointed by the Senate for a term of four years who is involved in victim services.
- One member who is appointed by the Assembly for a term of four years who is involved in the protection of privacy and civil liberties.

Office of Wildfire Technology Research and Development Staff

- Deputy Chief
- Research Data Manager
- Information Technology Specialist II
- Information Technology Specialist I
- Associate Governmental Program Analyst
- Research Data Specialist I
- Research Data Specialist I

Introduction

The Office of Wildfire Technology Research and Development (OWTRD) or "Office" was established by Senate Bill 109 (Dodd, Ch. 239, Stats. 2021) in the 2021-2022 legislative session. Its purpose is to serve as the "central organizing hub for the state government's identification of emerging wildfire technologies."[1]

The Office was established due to the "escalating frequency and devastation caused by wildfires," which SB 109 reasons, "demand ongoing research and development of emerging wildfire technologies and tools to prevent, monitor, identify, and suppress wildfires developed by public, private, and nonprofit entities in order to protect lives and property…"[2]

SB 109 concludes that "It is in the best interest of the state that our wildfire preparedness and response infrastructure include and integrate the most effective and evidence-based scientific and technological perspectives and tools…"[3]

SB 109 also created the Wildfire Technology Research and Development Review Advisory Board (Advisory Board). This document serves as the first annual report that the Advisory Board is required to deliver to the Office of the Governor and the Legislature, no later than January 1, 2024, pursuant to Government Code Section 8586.8.

This report is organized into the following sections:

- Overview of the Office
- Emerging Technology Evaluation Process
- Scope of the Office
- Current Areas of Focus
- Conclusion

Overview of the Office

The Office has seven full-time equivalent (FTE) positions and became fully staffed and operational in May 2023. Figure 1, below, provides a timeline of key milestones for the Office:

Figure 1: Timeline of key milestones for the Office

Personnel and Reporting Structure

The Office is comprised of staff with a mixture of research and information technology skills and is led by a uniformed CAL FIRE Deputy Chief, who, in addition to leading and directing the Office, provides invaluable wildfire subject matter expertise and experience, which helps guide and inform the work of the staff.

The Deputy Chief serves as the Chief of the Office, and reports directly to the Assistant Deputy Director for Research, Development, and Innovation (RDI). The Assistant Deputy Director of RDI reports to the Deputy Director for Technology, a member of the CAL FIRE Executive Team, reporting to the Director. This reporting structure emphasizes the importance of the Office within CAL FIRE, and ensures the Office is highly visible across the organization. Such visibility and executive sponsorship are important as they encourage participation in the activities of the Office by other program teams within CAL FIRE.

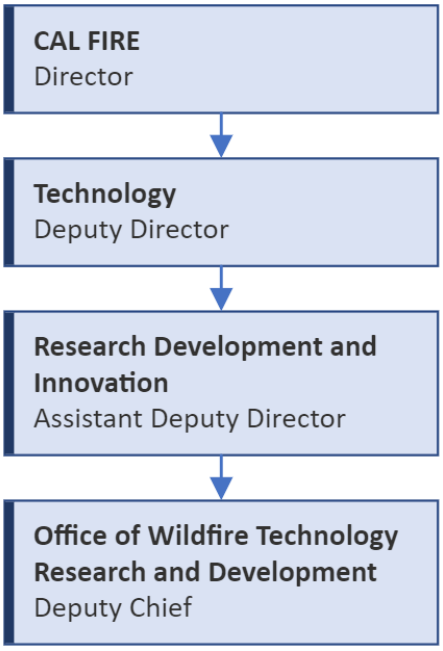


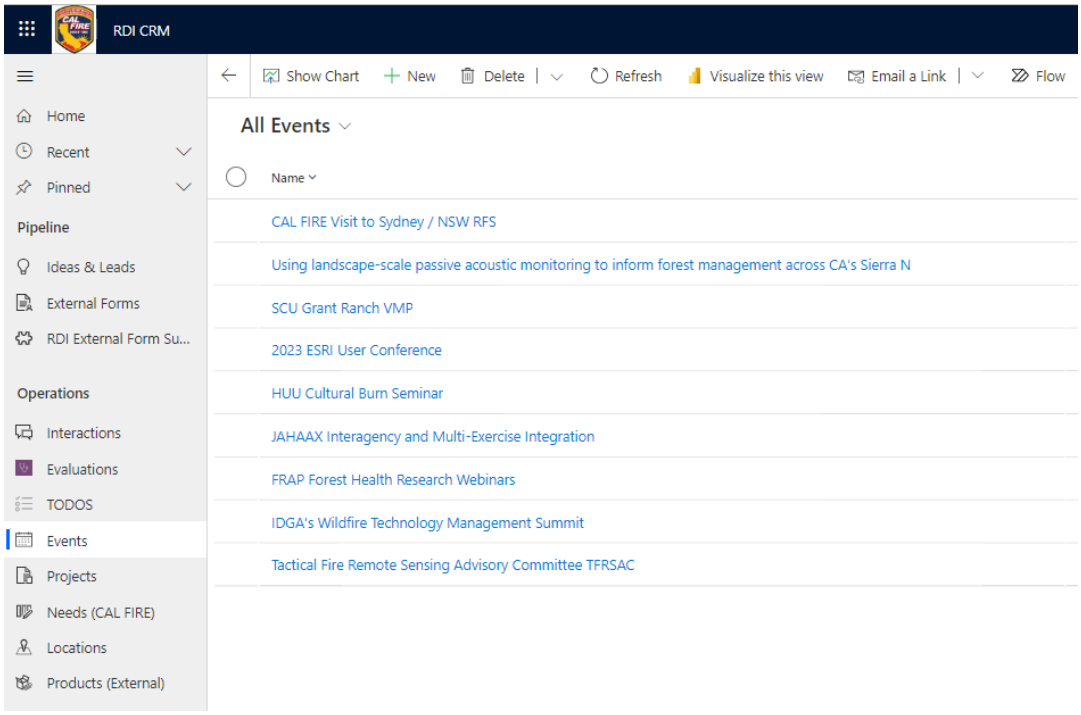
Figure 2: Office Reporting Structure and organization within CAL FIRE

