

# AI Camera Technology for Bushfire Detection

A FOREST MANAGEMENT VIEWPOINT



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# Introduction

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## Mike Lawson

SFM CHIEF OPERATING OFFICER

- SFM manage forests in the Green Triangle, WA and Tasmania
- Involved with the deployment of AI camera technology (Pano AI) in the Summer of 2020/21 (Southern Tasmania and Green Triangle)
- CFA Volunteer (SFM Forest Industry Brigade)
- GTFA Chair in 2023
- GTFA steering committee 2022/23
- Governing Council member VFPA and SAFPA



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# AI Fire Detection

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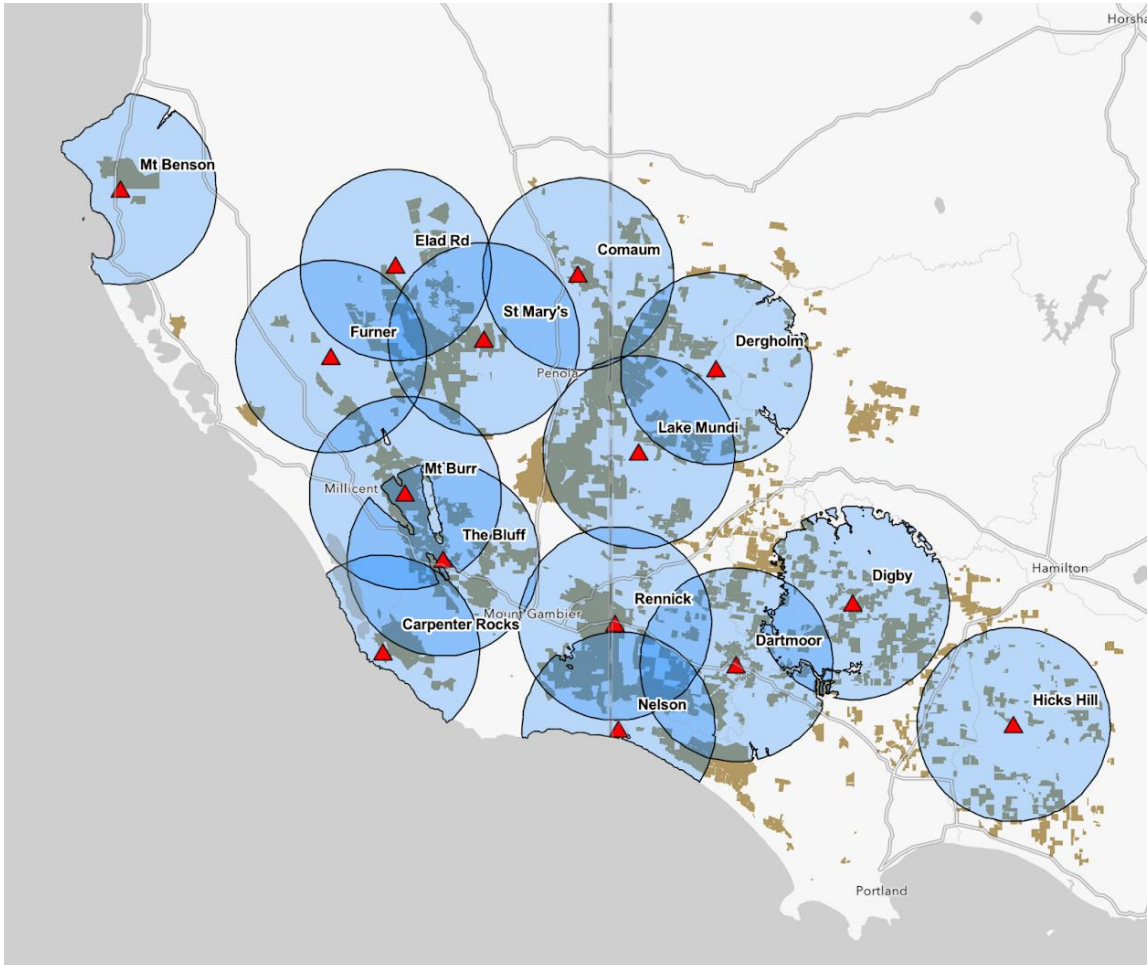
## HOW DID WE GET TO OPERATIONAL DEPLOYMENT?

