



Code of Practice for Aircraft Operations - FIRE FIGHTING

Introduction

In April 2011 a meeting took place to explore ways that the aviation industry and those agencies responsible for rural fire control could work together to better manage fire suppression activities. The meeting was attended by representatives from:

- National Rural Fire Authority
- Rural Fire Authorities
- End Users
- Department of Conservation
- Aviation

Numerous issues were identified but when analysed they fell into two main categories:

- Safety
- Performance

Agreement was reached that a code of practice be developed that would address these two issues and further, would be the foundation document to standardize fire fighting protocols throughout New Zealand. The meeting was unanimous that this document had to be a New Zealand solution to the issues.

The goal of this code of practice is safe, effective and efficient aerial fire management.

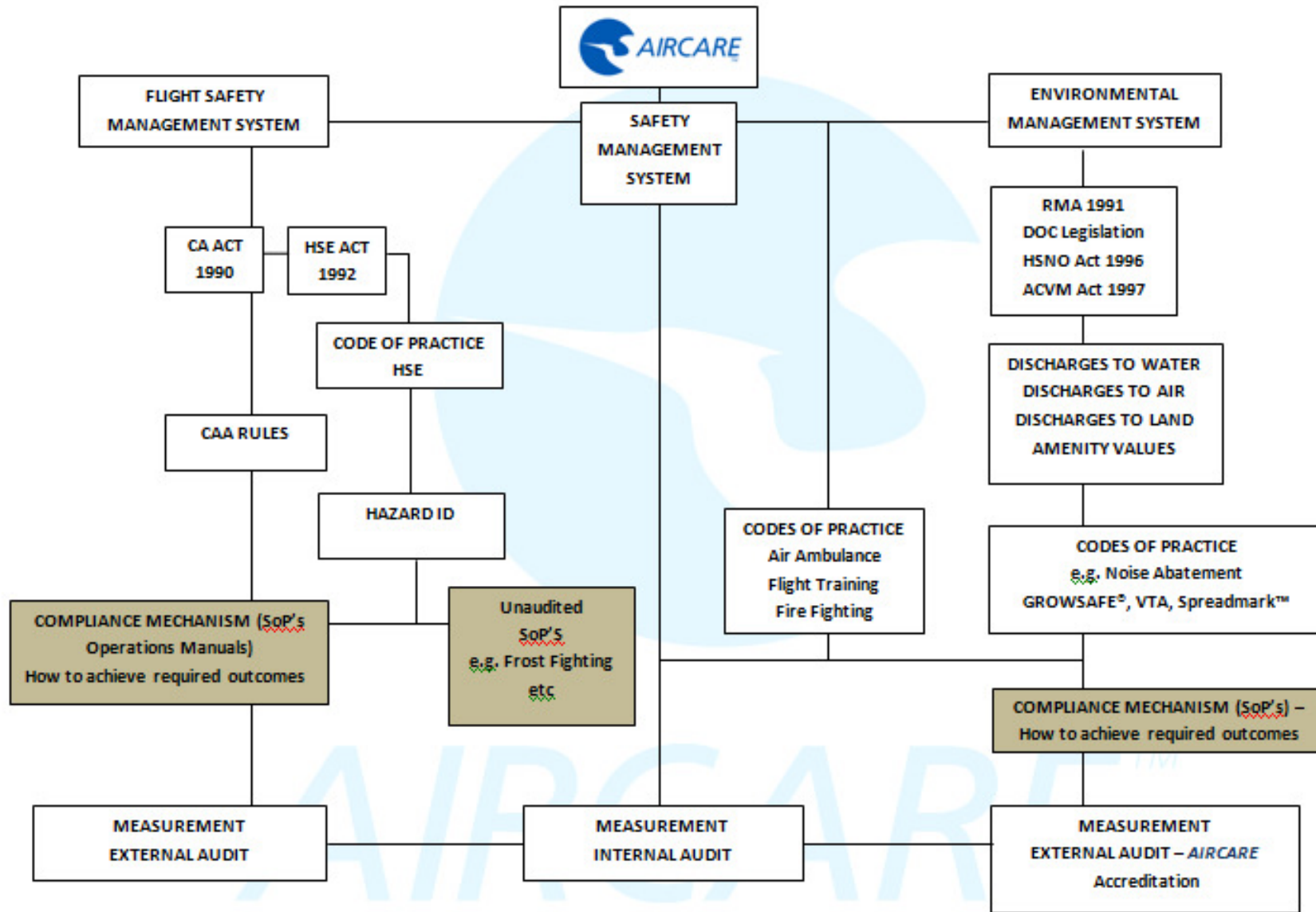
This code of practice is the outcome from the April 2011 decision. It is intended to satisfy the requirements of those who have authority to manage fire suppression as well as those aviation companies who are called upon to deliver the firefighting service.