Key Activities

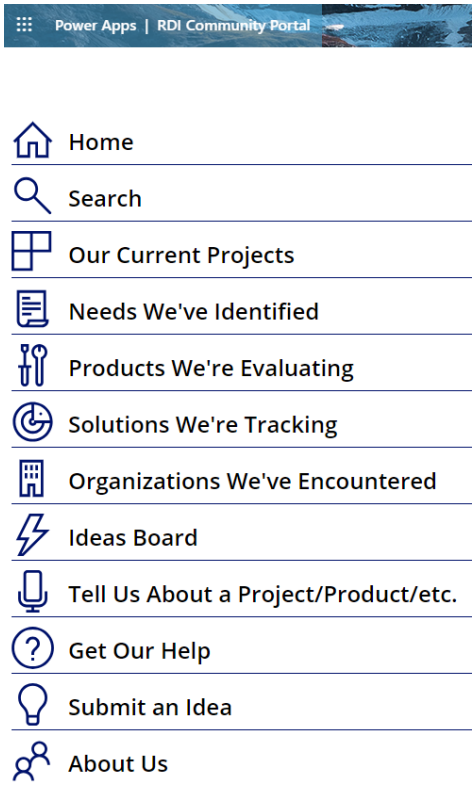
The following section lists the activities of the Office required by SB 109, and the progress of the Office towards each one.

Serve as the central organizing hub for the State government's identification of emerging wildfire technologies.

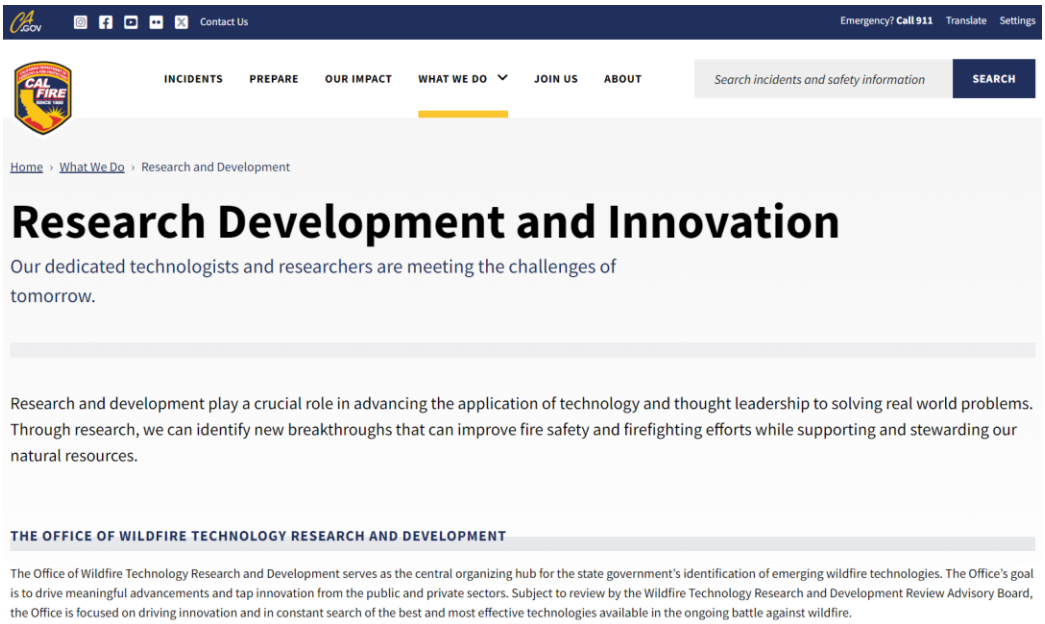
1. Creation of a bespoke database and management system to catalog and organize the findings and work of the Office.
    a. Data captured includes:
        i. Needs, Requirements and Priorities
        ii. Solutions
        iii. Products
        iv. Projects
        v. Evaluations
        vi. External Organizations
        vii. Contact Information
        viii. Events and Interactions
    b. The database is organized so that the information is linked together wherever possible and appropriate; for example, a Solution should be linked to an original Need (or multiple needs). A Solution may be implemented by one or many Products, in turn linked to Organizations and Contacts.



2. Development of an internal CAL FIRE Research, Development, and Innovation Portal where staff members are encouraged to submit ideas and provide feedback on the work of the Office.



3. Development of a web presence in a prominent location on CAL FIRE's recently redesigned home page.[4]
    a. This includes a web-form that enables the public to submit items to the Office for consideration. These submissions also form part of the database, mentioned above.



4. Development of a single, shared inbox for inquiries and requests: wildfiretechnology@fire.ca.gov
5. Ongoing research projects, both internal and external, continue to add to and update the information in this database. Research activities included:
    a. Internal CAL FIRE surveys.
    b. Focus groups on a specific technology, solution, or product.
    c. Regular information sharing meetings with internal programs and external partners.
    d. One-on-one interviews and meetings with key personnel and stakeholders.
    e. Attendance of industry and government conferences.
    f. Analysis of relevant journals, white papers, product materials, government reports, and other documents for pertinent information.

Develop a balanced research and development program designed to identify, research, and evaluate emerging technologies and tools designed to improve the State's preparation for, and response to wildfires.

