Scientific approach in assessing aerial suppression

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Are aircraft effective?

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

Source: Erickson Air-Crane Inc.

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

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 to generate digital maps
Fixed wing aircraft

- 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

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, e.g. 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 bulldozers and tankers.
  - 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

Factors Affecting Aerial Drops

<table>
<thead>
<tr>
<th>Category</th>
<th>Factors</th>
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<tbody>
<tr>
<td>A/C Speed</td>
<td>Pilot Release, Drop Height</td>
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<tr>
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<td>Canopy &amp; Fuel</td>
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<td>Retardant Characteristics</td>
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Data Collection Methods

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

Data Collection Field Methods

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<th>Strengths</th>
<th>Weaknesses</th>
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<td>Link other CRC studies to project</td>
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<td>Cost &amp; time for preparation</td>
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<td>Limited sites &amp; opportunities</td>
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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

Data Collection
Field Methods: Air based

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

Data Collection
Field Methods: Air based

- Observing aircraft:
  - Infrared footage

Cool (wet) areas are dark
Hot areas are white

Drops around a spot fire filmed during Operation Tumbarumba
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

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.

Strengths

- Data cheap to acquire
- Could collect a large amount of data
- Involve all CRC fire agencies

Weaknesses

- Observer bias
- Qualitative data (limited application)
- Information limited

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.
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).