AIRCARE™ is an independently audited integrated accreditation programme for all of an aviation business. This code of practice has been developed to manage the risks in aerial firefighting. It is appropriate therefore that it lives in the AIRCARE™ Program that has itself been developed to manage both the flight safety and environmental risks in aviation businesses.

This code of practice recognizes the value of the partnership between rural fire and aviation.

AIRCARE™ Management Committee
National Rural Fire Authority

Compliance Flowchart



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Referenced Documents

- Air Operations Information and Checklist
- Resource Management Act 1991 including the RM Amendment Act 2009
- Minutes Forest and Rural Fire Aviation Meeting, Brentwood Hotel, Wellington 28th April 2011
- Aircraft Safety – Fire Management – working with the aviation sector. July 2009
- Air Operations Information and Checklist. August 2009 (The Orange Book)

Abbreviations

AAS	Air Attack Supervisor
ADC	Air Division Commander
AFM	Aircraft Flight Manual
AGL	Above ground level
AIA	Aviation Industry Association of NZ Inc
AOP	Aerial Observation Platform
ASS	Air Support Supervisor
ASUM	Air Support Unit Management
CAA	Civil Aviation Authority of NZ
CAR	Civil Aviation Rule
CL	Crew Leader
CRM	Cockpit Resource Management
CIMS	Coordinated Incident Management System
DC	Divisional Commander
DOC	Department of Conservation
FCTAF	Fire Common Traffic Advisory Frequencies
H&S	Health and Safety
IAP	Incident Action Plan
iaw	In accordance with
IC	Incident Controller
ICP	Incident Control Point
IMT	Incident Management Team
NRFA	National Rural Fire Authority
NVG	Night Vision Goggles
NZHA	NZ Helicopter Association being a division of AIA
RFA	Rural Fire Authority
RMA	Resource Management Act 1991 including amendments
SS	Sector Supervisor
SMS	Safety Management System
USDA	United States Department of Agriculture/Forest Service

Definitions

AIRCARE™	A brand owned by AIA. AIRCARE™ is an independently audited accreditation program for all of an aviation business, the management system of which utilizes elements of an SMS
Accreditation	Confirmation that an organization has demonstrated compliance with selected rules and standards
Aircraft	Fixed wing aeroplanes and helicopters
Aircrew	Persons carried in an aircraft other than pilots. They must be appropriately trained and are essential to the conduct of the aerial work operation
AOP	An AOP is an aircraft that is deployed as an aerial surveillance platform from which the AAS can manage the fire attack
Dipping	When an underslung bucket is recharged with water by the pilot partially submerging the bucket and allowing it to fill without any help from ground crew
Ground Crew	Appropriately trained persons who are required to undertake essential duties in the immediate vicinity of aircraft operating on or near the ground. E.g. Loaders, refuelers, marshallers and the like
Lead Pilot	Pilot of an aircraft on the fireground who has a coordination role of aircraft in terms of separation, flight circuits, technical performance and safety overview
Person in Charge	IC, Operations Manager, ADC, AAS, ASS, DC, SS, CL

1. SCOPE

This code has been developed to manage the risk and management associated with aerial fire fighting. It applies to aircraft operators as well as fire management organizations. Managing risk in the AIRCARE™ SMS means:

- Identifying hazards
- Placing controls on those hazards
- Regularly reviewing the effectiveness of those controls.

Managing risk does not mean that there will be no risk.

1.1 Relevant NZ Legislation

- a) Fire Service Act 1975
- b) Forest and Rural Fires Act 1977
- c) Resource Management Act 1991
- d) Health and Safety in Employment Act 1992
- e) The Civil Aviation Act 1990

1.2 Compliance

For the purposes of this Code the word “shall” refers to practices that are mandatory for compliance with the Code and the word “should” refers to practices that are advised, recommended or are industry best practice.

