Critical Nature of Prompt Wildfire Detection Along Power Lines and a System for Providing Same

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Almost 25% of California's Major Wildfires were caused by power lines
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On average, power line fires become 10x larger than other wildfires
2021 Dixie Fire
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The Problem with Power Lines

All of these can produce arcs or flames:

- Wind blowing wires together
- Wind blowing debris onto lines
- Trees falling on lines
- Cars hitting poles
- Animals climbing on equipment
- Utility equipment operation and mis-operation
- Utility equipment failure

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Wildfire prevention
Wildfire mitigation
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Wildfire prevention
Wildfires
Wildfire mitigation
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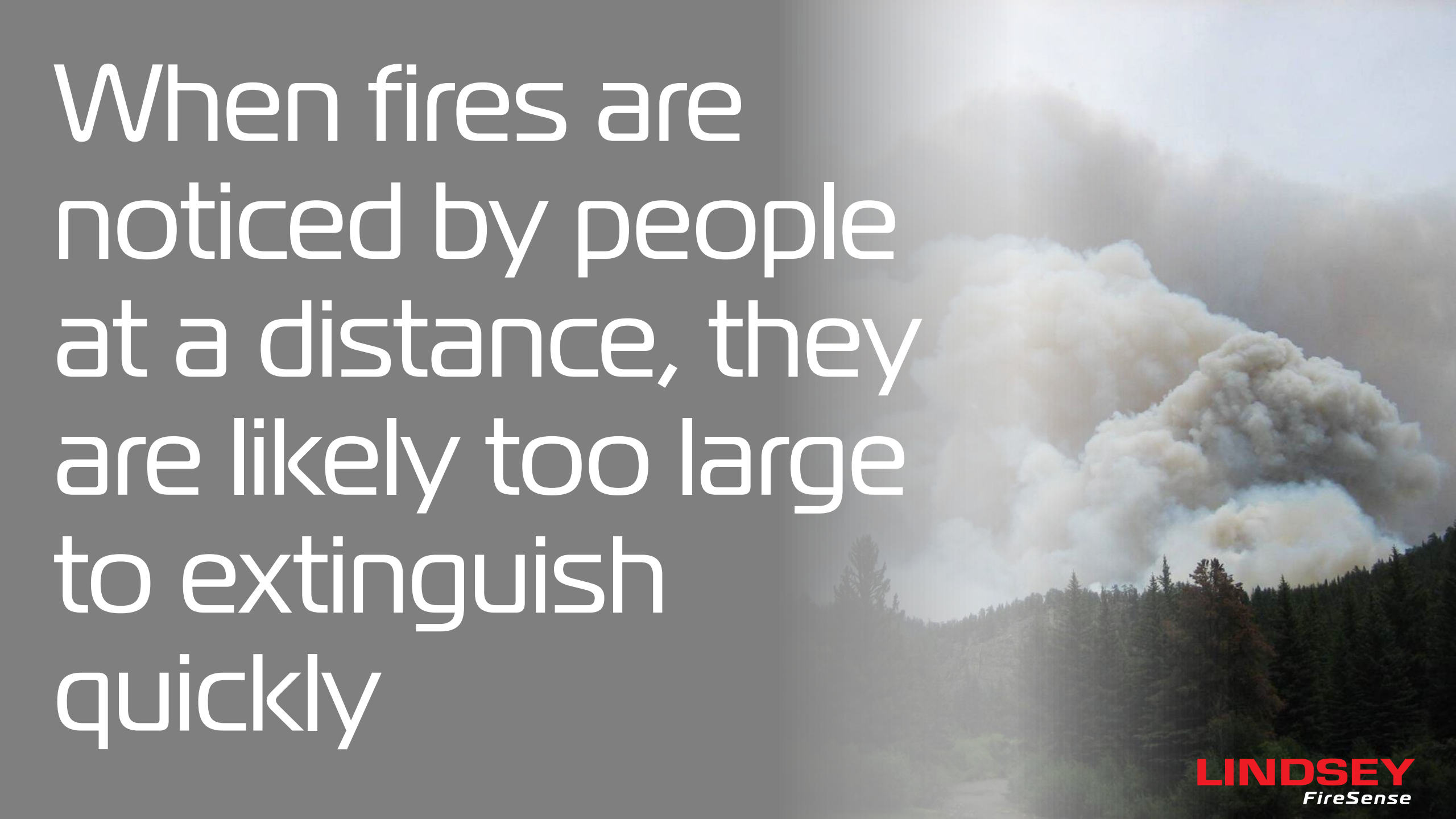
When fires are noticed by people at a distance, they are likely too large to extinguish quickly