- 2021 – Camera and satellite fire detection technology discussed in the newly formed Green Triangle Fire Alliance (GTFA) as insurance costs increase significantly and forest growers look to innovation to improve regional fire management
- The GTFA investigates options
  - Industry is in growth mode
  - Relatively low barriers to entry so its crowded, and getting more crowded
  - USA and parts of Europe already utilising technology for fire detection as a matter of course
  - Australia akin to the ‘wild west’
- Satellite technology trickier to navigate, cameras seen as a viable option
- 3 strikes before settling on current provider, Pano AI (3yr Term)



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# Green Triangle



## GREEN TRIANGLE

- Fifteen cameras now operating on fixed towers, 4 of which are fire towers, covering over 1.7M hectares
- Approximately 350k hectares of production forest
- **GTFA members**
  - SFM
  - OFO
  - GTFP
  - PFO
  - ABP
  - TPPL
  - AKD
  - HVP
  - GPFL

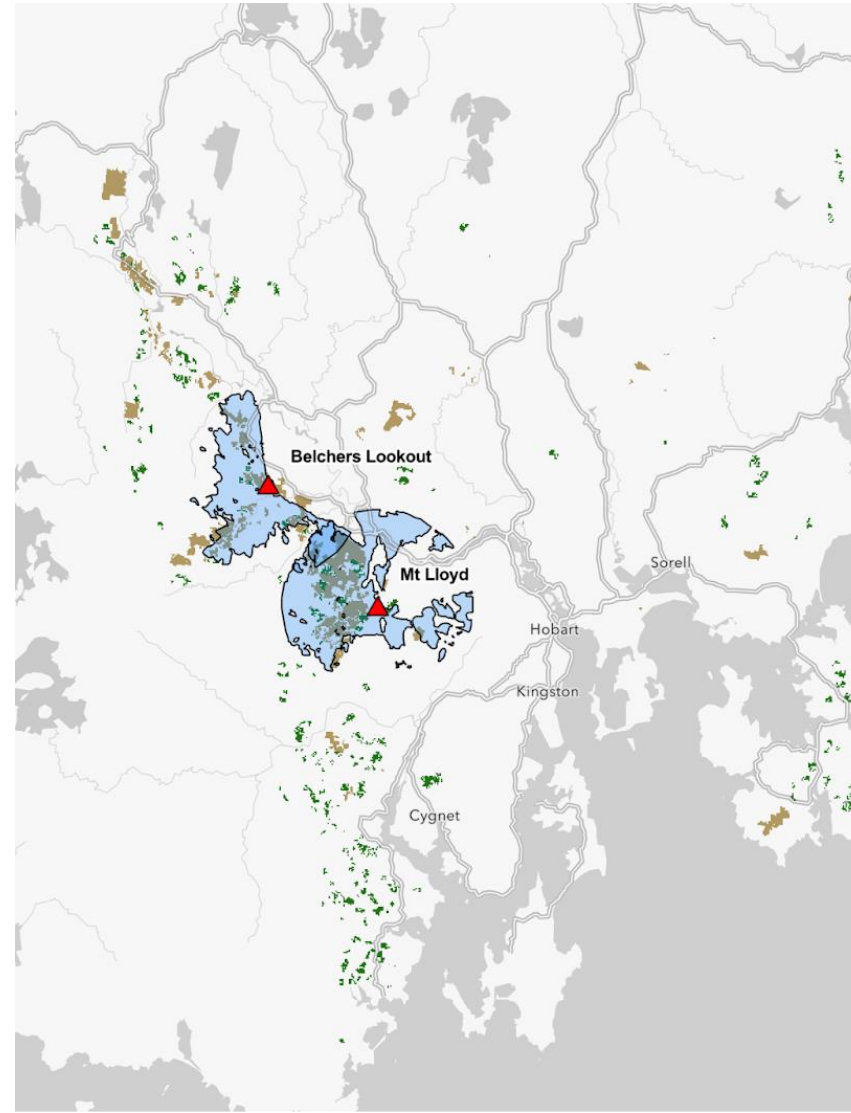


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# Tasmania

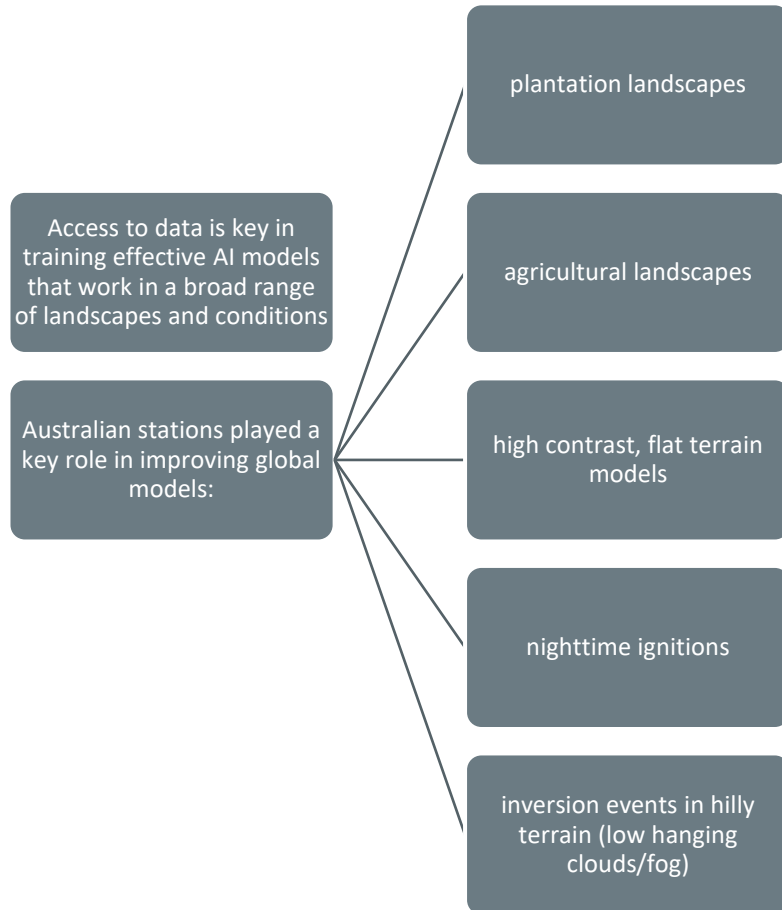
## TASMANIA

- Two cameras established atop mountains up the Derwent Valley
- Approximately 40k hectares of production forest (Lenah Estate and RFF) within the official viewshed
- Total area within viewshed is ~67k hectares including native forest, farmland and domestic dwellings.



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# How do the cameras work?



- Contrary to popular belief, humans are still involved. Service providers operate 24/7
- An algorithm identifies specific changes in the landscape
- Human-in-the-loop verifies fires prior to alerts being sent to forest managers and fire fighters
- False-positive detections get marked and fed back into the machine learning loop, depending on source of detection:
  - industrial sources (eg: factories) are 'learnt' so not to be alerted in the future
  - non-fire behaviour - example in Australian landscape is lime spreading - single frame can look like smoke, however it is very thin, white and moves horizontally and dissipates quickly.





# Machine Learning and continuous improvement

- Cameras cover 360° out to 20km radius
  - Fires have been detected at distances beyond 60km
- Every new station gets calibrated, usually with a process linked to the algorithm
- First few days & weeks are spent 'learning' about the environment
  - Every new camera benefits from 'learnings' of the whole network
  - Every new camera adds new learning potential for the network
- False-positive detections get marked and fed back into the machine learning loop, depending on source of detection:
  - Industrial sources (eg: factories) are 'learnt' so not to be alerted in the future
  - Non-fire behaviour (such as lime spreading) – A single frame can look like smoke however it is very thin, white and moves horizontally and dissipates quickly.