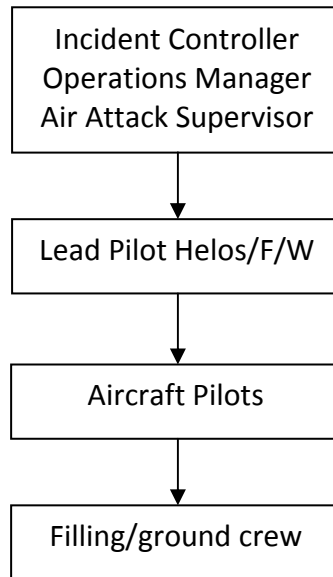
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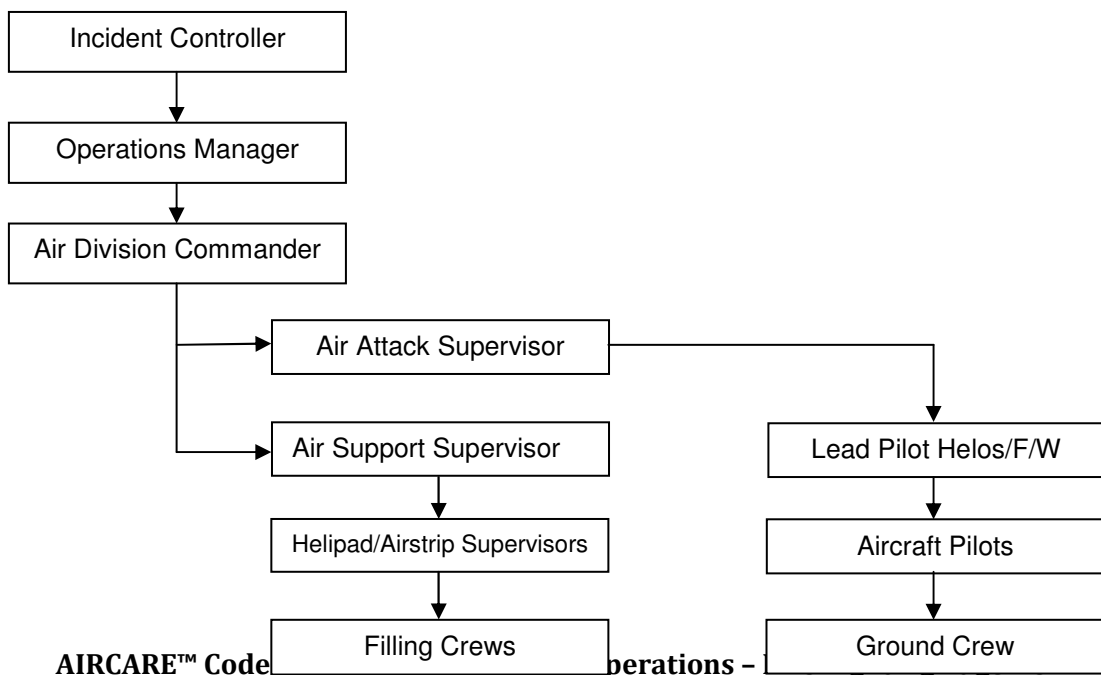
2. Responsibilities

The following flowcharts show the responsibilities for managing aircraft operations at fires

Initial Response



Established Large Event



2.1 Person in Charge

2.1.1 The person in charge is the person responsible for aircraft operations, normally IC, Operations Manager ADC or AAS depending on the circumstances e.g. the size and stage of the fire. The person in charge shall be competent and as evidence of competency shall hold Unit Standards 3293 Manage Ground Support For Air Operations at Vegetation Fires and 14563 Lead Aircraft Operations at Vegetation Fires as a minimum and have proven skills and experience in the role. His/her responsibilities and delegations include:

Appoints

- Appoints personnel to unit (fill crews, pad/strip supervisors, aircraft logistics etc)
- Appoints and tasks lead pilot or lead pilots for specific sectors (if required)
- Appoints aircraft/companies to employ from list of AIRCARE™ Accredited companies. (See also 3.4.2)
- Finds out from operator what Category pilot is flying the aircraft and passing this information on to any lead pilot appointed in order that the lead pilot knows what he is managing