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WITHOUT EARLY DETECTION

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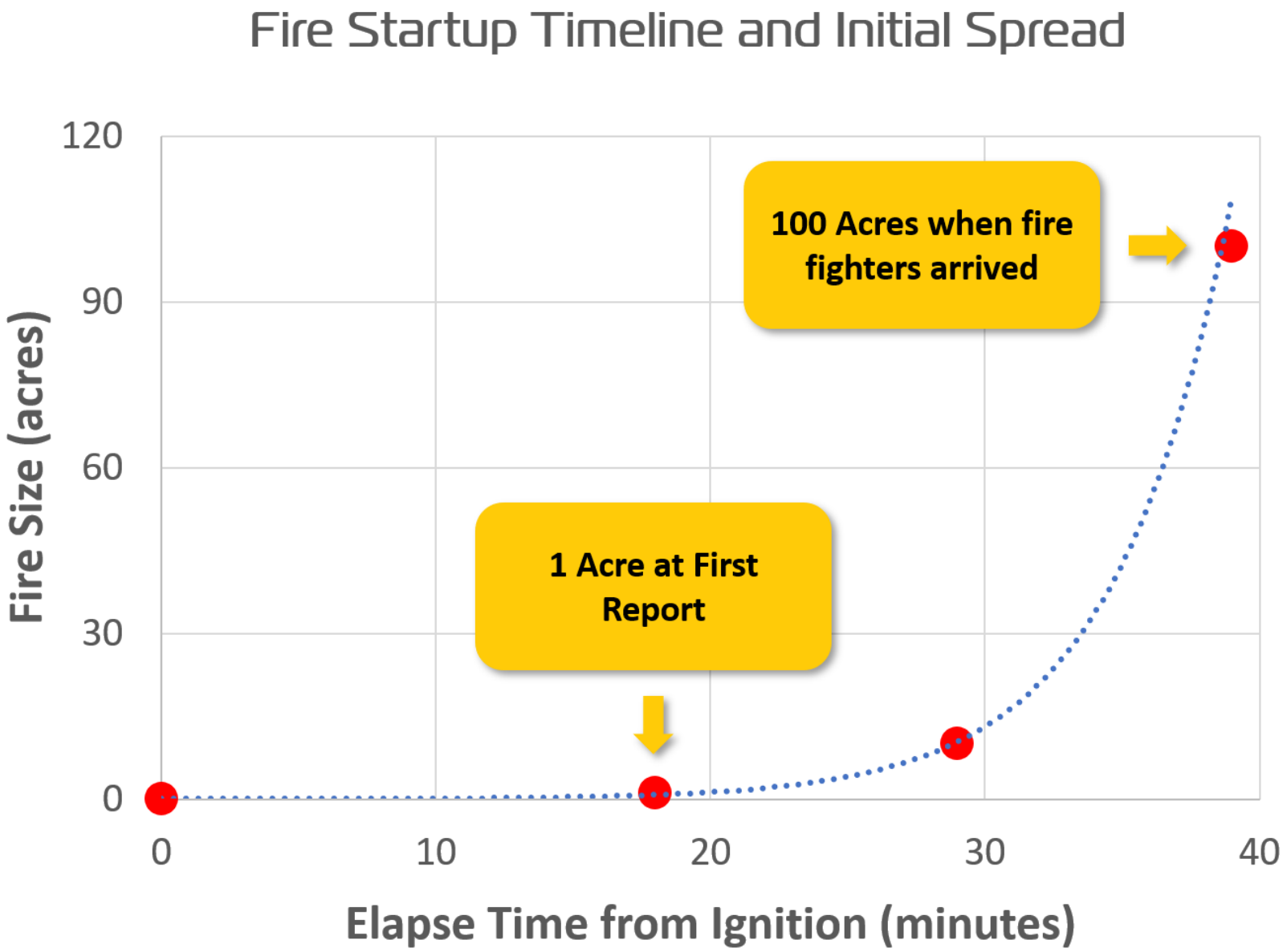

DATA FROM AN ACTUAL EVENT

A fire started 18 minutes before being reported

it was 1-acre in size at that time

during the 21-minute response time, prevailing weather and terrain resulted in a fire that had spread to 100 acres