1. Development of a web-form that provides a single, consistent entry point for external parties to submit information for consideration by the Office.
2. Planning and implementation of research projects to discover emerging technologies from across the State, nation, and globe.
3. Development of review and evaluation processes triggered upon the intake of a newly identified emerging technology, either from a form submission (1) or internal discovery project (2). These processes include the following activities:*
    a. Classification and initial assessment.
    b. Matching with needs and priorities.
    c. Identification of CAL FIRE programs that may be interested or impacted.
    d. Internal discussion and initial review meetings.
    e. Meetings with the originator (such as the submitter, company, or author), if deemed necessary.
    f. Field tests, if practicable and deemed necessary.
    g. Evaluation and Conclusion, filed in the central database.

*These activities are described in the context of the overall process and in more detail in the "Emerging Technology Evaluation Process" section which follows.

Consult with public, private, and nonprofit entities in identifying new technologies, tools, software, and other advances in wildfire preparedness and response.

1. Interacted with over one hundred public, private, and nonprofit entities (in 2023) in a variety of different forums including vendor presentations and demonstrations.
2. Attended relevant wildfire technology conferences, webinars, and other industry meetings.
3. Established regular knowledge sharing and collaboration meetings with state and federal agencies including the United States Forest Service (USFS) and National Aeronautics and Space Administration (NASA).

Make recommendations to State and local agencies on the most effective and useful technologies and tools for procurement.

1. The Office has several evaluations currently ongoing, detailed in the Current Areas of Focus section below, and will share findings and conclusions following completion.

Supporting the Advisory Board

SB 109 also establishes the Wildfire Technology Research and Development Advisory Review Board (Advisory Board) consisting of nine members, including the Secretary of the Natural Resources Agency, the Director of the Office of Emergency Services (CalOES), the Director of CAL FIRE, four members appointed by the Governor representing a cross-section of firefighting professionals, one member appointed by the Senate, and one member appointed by the Assembly (Figure 3).

WILDFIRE TECHNOLOGY RESEARCH AND DEVELOPMENT ADVISORY REVIEW BOARD
Secretary of the Natural Resources Agency, or their designee
Director of the Office of Emergency Services, or their designee
Director of the Department of Forestry and Fire Protection, or their designee
Representative from academia (Appointed by the Governor)
Representative from the private wildfire science, engineering, and technology industry (Appointed by the Governor)
Representative from local government (Appointed by the Governor)
Member of the public employed as a first responder (Appointed by the Governor)
Member involved in victim services (Appointed by Senate)
Member involved in the protection of privacy and civil liberties (Appointed by Assembly)

Figure 3: Wildfire Technology Research and Development Advisory Review Board Membership

The Office has performed several activities related to the support of the Advisory Board in addition to preparing this report, including the preparation of meeting logistics, materials, travel coordination, board member onboarding, and technical support. The Office expects these activities to expand in scope as the Advisory Board becomes fully operational and establishes a full calendar of quarterly meetings in 2024.

Emerging Technology Evaluation Process

The Office has established a standardized evaluation process to help ensure comprehensive, consistent, and equal consideration of each emerging technology. The Office does not review individual products in isolation, but rather reviews the features and benefits of the application of the technology as a whole—which may include similar products in the same category. Additionally, the Office will review emerging technologies independently of vendors and organizations. In other words, the Office focuses on the merits of the technology as opposed to those of a specific product or organization.

The Office performs an initial review based on an assessment of the following criteria:

1. The technology is new and relevant to the purpose of the Office.
2. The emerging technology would meaningfully enhance a current wildfire industry operation or need and has enough features to be useful to early adopters of the technology.
3. The emerging technology is developed beyond the concept or prototype phase, currently exists, and is, at a minimum, at a stage at which the technology can be evaluated in real or near real-world conditions.
4. Evaluating products that have a path to procurement or productization.

Once the technology has received an initial review, depending on the outcome of that review, the solution provider may receive a request to present further information or notification to visit our website to better learn about the purpose of the Office.

This allows the Office to communicate uniformly and fairly with each entity submitting information related to an emerging technology. A summary of the overall process is outlined in Figure 4, below:

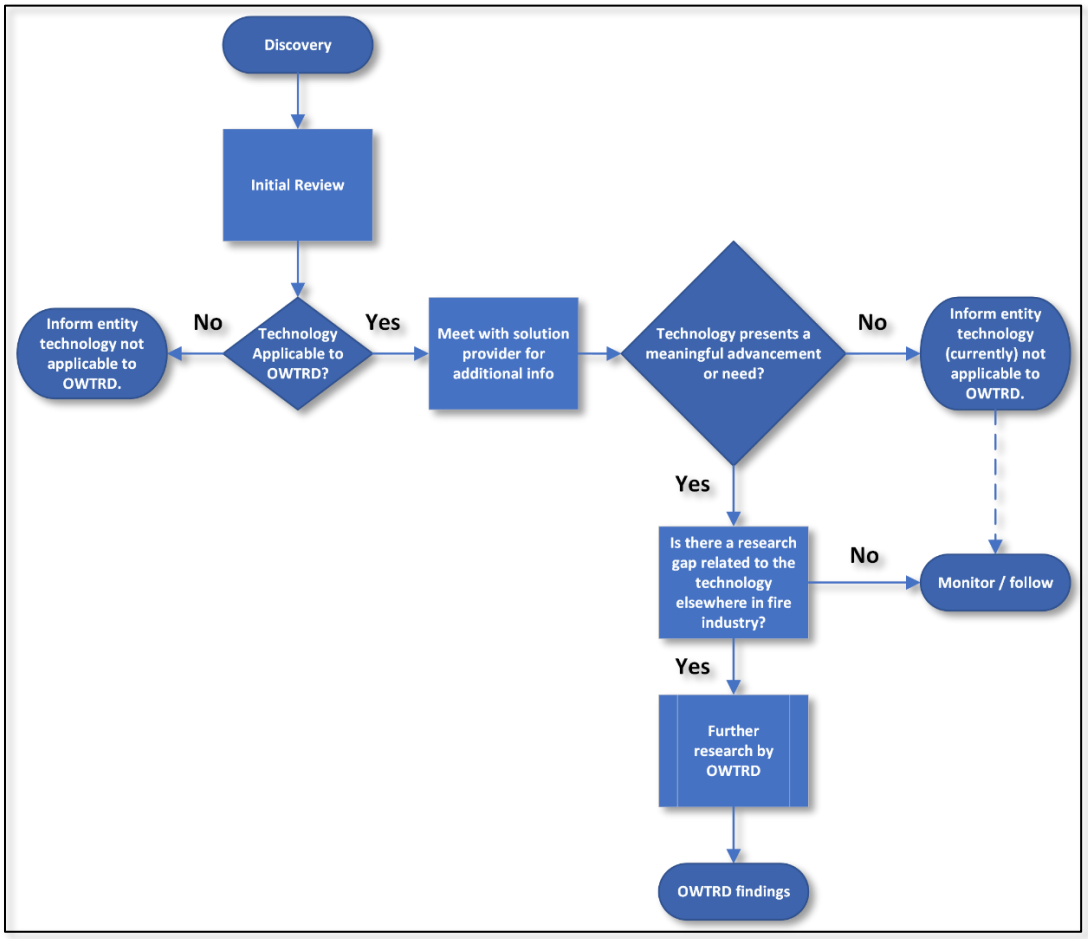


Figure 4: OWTRD Emerging Technology Evaluation Process

It is important to note that this initial review may involve Subject Matter Experts (SMEs) from across CAL FIRE; particularly if the technology is highly specialized and applicable to a program, e.g., Drones or Uncrewed Aerial Systems (UAS).

If a technology satisfies the three initial review criteria, listed above, the solution provider may be asked to provide more information. After that occurs, the Office may determine that this solution is not currently suitable for further research or evaluation. In this situation, the Office may monitor and follow the evolution of the technology and review future iterations of the technology.

Alternatively, if the emerging technology does satisfy the initial review criteria, and the solution provider has provided enough supplemental information to the Office, the Office may create a business use case and may recommend creating an environment for evaluation.

In the evaluation phase, the Office may seek access to work projects, training exercises, prescribed fire, or to CAL FIRE facilities or demonstration state forests to conduct real-world field testing.

At the conclusion of the evaluation, the Office will create a set of findings regarding the technology that may be useful for fire agencies and those interested in wildfire prevention and suppression activities.

The Office will evolve these processes and procedures on an ongoing basis, with guidance from the Advisory Board, and through continuous evaluation and improvement, such as After Action Reports (AARs) following each field test.

The Office will not directly procure the technologies that may ultimately be integrated into CAL FIRE department operations. Rather, the Office will publish its evaluations and findings in subsequent reports to the Advisory Board; CAL FIRE and other State and local partners may then use this information to assist with procurement decisions as desired.

The Office will continue to address industry gaps and drive product development related to emerging technologies that are not a focus of other programs within CAL FIRE or other fire agencies for the benefit of all within the fire industry and the communities we serve.

Scope of the Office

As stated by SB 109, the Office was created to serve as the central organizing hub for the State government's identification of emerging wildfire technologies. While the Office exists within CAL FIRE, the Office aims to serve the needs of the fire service community as a whole; this includes local, State, and federal fire agencies as well as the public we all serve.

When the Office meets with private, public, and non-profit entities, it is for the sole purpose of learning about a potential emerging technology that may benefit the wildland fire service community. The Office is a non-partisan, vendor-agnostic program focused on the identification and development of emerging wildfire technologies.

The Office only considers emerging technologies that may produce a meaningful advancement in how the fire service community prevents and suppresses wildfire. The Office does not consider pre-existing solutions that represent a one-to-one alternative to a product or solution already being used within the wildfire service community.

Additionally, the Office is not a pathway for vendors to sell or market their solutions to CAL FIRE or others. Meetings with the Office are limited to discussion of emerging technologies, and the Office will not provide information to internal or external contacts for the purpose of connecting with a potential customer.

While the Office does not focus on the development of technologies in-house, it does educate the public, as well as private and non-profit entities, on the types of technologies, products, features, and specifications that the fire prevention and suppression community is looking for.

The Office aims to drive industry technologies still under development by providing feedback and inputs early on, and at key phases of the development lifecycle. The Office hopes to steer these emerging technologies in a direction that will result in a technology that is more likely to be useful to (and ultimately, procured by) fire agencies in the future.

The Office and CAL FIRE do not have unlimited access to sites for field evaluation of emerging technologies. Access to evaluation sites relies heavily upon cooperation and coordination with CAL FIRE units, local agencies, and federal agencies. The Office also hopes to establish relationships with tribal and private landowners to increase the availability of field evaluation sites that are representative of the various topographies and climates that are affected by the threat of wildfire.

The Office is staffed to support the task identified in Government Code §8586.8; however, it is not funded to directly procure the emerging technologies itself or fund pilot products or research projects by external entities. Additionally, with limited funding, overall staffing, and qualified safety personnel assigned to the Office, the Office places great importance on being alert to the current needs of the overall wildfire industry in determining its current areas of focus.

Current Areas of Focus

The Office has identified several priority areas of focus. These were determined based on internal and external collaboration and research, as described above. Essentially, these are the highest priority areas and gaps that the Office hopes can be filled by emerging wildfire technology.

