Scientific approach in assessing aerial suppression

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Are aircraft effective?

- Yes!!
  - Well can be?
    - By keeping fire small
      - Ground support required
    - Reduced area burnt
    - Generate savings
    - Environmental benefits

Source: Erickson Air-Crane Inc.

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Suppression

- Ground based suppression is the most efficient and effective means.
- Over forty years of operational experience has shown the use of aircraft can enhance fire protection capacity by:
  - Aerial fuel reduction
  - Fire detection and mapping
  - Airborne fire command
  - Transport of personnel
  - Fire bombing

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Helicopters
Multi-tasking aircraft

- Equipped with bucket or fixed belly tank
  - Light- bucket (600 litres)
  - Medium- bucket or underbelly tanker (1,400 litres)
  - Large- Air-crane helitanker (9,000 litres)
- Air attack supervisor / air observer role
- Transport fire fighting personnel and equipment.
- Rappel crews to reach fires in remote locations.
- Reconnaissance- infrared imaging or to generate digital maps

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Fixed wing aircraft
agricultural

- Can carry up to 3,200 litres of fire retardant or foam.
- Short take off and landing characteristics enable to work from remote airstrips.
- Where possible the distance should be less than 25 km to maximise delivery to fire
- Generally operated by commercial agricultural business.

Other aircraft

Photo: Ontario Ministry of Natural Resources

Photo: Conair Aviation

amphibious aircraft

- Used in Canada, US, Europe – France, Greece, Spain, etc
- Limited application in the drier inland regions
- Specialized aircraft / high capital cost

large airtankers

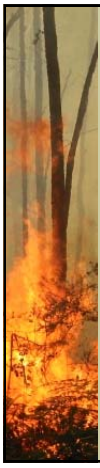
- Conventional aircraft converted to fire bombers
- Require high volume mixing and loading equipment.
- Require to operate from major aerodromes
- The DC 6 and the Modular Airborne Fire Fighting System were evaluated in Australia in the early 1980s.
- Development of supertankers, eg Ilushin, 747

Effectiveness of aerial fire fighting
Australian experience

- Experience backed by local research has shown that fire bombing will be as effective in halting the forward spread of the fire as experience ground crews with bull dozers and tankers.
  - DSE Vic – Rawson & Rees(1983), McCarthy et al. (1998, 2000, 2003)
  - CSIRO – Aquarius study (Loane and Gould 1986)
  - CALM, FESA WA- Operation Firebird 1996- 2003
- Fire intensity exceeds 3,000 kW/m where fuel loads are high, fire bombing is ineffective in stopping the forward spread of fires.
- Still has a role in high intensity fires in conjunction with ground forces, in delay fire spread, dealing with spot fires, or property protection.

Common Causes of Control Line Failures

- Operational
  - Gaps in retardant release patterns
  - Failure to anchor / tie in retardant drops
  - Improper placement of retardant or location in relation to fire perimeter
  - Improper adjustments for wind drift



Common Causes of Control Line Failures

- Fire behaviour
  - Misjudgment of fire behaviour
  - Inadequate coverage level for fuel type or fire intensity
  - Spotting
  - Availability and timing of additional drops to support initial line building process

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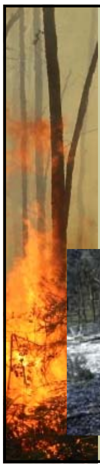
Factors Affecting Aerial Drops

Pilot Release
Drop Height
A/C Speed
Fire Conditions

A/C Altitude
Drop Type
Retardant Characteristics
Canopy & Fuel
Tank / Venting System
Wind Speed / Direction
Topography



Data Collection Methods

- Field measurements
  - Operational: *direct measurement of suppression during wildfire events*
  - Experimental: *dedicated exercise*
- Surveys and interviews

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Data Collection
Field Methods

	Strengths	Weaknesses
Operational	✓ Representative of situations for application ✓ Collect large data set ✓ Promote research amongst fire fighters	× Logistical problems × Safety × Uncertain data quality × Dependant on weather and fire activity