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WITH EARLY DETECTION

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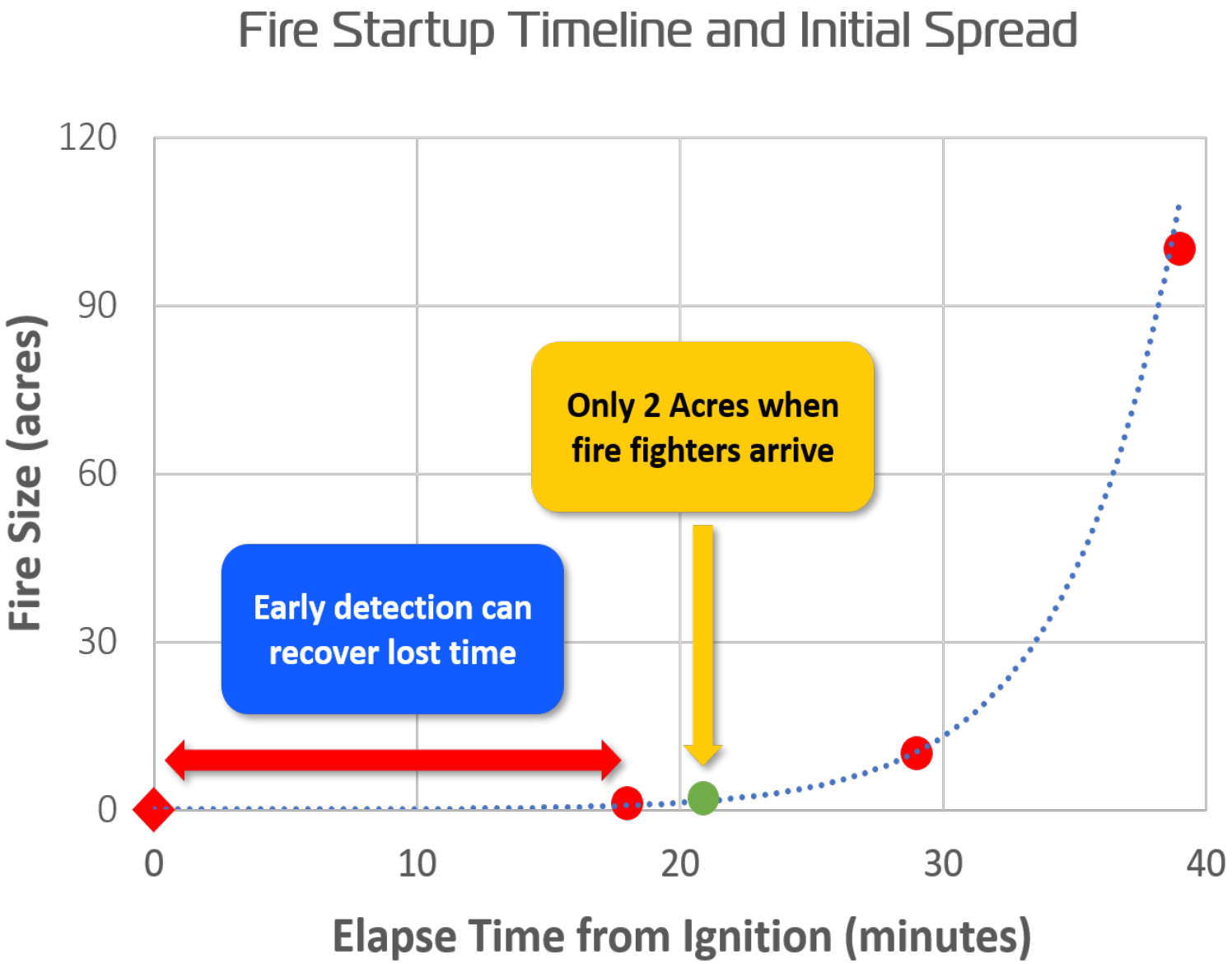