Authorizes

- Authorizes the use of aircraft
- Authorizes the use of fire fighting foam/suppressant or fire retardant in conjunction with the Operations Manager
- Authorizes and collects documentation from aircraft operators
- Authorizes selection of filling point(s) airstrips and helipads (in consultation with lead pilots)
- Authorizes an AOP when the complexity of either the operation or the environment require an AOP
- Organizes and controls restricted airspace if required

Organizes

- Organizes briefing pilots on operational and tactical objectives and known hazards as they arise
- Organizes aircraft communication plan
- Organizes fuel supplies after the first shift (if bulk supplies cannot be provided locally)
- Organizes foam/suppressant/retardant supplies
- Organizes Air Operations personnel including RFA filling crews and has oversight of aircraft companies support crews
- Organizes air transport operations (cargo & personnel)
- Organizes Flight Manifests when passengers or cargo loads are carried

Manages

- Assessment of risk in consultation with the aircraft operators (*The Orange Book* and *Aircraft Safety* checklists)
- Instigates and maintains flight following
- Manages/Supervises air attack activities
- Considers request for non-tactical use of aircraft (media, IMT over-flights, mapping etc)
- If required ensures site security by sealing off the site from the public or other injurious influences
- Co-ordinates aircraft activities over the fire
- Makes tactical recommendations to Operations Manager/ADC/IC
- Through the Incident Controller releases resources from the incident

Monitors

- Prioritizing where on the fire the aircraft are deployed in conjunction with Operations Manager
- Monitors pilot and ground support crew welfare and workloads
- Ensures all RFA personnel boarding an aircraft have demonstrated knowledge in accordance with Para 8.3
- Monitors aircraft tactical performance
- Ensures safety standards are maintained

Note that on small, non complex fires, typically where no more than three aircraft are involved, limited responsibilities above may be carried out by one person but if the fire escalates the responsibilities above shall be divided between, ADC, AAS and ASS.

2.1.2 The selection of aircraft types to deploy to a fire will typically depend on the following:

- Assets under threat from the fire
- Fuel loadings (vegetation density)
- Fuel (vegetation type)
- Terrain type
- Fire intensity
- Type of aircraft available

The person in charge is required to evaluate the benefits of using aircraft that can attend the fire quickly versus calling larger capacity aircraft that may have to ferry sometimes considerable distances but may be more cost effective at the fire. In general it is preferred that the person in charge will assemble suitable resources that offer a response that is safe, efficient and effective.

2.2 Lead Pilot

2.2.1 Lead Pilots responsibilities shall include:

- An initial flyover with Person in Charge to identify hazards in the area of operations and an ongoing review of hazards throughout an incident
- Managing the safety of his/her and the other aircraft in his/her assigned sector. This will include approach/departure routes, circuit direction, cessation of operations etc. in consultation with the Person in Charge (Note 2)
- Assist in coordinating flight patterns of fire fighting aircraft where appropriate
- Ensure incident strategies and tactical objectives as outlined by the person in charge are being met
- Ensure an information feedback loop is established between pilots and the person in charge
- Communications with the person in charge and other aircraft attacking the fire
- Ensuring a high level of aviation professionalism during air operations
- Not directing aircraft strategies and tactics in suppression work – this is the responsibility of the person in charge

Note 1. To avoid any conflict between 2.1.1 and 2.2.1 this code quotes a senior AAS when addressing aviators at the April 24th meeting, “We make the call on the priorities - you make the call on if it is safe to fly”

Note 2. To all pilots attacking fires, there is a need for absolute professionalism. As conditions change some pilots will approach their personal limit sooner than others. This may depend on the aircraft type, their experience or other factors. It is important that pilots and the person in charge regularly carry out hazard identification and risk assessments. If any pilot has safety concerns e.g. too dark, too turbulent, insufficient performance etc, the lead pilot and the person in charge are to be advised accordingly and that pilot may stand down without fear of any criticism. When pilots are working close to the limits, either theirs or the aircraft's, there will not always be an accident but there will always be additional risk and good aviation practice requires that to be managed. Any pilot seeing the need to modify, decline, postpone, cancel, divert, or terminate a task, shall discuss the concerns with the person in charge and make decisions based on his/her concerns and the tactical requirements of the fire. A co-operative approach is required so that the two can work in harmony.