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Operational	✓ Representative of situations for application ✓ Collect large data set ✓ Promote research amongst fire fighters	× Logistical problems × Safety × Uncertain data quality × Dependant on weather and fire activity
Experimental	✓ Detailed & accurate data ✓ Comprehensive site assessment ✓ Target conditions ✓ Link other CRC studies to project	× Cost & time for preparation × Small amount of data × Dependant on weather and resource availability × Limited sites & opportunities

Data Collection
Field Methods: Ground based

- Effect of drop on fire
  - most vital information
- Collect information such as:
  - Location & site characteristics
  - Time of drop
  - Drop characteristics
  - Fuel characteristics
  - Fire behaviour and effect on fire
  - Weather
  - Ground suppression effort
- During drop and post drop/ fire

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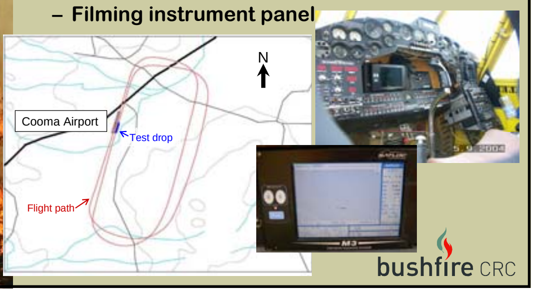
Data Collection
Field Methods: Air based

- Bombing aircraft:
  - Aircraft characteristics at time of drop
  - Navigational tracking systems
  - Filming instrument panel



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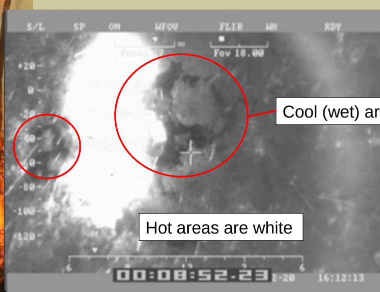
Data Collection
Field Methods: Air based

- Observing aircraft:
  - Infrared footage



Drops around a spot fire filmed during Operation Tumbarumba

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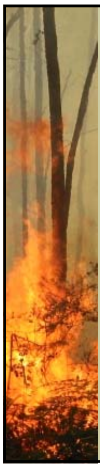

Data Collection

Survey and interview techniques

- Air and ground based officers surveyed about the operational performance of aircraft
- Supplementary information from interview and fire reports to complement data
- Method used in previous research

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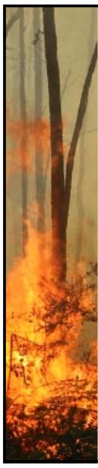

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Strengths	Weaknesses
✓ Data cheap to acquire ✓ Could collect a large amount of data ✓ Involve all CRC fire agencies	× Observer bias × Qualitative data (limited application) × Information limited

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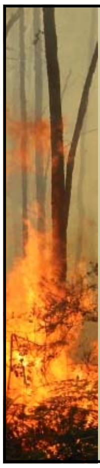

Outcomes

The project will provide information needed to shape a national aerial fire fighting strategy by:

- Raising the awareness of the fire control officers, aerial operations, government officials, media and the community on the effective use of aircraft for combating bushfires.
- Produce data for use for training at all levels to improve suppression operation safety awareness.

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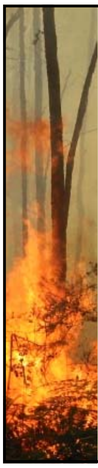

Outcomes

- Verify the effectiveness of suppression drops (i.e. drop heights, aircraft speed etc) to increase fire fighter safety, and overall efficiency of suppression tactics.
- To develop methodology to allow us to evaluate the effectiveness of “new generation” suppression resources – i.e. new aircraft platforms, ground equipment, etc
- To provide data and verification of the past research work on evaluation of aerial suppression through detail recording of actual fire actions on high intensity wildfires

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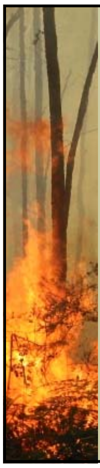

Deliverables

- Guidelines for optimising the selection, allocation, deployment and use of airtankers and retardants (including limits of effectiveness).
- Identification of the major variables influencing the suppression capabilities of specific aerial delivery systems.
- Provide appropriate methods and procedures for quantifying aerial delivery systems effectiveness and productivity in various applications (line building, spotting, property protection, etc).

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