Early detection and notification shortly after ignition can recover lost time

if quickly reported after ignition…

Fire fighters could have arrived to a more easily contained 2-acre fire

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WITHOUT EARLY DETECTION

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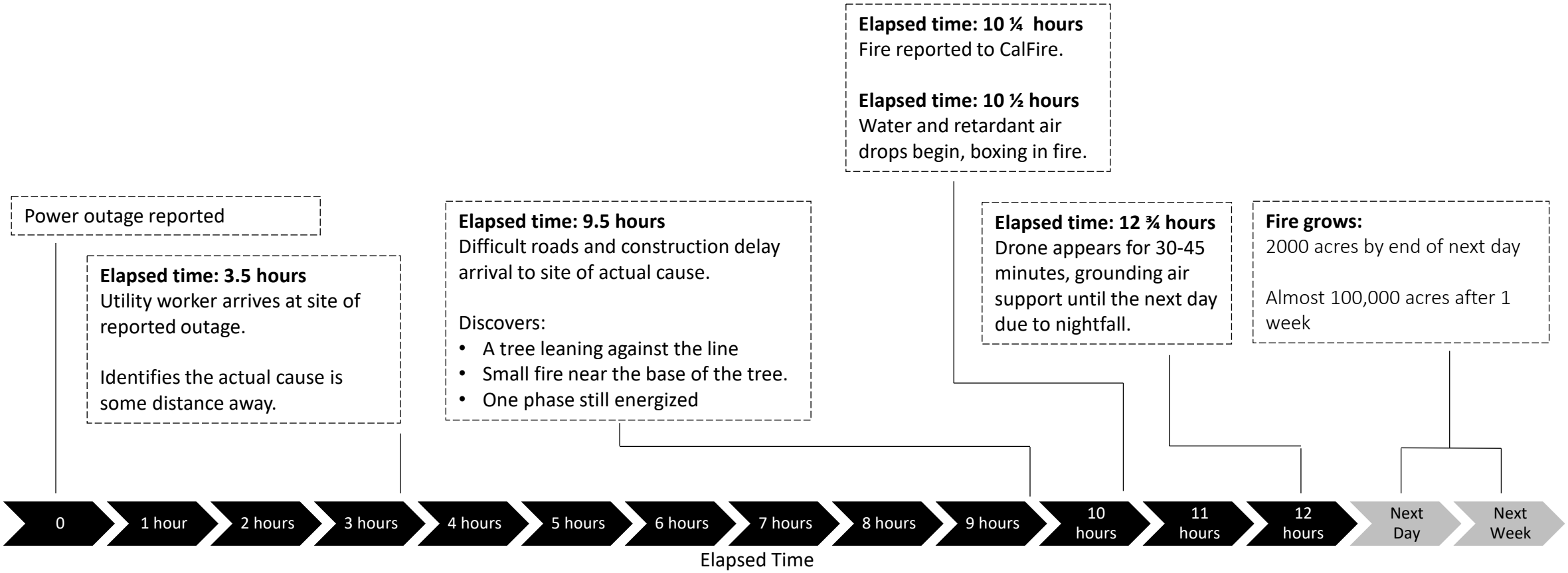
Example Wildfire



☐ Documented event

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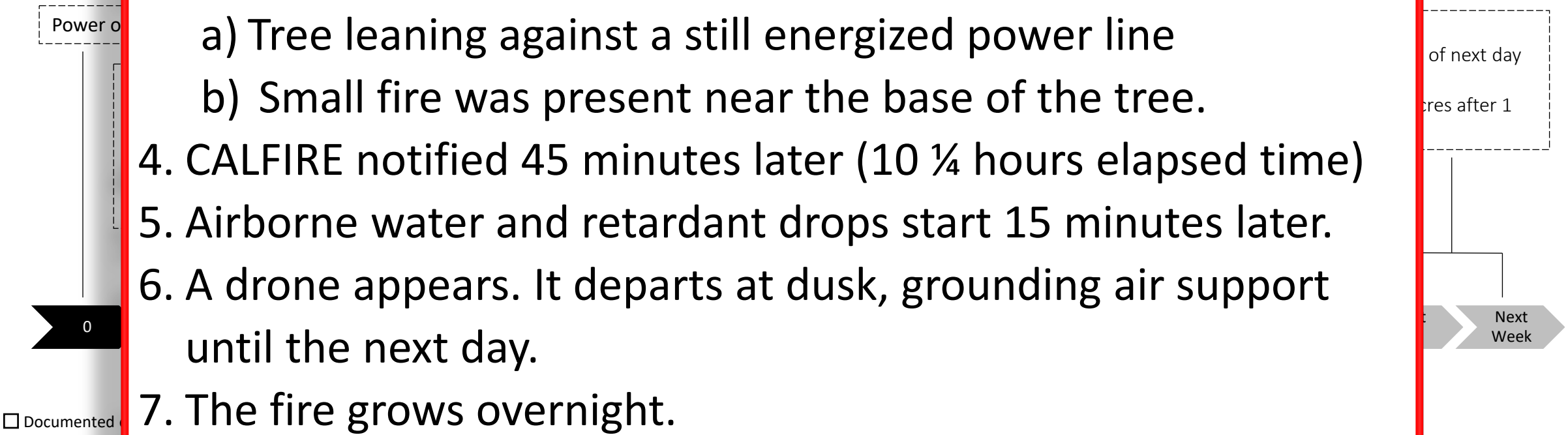
EXAMPLE FIRE – ACTUAL TIMELINE

1. Power outage is reported.
2. Worker arrives at outage site 3 1/2 hours later.
   Site of actual problem is some distance away.
3. After 6 more hours of travel, worker discovers:
   a) Tree leaning against a still energized power line
   b) Small fire was present near the base of the tree.
4. CALFIRE notified 45 minutes later (10 ¼ hours elapsed time)
5. Airborne water and retardant drops start 15 minutes later.
6. A drone appears. It departs at dusk, grounding air support until the next day.
7. The fire grows overnight.
8. End of the next day the fire was 2000 acres
   and almost 100,000 acres by the end of the week.