Snow



High contrast landscapes



Plantation, farmland



Urban environment,  
low contrast horizon



Night time ignition



Highly varied topography  
& terrain



Pixelation



Dense low cover fog



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# 2023/24 Green Triangle Fire Season Summary

## Fire detection system overview (Dec 2023 - Apr 2024):

### •Alert frequency (Dec 2023 - Mar 2024):

- 97 alerts (average <1 per day)
- 54 alerts were for confirmed fires
  - 40 of these fire alerts were for unplanned fires

### •Alert frequency (Mar 21 - Apr 30, 2024):

- Total of 1608 alerts (average of 39 per day). Almost 100% planned burns.
- Difficulty distinguishing unplanned fires due to high volume
- Alerts for planned burns were accurate (not false positives), showing improvements in accuracy
- Increased alerts led to **message fatigue**

*Table 1 Classification of alerts that were compiled.*

Alert classification	Number of alerts	Percentage of total alerts
Fire	54	51%
Dust	15	14%
False positive	18	17%
Repeat alert	6	6%
Inconclusive / unknown	12	11%
<b>Total</b>	<b>105</b>	<b>100%</b>

*Table 2 Initial fire notification for unplanned fires detected by the GTFM camera system.*

Initial fire notification type	Number
Call to 000	16
Camera	8
Fire tower	4
Agency (fire rekindle)	1
Fire crew patrolling	1
Unknown	10
<b>Total</b>	<b>40</b>

\* Of the 16 fires reported to 000, 9 of these fires were reported by people already on site at the ignition point

\*\* Of the 8 fires picked up and alerted by the camera system, all were at times where towers were unmanned, or in areas not covered by towers



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# 2023/24 Green Triangle Fire Season Summary Cont.

Date	Incident name	Tower / camera	Distance (km)	Alert time	Elapsed time from first report	Camera incident start time	Fire authority incident start	Reported by	Cause	Comment
2/02/2024	Rowney Rd, Keilira	Mt Benson FT	57	17:25	0:35		16:50	000	Slasher	
		Mt Benson camera	57	17:28	0:38	17:14				
7/02/2024	Bangham	Comaum FT	62	14:46	0:16		14:30	000	Chainsaw	
		Comaum camera	62	15:11	0:41	15:03				
8/02/2024	Avenue Range	Mt Benson FT	36	15:02	0:20		14:42	000	Slasher	
		Mt Benson camera	36	15:22	0:40	15:12				
12/02/2024	Kangaroo Inn	Furner FT	13	14:20	0:04		14:16	000	Angle grinder	
		Mt Burr FT	42	14:24	0:08					
		Furner camera	13	14:30	0:14	14:19				
16/02/2024	Biogrow	Mt Edward FT	15	17:06	0:00		17:11	Fire tower	Machinery	
		Mt Burr FT	26	17:06	0:00					
		Comaum FT	61	17:07	0:01					
		Rennick camera	26	17:11	0:05	17:05				
20/03/2024	Newmans Rd	Comaum FT	22	17:19	0:01		17:18	000	Unauthorised burn	
		Dergholm camera	8	17:19	0:01	17:12				
5/04/2024	Chapel Lane	Mt Edward	13	15:20	0:00		16:47	Fire tower	Lightning	There was a delay in the fire being reported to the CFS
		Mt Burr	30	15:28	0:08					
		The Bluff camera	10	16:52	1:32	16:36				
22/04/2024	Burrungule car fire	Mt Burr FT	22	14:18	0:20		13:58	000	Car fire - arson	
		Mt Edward FT	16	14:19	0:21					
		The Bluff camera	7	14:29	0:31	14:21				

## Alert Times and Accuracy

The GTFA Fire Manager compiled data on the effectiveness of the cameras over the first full season of operation. Some findings:

- Fires were detected up to 62km away, a significant improvement on the 20km as guaranteed
- Notification times relative to incident start were variable, but generally improved as the season continued
- One benefit from the deluge of planned burns experienced late season is the amount of data accrued for feedback into the machine learning cycle

Note that the camera network detected all fires on the table, however of the 8 fires, 6 were reported by people present on site at time of ignition

# The Toolbox



- Fire detection cameras are one tool in the toolbox when it comes to managing wildfire
- 24/7 monitoring of forest assets comes at a cost
- The fire fighting budget for response should not be cut to accommodate advanced detection
- One thing never changes: response time post-detection is still critical in addressing fires
  - Aerial
  - Fast attack
  - Tankers
  - Water
  - Well Trained personnel



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# Incident 1: German Flat Haystack Fire

**First to Detect a Haystack Fire in South Australia**  
17-Jan-2024 German Flat - between Forestry & Wind Farm Assets



**Incident Update**

**GERMAN FLAT**

**German Flat Hay Stack Fire**

The Country Fire Service firefighters are working to extinguish a hay stack fire near Tantanoola in the Lower South East.