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3. Aviation Resources

3.1 Aircraft

3.1.1 Aircraft selected for firefighting shall be fit for purpose. To be fit for purpose the aircraft shall:

- Have a minimum of 10 hours time to run before any scheduled maintenance at the time it is called out or, if less is available the person in charge shall be informed of the actual hours available before deployment to the incident and any actions that will be undertaken to mitigate this situation
- Be equipped with at least one VHF Radio and one FM Radio programmed with Fire Frequencies that is integrated into the aircraft audio system. The pilot shall be able to monitor both radios simultaneously
- Have a bucket/hopper/tank that is capable of carrying a load of water of sufficient capacity to allow the aircraft to reach its maximum permissible weight when one hour's fuel is aboard
- Be equipped with a reliable on board control system to release water
- Have a belly tank or hopper configured for firebombing or have a cargo hook and underslung fire bucket, all having emergency jettison capability
- Be fuelled sufficiently to allow them to continue fire fighting until their ground support vehicles arrive
- For operations in a control zone the aircraft shall be equipped with an operable transponder that is set to 0111 - unless advised otherwise
- Aircraft that are utilized in the AOP role shall be fitted with serviceable intercom at each occupied seat.
- Aircraft that are utilized in the AOP role shall allow communications for the observer that enable communication with fire ground operations and other aircraft.
- Have experienced Ground Crew on site to provide assistance with refuelling and minor maintenance requirements

3.1.2 In addition the aircraft should have:

- Hi Viz paint schemes on rotors and propellers
- GPS tracking equipment capable of showing flight paths and drop zones with the capability to produce this information as an electronic shape file
- Aircraft used in the AOP role should have GPS equipment that is capable of producing electronic shape files of fire boundaries, hot spots or other areas of interest

3.1.3 Aircraft shall not present at a fire event without first being called by the person in charge or his/her delegate.

3.2 Equipment

3.2.1 Buckets

- a) All bucket control systems shall have an emergency jettison system such that in the event the bucket is jettisoned in flight, these controls break away without interfering with the pilot or the main or tail rotors.
- b) Buckets shall have dipping capability.
- c) Buckets should be able to be transported to the fire inside the helicopters that will use them.

3.2.2 Other Equipment to be provided

- a) A foam injection unit capable of delivering a specified percentage of fire suppressant to each load of water with the amount of suppressant being controlled by the pilot. (Helicopters only) Any foam suppressant container carried inside the aircraft shall be securely tied down and banded to prevent spillage into the interior of the aircraft. Only fire suppressants, retardants and water enhancers listed on the current USDA-approved schedule shall be used in an on-board injection system
- b) Ground support vehicle(s) that can provide sufficient aviation fuel to allow aircraft to complete their first shift eg 10 hours.

Note that in respect of aircraft fuel, this requirement satisfies the demand for fuel in the early stages of a fire bearing in mind that the aircraft will typically leave their bases with sufficient fuel for the first one and a half hours of fire fighting plus additional fuel in approved containers that will keep them operating until their ground support vehicles arrive. In any event aircraft operators are responsible to make arrangements to have fuel supplied at least for the first 10 hours of a fire event.

Note that fuel supply can be very difficult in the more isolated places in NZ and there may be times that aircraft operators are unable to provide fuel from their own resources. In this instance they are required to notify the person in charge at the first opportunity. It may be that a joint strategic approach is required between aircraft operators, contract fuel suppliers and fire managers.

In the circumstance that the fire continues after the first shift, it becomes the responsibility of the IMT to arrange a supply of fuel. The person tasked with this role shall liaise with the local aircraft operators to determine:

- The type of fuel required
- The type of discharge equipment that tankers need. For example the largest fuel tankers cannot always refuel directly to aircraft or trailer tankers

3.3 Maintenance

- 3.3.1 Aircraft hoppers shall be maintained in accordance with the aircraft manufacturer's recommendations.

3.3.2 Aircraft belly tanks shall be maintained in accordance with their Instructions for Continued Airworthiness.

3.3.3 Underslung fire buckets shall be maintained in accordance with the manufacturer's instructions. If no such instructions are available the maintenance schedule that appears in Appendix 1 shall be used.

3.4 Certification and Accreditation

3.4.1 The company that is the operator of the aircraft to be used for fire fighting is not required to hold CAA Certification except if their aircraft is to be used for the carriage of passengers or freight (e.g. fire fighters, observers) then it shall be certified to CAR Part 119/135 and the subject aircraft is included on the Operations Specifications.