WITH EARLY DETECTION

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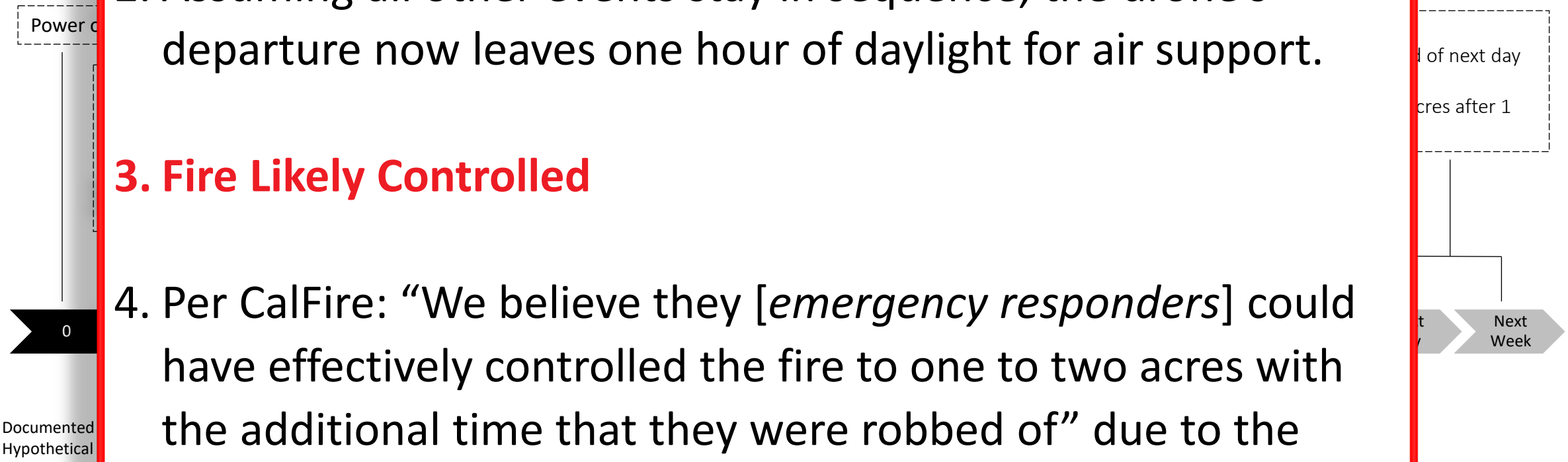
EXAMPLE with EARLY FIRE NOTIFICATION

1. Assume an early detection system provided only one hour's advance notice to CALFIRE.

2. Assuming all other events stay in sequence, the drone's departure now leaves one hour of daylight for air support.

3. **Fire Likely Controlled**

4. Per CalFire: "We believe they [*emergency responders*] could have effectively controlled the fire to one to two acres with the additional time that they were robbed of" due to the drone not allowing resumption of air support before nightfall.



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[1] Hypothetical scenario assumes none of the other events from the actual timeline were changed other than the time. The scenario is theoretical and is not meant to be a representation or guarantee of actual performance of the system, which depends on proper installation, operation and multiple other factors. Note the FIREBird system was not available for deployment before the example fire occurred. The FIREBird system is an aid to wildfire detection and should not be relied upon as the sole means of detection.