These current areas of focus include last-mile connectivity, dismounted firefighter location, enhanced situational awareness, firefighter health and safety, and data availability and integration. These topics are discussed in more detail in the sections below.

Last Mile Connectivity

Communications are essential to helping mitigate an emergency. Fire, law enforcement, emergency medical services, utility companies, etc., need readily available access to communications, whether it is voice, text, or data, to communicate vital information in a timely and efficient manner.

Last Mile Connectivity (LMC) in the context of wildland firefighting is the challenge of obtaining reliable telecommunications capabilities within locations that are underserved by wired or mobile networks. These areas are often remote with difficult terrain. Large wildfires often begin or expand into large geographic and sparsely populated areas that are often designated as Federal Responsibility Area (FRA) or State Responsibility Area (SRA). Within areas designated SRA, the State has the financial responsibility of preventing and suppressing fires. These areas commonly do not have the modern communication infrastructure afforded to more densely populated areas. Additionally, when large wildfires impact more densely populated areas with modern communications infrastructure, the destructive wildfire can either destroy the communications infrastructure or cause the system to overload due to elevated usage, rendering it ineffective. The lack of connectivity can place emergency responders at a significant disadvantage.

Wildland firefighting continues to become more efficient in adopting advanced technologies to protect people, property, and the environment. Readily available access to communication capabilities allows emergency personnel to send and receive information that is utilized to fight wildfires with more efficiency and safety. The technology to address LMC is becoming more readily available. However, challenges remain related to ensuring that devices work reliably in real-world conditions, firefighters are not dependent on one technology, and different solutions can work together seamlessly. The solutions likely implemented in the years ahead will be a combination of different technologies that create layers of redundancy to ensure reliable communications coverage in challenging environments.

The Office is investigating and evaluating both vertical and horizontal solutions. Vertical solutions include access to communication gateways via satellites or high-altitude platforms (HAP) and other types of Uncrewed Aerial Vehicles/Systems (UAV/UAS). These vertical solutions obtain access to the internet and allow that data to be sent down to remote areas that are traditionally deficient in data and communication availability.

Horizontal solutions then take the connection that is established vertically and spread it horizontally to personnel across the fire line. An example of this would be creating a mesh network. A mesh network is a type of wireless network that uses multiple nodes (point-to-point communication) to create a single network. The nodes in a mesh network can communicate with each other wirelessly, which makes them well-suited for providing internet access in rural and remote areas where there is no existing infrastructure (Figure 5).

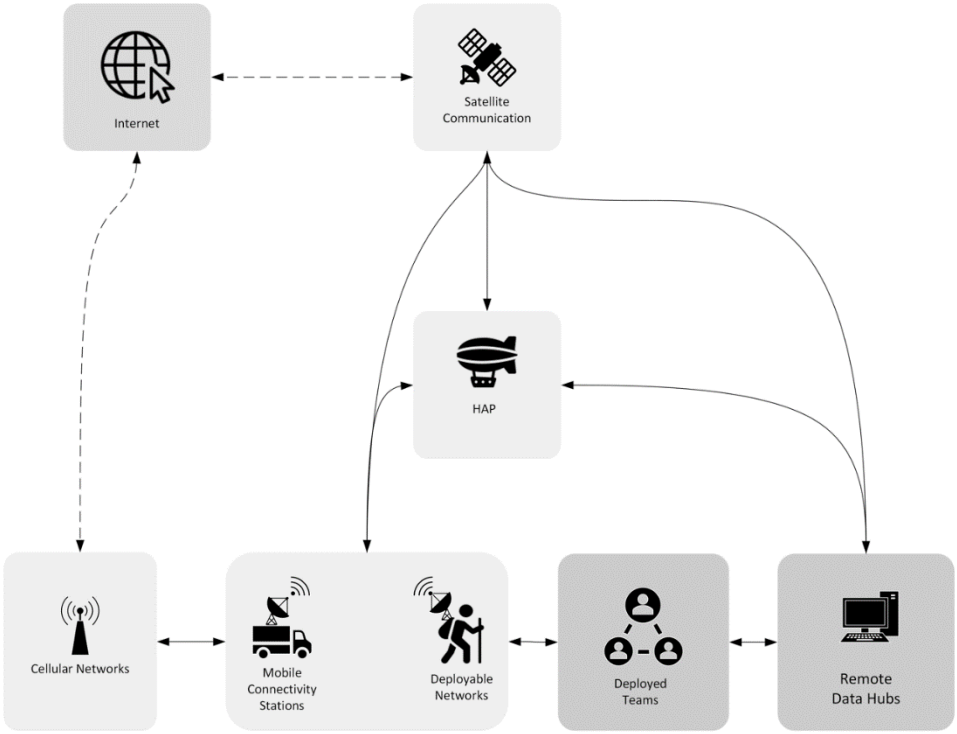


Figure 5: Vertical and Horizontal Configuration of a Mobile Mesh Network

The technology to address LMC is evolving rapidly. The solutions that are ultimately implemented will likely include several different types of technologies with different functions to ensure reliability in difficult environments.

The Office has conducted several field tests of emerging technology solutions for LMC, in a variety of environments, and will present findings to the Advisory Board once the Office has completed its evaluations.

Dismounted Firefighter Location

Fire departments commonly have capabilities to locate and track firefighting vehicles both on the ground and in the air. However, there is currently not a widely used solution to locate firefighters once they dismount the vehicle that transported them to the wildfire. Currently, the best method available for a dismounted firefighter to be located on the fire line is utilizing verbal radio communications describing the geographical area they are located or verbally reporting their longitude and latitude.