Emergency Services were alerted to smoke from forestry cameras located at Mount Burn and Carpenters Rocks. Fire crews with 25 firefighters, found approximately 400 hay bales, around a hectare of grass and a Manitou Telehandler (forklift) slight on arrival with an estimated loss of \$90,000.

Crews remain on scene spreading out the hay to extinguish hot spots which is causing smoke over German Flat, Tantanoola and Burungale areas.

Firefighters will remain on scene into the night and tomorrow morning due to the predicted upcoming heat.

Hazards may include reduced visibility due to smoke and emergency vehicles operating in the area. People with breathing difficulties should remain in doors and close windows and doors.

**NEAR TANTANOOLA**

**\$90,000 HAY STACK BLAZE**

**CFS FIREFIGHTERS MONITORING FOR FLARE-UPS**

**7 NEWS**

PANO AI Confidential 13

- On the 17<sup>th</sup> January 2024 a haystack at German Flat caught fire
- Emergency Services first notified by a forestry company employee
- Zoom facility used to confirm and report



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# Incident 1 Cont.

## Pano in Action: German Flat Fire - January 2024

Pano was the first to detect, enabling rapid response to prevent spread to nearby assets

Temp: 19.8°C · Wind Gusts: 35km/h



### Detection

Pano detection time: 18:55 ACDT

Pano **first to notify** customers and CFS to coordinate response.



### Optical Zoom

Response initiated: 19:00 ACDT  
Fire size: 1ha

Pano's 30x optical zoom provided situational intelligence at 14km range, with **visual confirmation of ignition source** and location.



### Proximity to Assets

Fire contained: 21:40 ACDT  
Fire size at suppression: 1.5ha

Map overlays helped identify the proximity of fire to plantation assets.



I received the Pano alert, determined the location to Hookings Rd, and called the CFS emergency services to send out the page. I was very impressed that the Pano camera was first to capture it

-Clinton Sim, Green Triangle Forest Products



# Incident 2: Stolen Vehicle Torched

## Triangulation Provided Accurate Location of the Fire Source

A stolen vehicle had been dumped and set alight, with fire starting to burn the plantation

PANO



*"The cameras picked it up first and the triangulation was spot on.  
We were alerted within 15 minutes of the car being set alight."*

*- Cameron Shaw, OneFortyOne*



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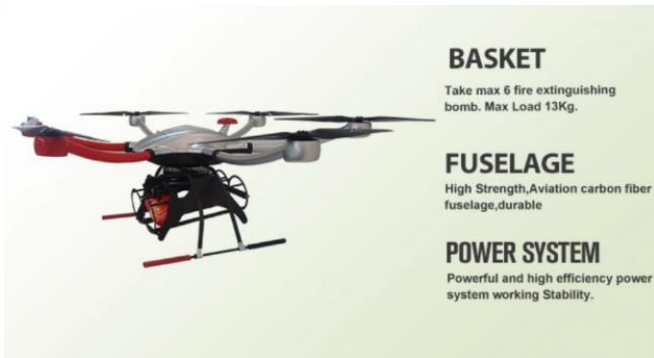
# Incident 2: Cont.

Temp: 12.1°C · Wind Speed: 25km/h





# What's coming?



Weather Map layers just released in Sept-2024 at AFAC:

- temperature
- humidity
- wind speed
- wind gusts

More 'map layers' to show what customers are asking for:

- Fire danger index
- permit burn details

Geo-fencing of alerts

Increased range estimation capabilities

Autonomous Deployment of 1st Attack Drones

- Drone in a box at camera site
- Initial attack capabilities and surveillance



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# Car Fire



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# Night Detection



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# Aurora Australis



# Questions & Discussion

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