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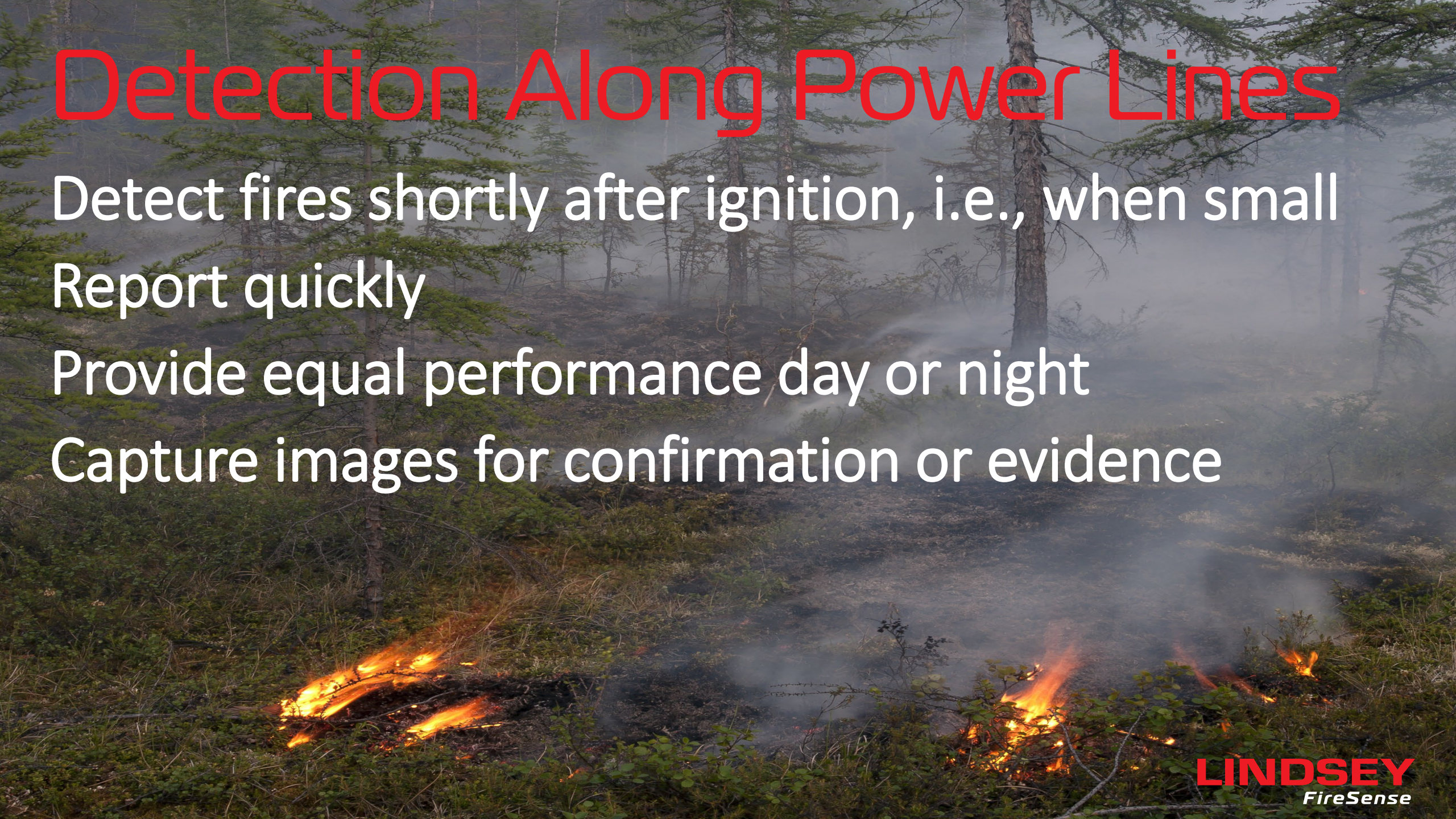
Detection Along Power Lines

Detect fires shortly after ignition, i.e., when small

Report quickly

Provide equal performance day or night

Capture images for confirmation or evidence



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The FIREBird Wildfire Detector

Achieves all the objectives by using:

- A new wildfire specific sensor
- Multiple fire detection techniques
- Autonomous computational processing
- Field-friendly package suitable for deployment along rights-of-way

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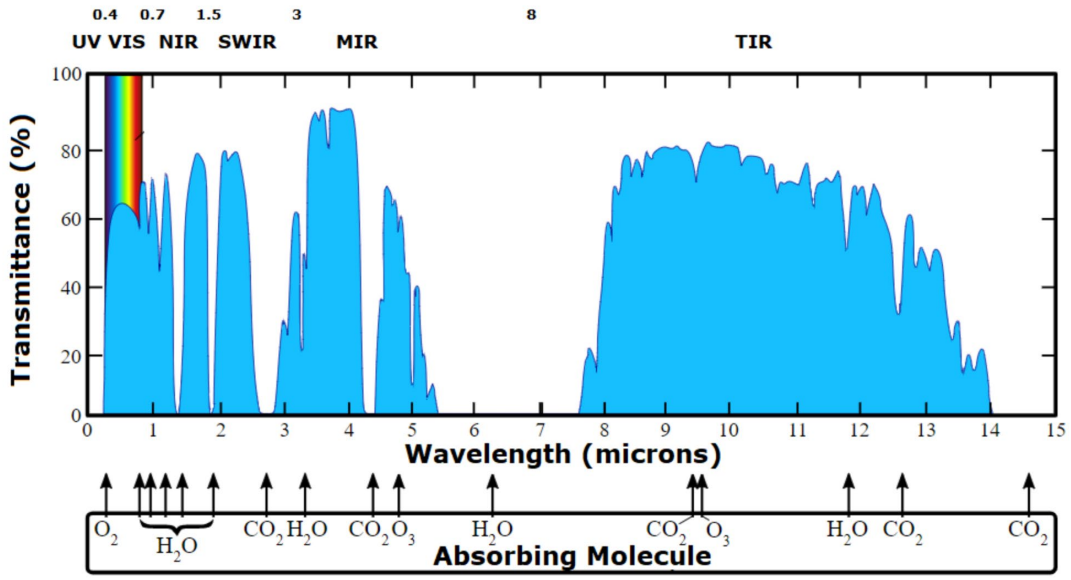
Wildfire Specific Heat Detection

Transmittance of IR Spectrum through Atmosphere



- COTS devices generally detect mid- through long-wavelength (aka thermal) IR. Sources can include:
  - Cars
  - Chimneys
  - Hot Ground
  - and Wildfires
- Fixed, “staring” type of focal plane array versus a scanning array IR sensor is used for optimal absorption of heat flux.
- Optimized pixel shape and narrow band pass coatings provide maximum detection efficiency at the characteristic wavelengths emitted primarily by wildfires.