The ability to quickly locate a firefighter is crucial when it comes to firefighting personnel relaying time-sensitive information, such as when firefighters need immediate assistance from additional resources (i.e., aerial drops of water or retardant, additional engines, etc.), calling in a hazard, or when a medical emergency takes place. Being able to locate the current or last known location of a firefighter in real or near real-time on the fire line can greatly enhance situational awareness and safety for firefighting personnel.

To address this pressing and challenging need, the Office is exploring solutions in two main categories: hardware and software solutions, and has begun field testing several products. These solutions include those that can communicate location in communication-deficient environments (i.e., satellite connectivity) where mobile cellular networks are unavailable or are of poor quality. The challenges that face Dismounted Firefighter Location (DFL) tracking are similar to the challenges of LMC, and so the Office is looking at both challenges and related solutions that address LMC and may affect DFL and vice versa.

A key component related to hardware is wearability and usability. The Office is exploring ways to equip firefighters with wearable devices that communicate their location, increase safety, help prevent disorientation, facilitate timely rescue operations, and enhance situational awareness.

Wearable solutions must be tough and durable but also lightweight and easy to operate and wear for a long duration and ideally, can be operated whilst wearing fire gloves and other Personal Protective Equipment (PPE), if button inputs are required at all. The wearable solutions must be simple to use and require minimal cognitive effort to operate, given the stresses and challenges that emergency personnel already face on an incident.

These solutions must also include the capability to integrate with existing systems and operational platforms already in place that provide incident commanders with a comprehensive overview of rapidly evolving incidents.

Enhanced Situational Awareness

Situational Awareness (SA) is a continual process that occurs before, during, and after an incident. The ability to gather, analyze, and communicate real-time information greatly enhances SA by enabling firefighters to make informed decisions during rapidly evolving emergencies.

Before an incident, SA involves awareness of the condition of the fuels (vegetation), weather conditions, topography, and availability of resources. When responding to an incident, SA involves knowing what was reported by the reporting party and what responding resources are observing on the ground or in the air. When personnel arrive at the incident, SA includes determining the initial size-up of the incident, including current fire activity, safety, assets at risk, and the potential size that the wildfire could grow to. During the incident, SA includes continual monitoring of fire progression, the effectiveness of actions being taken, resource locations, and any additional needs. After the emergency, SA includes making accurate damage assessments and monitoring post-wildfire recovery efforts.

There is also a component of SA for personnel not actively on-scene or enroute, including personnel within dispatch or command centers, Emergency Operation Centers (EOCs), and a host of other government agencies. SA is also applicable to the public in

relaying and conveying information before, during, and after the incident (red flag warnings, evacuation orders, road closures, repopulation status, shelters, etc.).

After an incident has been mitigated, SA concerns the identification of damaged infrastructure and buildings, additional hazards that may remain, and other post-fire operations. One of these operations is fire suppression repair. This includes repairing any damages caused by fire suppression efforts including repairing roads, bulldozer lines, hand lines cut by fire crews, etc. The goal is to return the area to as natural of a state as practical. These efforts reduce erosion, flooding, and contamination of water sources.

Advanced technologies, such as imagery from satellites, aircraft, and terrestrial cameras, as well as different types of sensor data, play a crucial role in enhancing SA. Figure 6, below, shows an example map of ALERTCalifornia cameras.

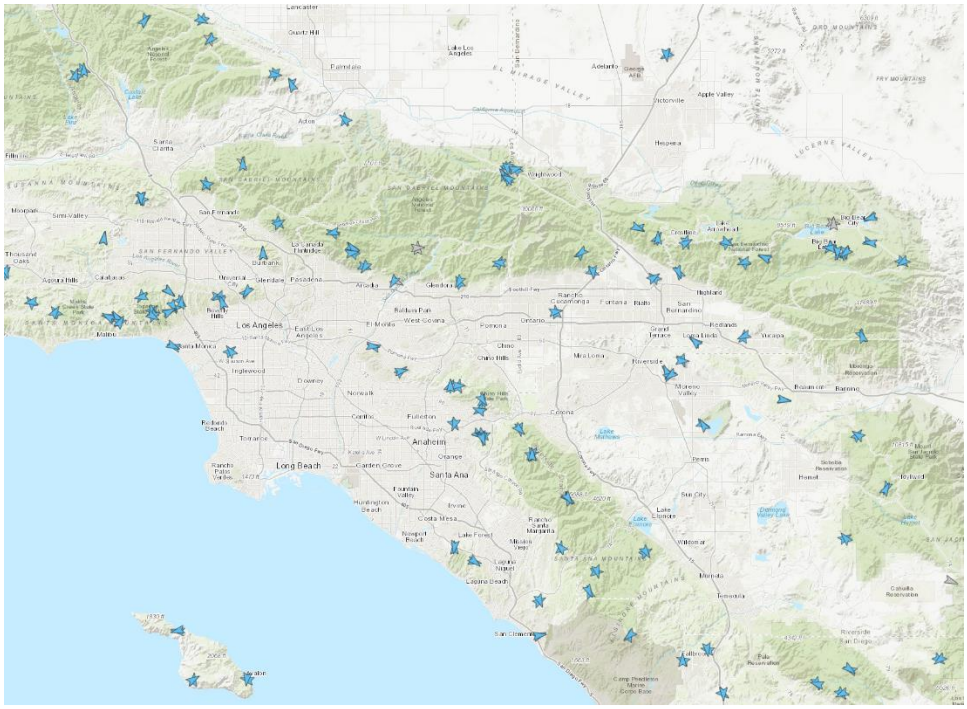


Figure 6: Example Map of ALERTCalifornia Network of Cameras

These tools enable fire agencies to access real or near real-time data, making it easier for decision-makers to assess and respond to evolving situations. Additional emerging technologies that may enhance situational awareness include developments in remote sensing, artificial intelligence, and machine learning.

An example of this technology is the ALERTCalifornia Camera Network, operated and maintained by the University of California San Diego (Figure 6, above). As of September 2023, this network contains more than 1,000 cameras strategically placed throughout California.[5] A notable recent addition to this network is Artificial Intelligence, which

possesses the capability to discern anomalies within the camera footage. These anomalies could potentially signify the presence of a smoke column.

The Office is monitoring currently evolving solutions already in place by incorporating advancements in capabilities as well as evaluating new solutions to supplement existing technology with the goal of enhancing SA. The Office recognizes that a robust and efficient remote sensing system, comprised of Internet of Things (IoT) sensors deployed throughout the State may play an important role in wildfire mitigation and response capabilities.

The Office is currently evaluating several of these remote sensing technologies in the field, including ongoing testing and monitoring in Jackson Demonstration State Forest, and will present its findings to the Advisory Board once the Office has completed these evaluations.

Firefighter Health and Safety

Firefighter health and safety is a focus of all fire agencies, and agencies often have personnel specifically dedicated to its maintenance and improvement. The Office is interested in advancements in technology related to location tracking, health monitoring, biometrics, and exposure monitoring, all of which have the potential to be obtained via wearable devices and incorporated into software platforms already utilized. Risk reduction, including looking into the feasibility of firefighters utilizing respiratory protection while fighting wildland fires, is also a consideration. Additionally, enhanced recordkeeping will contribute to this area of focus.

Data Availability and Integration (Business Process Optimization)

The ability to effectively collect, store, analyze, and visualize data is a challenge for most organizations; wildfire agencies are no exception, especially as these agencies continue to develop and incorporate new tools and technologies. The demand for data analysis, integration, and ease of use continues to grow. The ability to consolidate and integrate data assets will continue to become even more important. Data that cannot be easily accessed or interpreted quickly is often underutilized or not used at all.

This data resides in various Records Management Systems used throughout the industry, and includes large files from remote imaging, visual and infrared videos, LiDAR scans, and other sensor data. Artificial Intelligence has the potential to enhance the way fire agencies process and catalog this data, and ultimately approach fire suppression, wildfire mitigation, community outreach, disaster relief, and logistics.

For example, Artificial Intelligence can automatically identify, with an associated confidence score, where and when certain objects, like smoke, flames, or structures, appear in a video. Instead of watching or manually scanning through an hour-long video, the AI can suggest to an analyst when the key frames of interest are located within the video.

Enhanced data visualization will be useful for gaining rapid and digestible business insights from complex datasets on a regular basis. The ability of fire agencies to effectively use data assets will have a large impact on operations as data analysis, aggregation, and visualization are valuable tools that can add efficiencies to fire department operations.

Conclusion

Increasing rates of catastrophic wildfire remain a challenge in California. At the same time, technology continues to advance and play an important role in combating these incidents. Innovation offers an opportunity to improve how California prevents and protects against catastrophic wildfire. The creation of the Office of Wildfire Technology Research and Development is another important step in addressing these concerns.

In a short period of time, the Office has formed and begun the important work of identifying industry gaps in emerging technology and developing its current areas of focus. The Office has created foundational business processes and is working to gain a deeper understanding of the technologies available across a wide range of technology types to address those gaps.

In the years ahead, as remote sensing, Artificial Intelligence, wearable devices, and a host of other hardware and software technologies become more advanced, the Office will continue its work to evaluate how effective these advances may be in improving how fire agencies approach their increasingly important work.

Appendices

Appendix A: Acronyms and Definitions

DFL	Dismounted Firefighter Location, is the location of a firefighter who has dismounted from a fire engine or other vehicle.
EOC	Emergency Operations Center, is a location from which leaders of a jurisdiction or organization coordinate information and resources to support incident management activities.
FRA	Federal Responsibility Area is the area of the State where land is controlled by the Federal Government for which federal agencies have administrative and protection responsibility.
HAP	High Altitude Platform, is an uncrewed aircraft that flies at high altitudes (11 – 14 miles) and can provide communication, surveillance, and other services over a wide area.
LMC	Last Mile Connectivity, in the context of wildland firefighting, is the challenge of obtaining reliable telecommunications capabilities within locations that are underserved by wired or mobile networks. LMC may also apply in urban areas when broadband infrastructure has been destroyed by a disaster.
OWTRD	Office of Wildfire Technology Research and Development
SA	Situational Awareness, is the ability of individuals or teams to understand various aspects of an incident and make informed decisions.
SRA	State Responsibility Area means areas of the State in which the jurisdictional and financial responsibility of preventing and suppressing fires has been determined to be primarily the responsibility of the State. (Public Resources Code 4102)
UAV /UAS	Uncrewed Aerial Vehicle/System(s) are aerial vehicles without a human pilot, crew, or passengers on board.

Appendix B: Senate Bill 109

Senate Bill 109, published 09/24/2021, is reproduced below in full, for reference:

LEGISLATIVE COUNSEL'S DIGEST

SB 109, Dodd. Department of Forestry and Fire Protection: Office of Wildfire Technology Research and Development.

Existing law, the California Emergency Services Act, establishes, within the office of the Governor, the Office of Emergency Services, under the direction of the Director of Emergency Services for the purpose of mitigating the effects of natural, manmade, or war-caused emergencies.

Existing law also establishes the Department of Forestry and Fire Protection and establishes various programs for the prevention and reduction of wildfires. Existing law requires the office and the department to jointly establish and lead the Wildfire Forecast and Threat Intelligence Integration Center, and sets forth the functions and duties of the center, including serving as the state's integrated central organizing hub for wildfire forecasting.