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Continuous Monitoring

Sensors are deployed across a hemisphere for continuous, overlapped, monitoring.

6 optical cameras

8 wildfire specific thermal detectors

Not a scanning system

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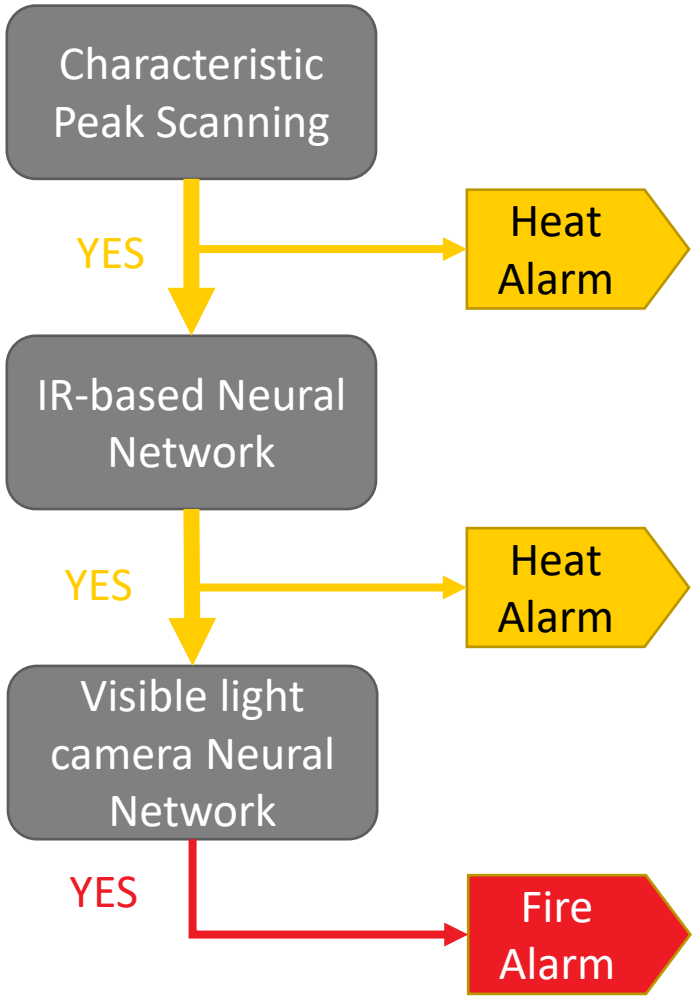
Multiple Detection Techniques

- Each IR thermal detector's output is examined for characteristic peaks.
- If positive, the output of all IR sensors are then passed through a neutral net algorithm.
- If that confirms, visible light images are passed through a separate NN.



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Autonomous Operation

- All data processing is performed within the FIREBird device itself to minimize detection time.
- Built-in cellular and satellite communication
- Solar-powered with multi-day battery
- All alarms are self-generated

No personnel required for monitoring

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Autonomous Operation

Independent communication, power, and use of cloud-based storage and notification means there is no requirement for the system to depend upon – or even to interface - with a user's existing IT or communications infrastructure.

No personnel required for monitoring

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Each FIREBird detects wildfires within 1000 ft

20 ft^2 fires out to 200 ft

Provides detection across 60-acres

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Wildfire to report typically within 2 minutes