This bill would, until January 1, 2029, also establish the Office of Wildfire Technology Research and Development within the Department of Forestry and Fire Protection under the direct control of the Director of the department. The bill would make the office responsible for studying, testing, and advising regarding procurement of emerging technologies and tools in order to more effectively prevent and suppress wildfires throughout the state, through specified activities, as provided.

This bill would establish the Wildfire Technology Research and Development Review Advisory Board consisting of 9 specified members, including the Secretary of the Natural Resources Agency, or their designee, the Director of the Office of Emergency Services, or their designee, and the Director of the Department of Forestry and Fire Protection, or their designee, among others. The bill would make the Office of Wildfire Technology Research and Development subject to review by the board. The bill would require the board to meet at least 4 times per year, as specified. The bill would require the findings and recommendations of the board to be compiled and delivered to the office of the Governor and the Legislature no later than January 1, 2024, and annually thereafter, as provided. The bill would require members of the board to serve without compensation, but would allow members to be reimbursed for actual expenses incurred in connection with their duties.

BILL TEXT
THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. The Legislature finds and declares all of the following:

(a) With approximately 40,000,000 residents, the State of California is the most populous state in the nation and has the third largest land area among the states (163,695 square miles).

(b) California faces arguably the most complex and severe wildfire disaster conditions in the nation that pose threats to our people, property, economy, and environment. These challenges and complexities grow in magnitude each year.

(c) Catastrophic wildfires pose an urgent threat to lives, property, and resources in California.

(d) Seventeen of the 20 largest wildfires in California history have occurred since 2000, and 6 of the 7 largest wildfires occurred in 2020 alone.

(e) The escalating frequency and devastation caused by wildfires demand ongoing research and development of emerging wildfire technologies and tools to prevent, monitor, identify, and suppress wildfires developed by public, private, and nonprofit entities in order to protect lives and property from the effects of wildfires.

(f) It is in the best interest of the state that our wildfire preparedness and response infrastructure include and integrate the most effective and evidence-based scientific and technological perspectives and tools to address the wildfire threat facing California.

SEC. 2. Section 8586.8 is added to the Government Code, to read:

8586.8. (a) For purposes of this section, “office” means the Office of Wildfire Technology Research and Development.

(b) The Office of Wildfire Technology Research and Development is hereby established in state government within the Department of Forestry and Fire Protection to study, test, and advise regarding procurement of emerging technologies and tools in order to more effectively prevent and suppress wildfires within the state. The office shall serve as the central organizing hub for the state government’s identification of emerging wildfire technologies.

(c) The office shall be under the direct control of the Director of Forestry and Fire Protection.

(d) The office shall undertake, but is not limited to, the following activities:

(1) Develop a balanced, multimodal research and development program designed to identify, research, test, and evaluate emerging technologies and tools designed to improve the state's preparation for, and response to, wildfires in the state, including, but not limited to, fire retardants and ground, aerial, mobile, portable, communication, predictive modeling, software, or stationary equipment used for California's wildfire preparedness and by first responders.

(2) Consult with public, private, and nonprofit entities in identifying new technologies tools, software, and other advances in wildfire preparedness and response.

(3) Make recommendations to state and local agencies on the most effective and useful technologies and tools for procurement.

(e) The office shall be subject to review by the Wildfire Technology Research and Development Review Advisory Board, which shall serve in an advisory capacity, and shall consist of the following nine members:

(1) The Secretary of the Natural Resources Agency, or their designee.

(2) The Director of the Office of Emergency Services, or their designee.

(3) The Director of the Department of Forestry and Fire Protection, or their designee.

(4) Four members who are appointed by the Governor for a term of four years each, as follows:

(A) One representative from academia involved in the field of wildfire research and technology development.

(B) One representative from the private wildfire response science, engineering, and technology industry.

(C) One representative from local government.

(D) One member of the public employed as a first responder.

(5) One member who is appointed by the Senate for a term of four years who is involved in victim services.

(6) One member who is appointed by the Assembly for a term of four years who is involved in the protection of privacy and civil liberties.

(f) The board shall meet at least four times per year to review, analyze, and assess the activities and progress of the Office of Wildfire Technology Research and Development,

and to consult with public, private, and nonprofit entities regarding their interaction and responsiveness of the office.

(1) The findings and recommendations of the board shall be compiled and delivered to the office of the Governor and the Legislature as a report no later than January 1, 2024, and annually thereafter.

(2) The report developed by the board pursuant to this section shall be submitted in compliance with Section 9795.

(g) Members of the board shall serve without compensation, but they may be reimbursed for actual expenses incurred in connection with their duties.

(h) This section shall remain in effect only until January 1, 2029, and as of that date is repealed.

Endnotes

[1] California Government Code, Section 8586.8(b). Senate Bill 109, Dodd. Department of Forestry and Fire Protection: Office of Wildfire Technology Research and Development. Chapter 239, Statutes of 2021, established Government Code Section 8586.8.https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=GOV&sectionNum=8586.8, accessed on September 5, 2023.
[2] Senate Bill 109, Dodd. Department of Forestry and Fire Protection: Office of Wildfire Technology Research and Development. Chapter 239, Statutes of 2021. Section 1(e). https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220SB109, accessed on September 5, 2023.
[3] Senate Bill 109, Dodd. Section 1(f).
[4] The CAL FIRE Research & Development page is accessible from the CAL FIRE website by clicking on the menu item “What we do” and then “Research and Development”. Direct Web Link: https://www.fire.ca.gov/what-we-do/research-and-development, accessed on September 12, 2023.
[5] AlertCALIFORNIA Camera Network, based at the University of California San Diego. https://alertcalifornia.org/, accessed on September 8, 2023.