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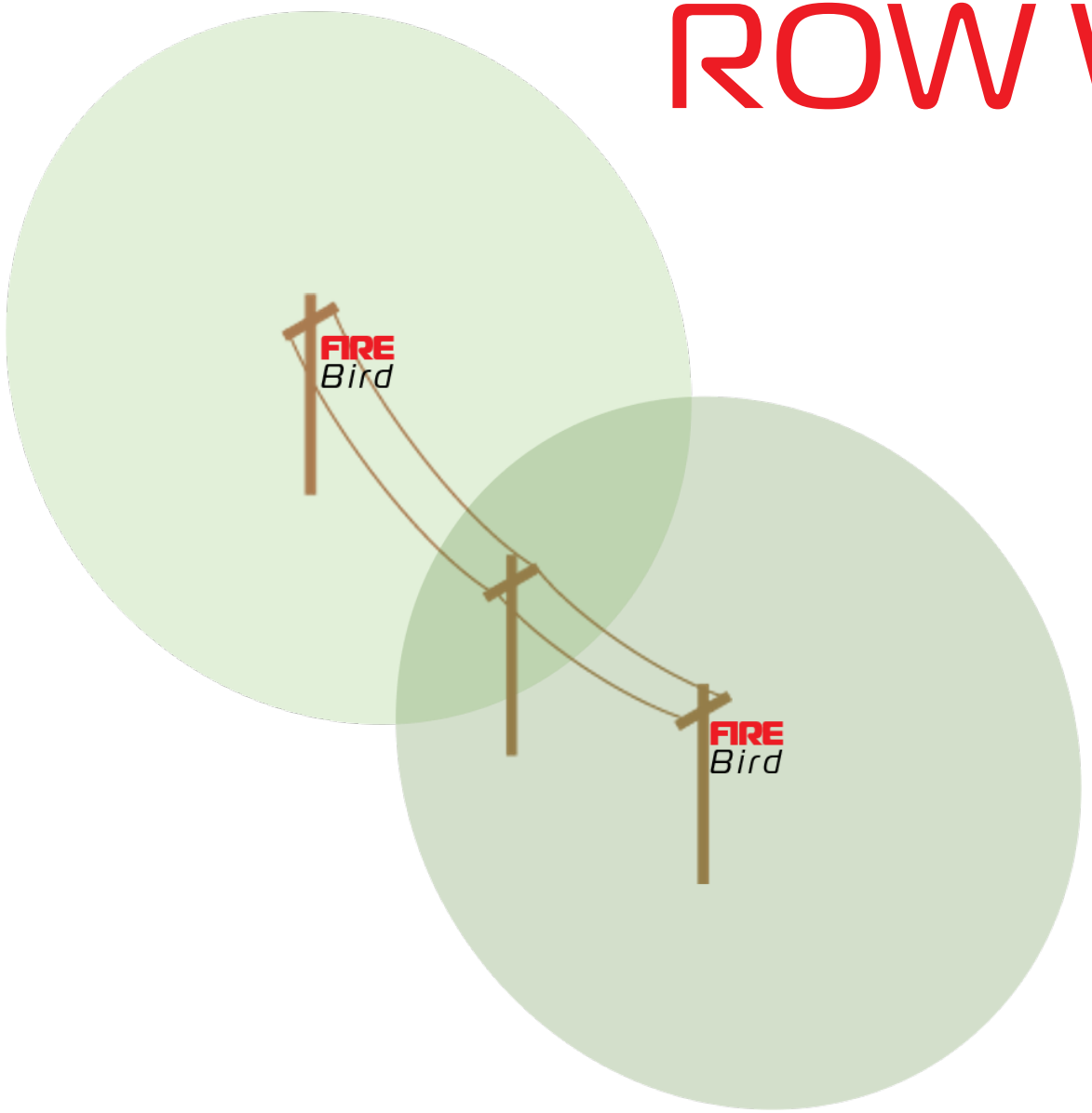
ROW Wildfire Detection



Regular placement – roughly 4 per mile - will provides continuous wildfire detection.

Suitable for MV or HV power lines, roadways, pipelines, railroads and other critical boundaries.

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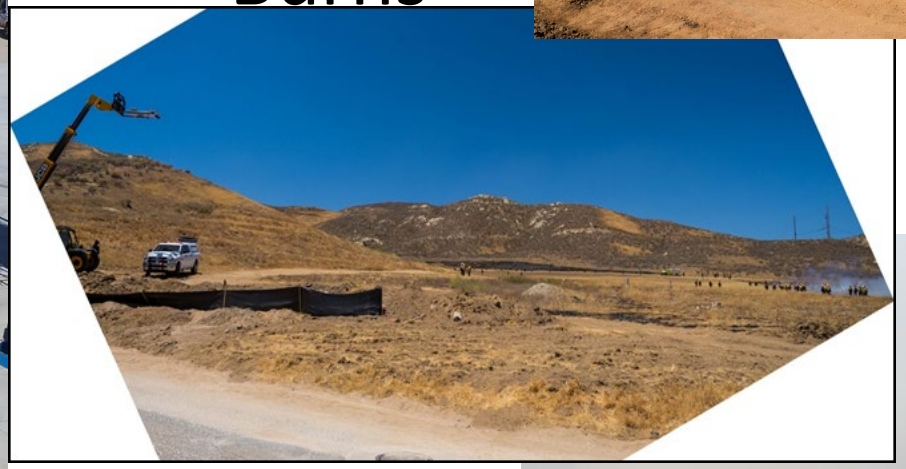
Extensive Field Testing

Controlled Barrel Fires

Prescribed Burns



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FIREBird

Fast (≈ 2 minute) detection and reporting

Detects fires as small as 10 sq ft

Detects fires out to 1000 ft

Fully self-contained

Requires no full-time monitoring

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Faster Wildfire Detection

FIREBird reduces the likelihood of small wildfires going unnoticed.

Reduces the fire fighting resources needed to control an event.

Increases public safety.

Reduces property damage.

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FIREBird is California

Designed, built and tested in California.

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