3.4.2 As a prerequisite to undertaking fire fighting in NZ, a NZ aviation company shall be AIRCARE™ Accredited. This requirement shall not preclude NRFA from bringing aircraft into NZ from a foreign jurisdiction in the case of a catastrophic event.

3.5 Personal Protective Equipment

In respect to risk management the consequences of an accident can be reduced if personnel are wearing the appropriate Personal Protective Clothing (PPE). The following PPE shall be worn:

3.5.1 Pilots and aircrew – all operations

- Flying suit or overalls of fire resistant or natural material, extending to wrists and ankles
- Leather or fire retardant ankle length footwear
- Natural fibre underclothing

3.5.2 Pilots and aircrew – operations below 500' AGL

- All items specified in 3.5.1 plus
- Protective flying helmet with communications

3.5.3 Pilots and aircrew – operations involving pick-up of water where there is a risk of swimming in the event of unplanned entry into water:

- All items specified in 3.5.1 and 3.5.2 plus
- Life jacket

3.5.4 Aircraft ground crew – all operations

- Protective goggles when conditions dictate
- Full length protective clothing such as overalls
- No loose clothing
- Safety boots
- Hearing protection
- High visibility ant-static outer garment
- Safety helmet with either chin straps or attached ear muffs

3.5.5 Rural Fire Authority ground crew

- In accordance with NRFA requirements

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4. Training & Deployment

4.1 Pilot Qualifications

4.1.1 Helicopter pilots in command used in the low level fire fighting role shall have:

- A minimum of Commercial Pilot Licence (Helicopter) with a current medical certificate or Class 1 medical certificate if called upon to carry passengers or freight
- Unit Standard 3285
- Demonstrated competency in accordance with Para 4.4 for the role being undertaken
- A type rating on the helicopter type deployed
- Fatigue management system

4.1.2 Fixed wing pilots used in the low level fire fighting role shall have:

- A minimum of Commercial Pilot Licence (Aeroplane) with a current medical certificate
- Unit Standard 3285
- A type rating on the aeroplane type deployed
- A minimum of 100 hours on the aeroplane type deployed
- A Grade 1 Agricultural Pilot Rating
- Fatigue management system

4.1.3 Helicopter pilots used to pilot an AOP shall have:

- A minimum of Commercial Pilot Licence (Helicopter) with a current Class 1 Medical Certificate
- A type rating on the helicopter type deployed
- Local knowledge
- Fatigue management system

4.1.4 Fixed wing pilots used to pilot an AOP shall have:

- A minimum of Commercial Pilot Licence (Aeroplane) with a current Class 1 Medical Certificate
- A type rating on the aircraft type deployed
- Local knowledge
- Fatigue management system

4.1.5 Lead Pilots shall hold Unit Standards 3285 and 14564

4.2 Ground Crew Qualifications

- a) Aircraft Ground Crew are personnel employed by the aircraft operator to support the pilot. Ground Crew shall be trained by the company for whom they work
- b) Fire Authority Ground Crew shall hold:
 - Unit Standards 3285/3288/20388

4.3 Pilot Categorisation

4.3.1 Fire fighting pilots fall into three categories. They are:

- Category III - Lead Pilot - will have at least 100 hours fire fighting experience and have demonstrated competency iaw Para 4.4
 - Category II - Unrestricted Pilot - will have at least 50 hours fire fighting experience and have demonstrated competency iaw Para 4.4 and is authorized without supervision
 - Category I - Restricted Pilot - will have 0 - 49 hours fire fighting experience and have demonstrated competency iaw Para 4.4 and can operate under the direct supervision of the Lead Pilot or is a Grade 1 fixed wing pilot
- 4.3.2 Lead Pilots shall be appointed regionally by the RFA and shall be selected not only because they meet the experience requirements but because they have local knowledge, a proven ability to manage other pilots and because they display professionalism.
- 4.3.3 In the event that no person in charge is in attendance to appoint a lead pilot, the first pilot to attend the fire will act as lead pilot until a suitably qualified pilot arrives or is appointed.
- 4.3.4 RFA's shall maintain a register of pilots in each of the three categories in their areas and issue the pilots with a card showing their category.

4.4 Pilot Competency

A pilot is competent when he possesses the following disciplines:

- General wildfire operations knowledge
 - Mountain flying
 - External Load operations
 - Water bucketing
 - Hover exit
 - Confined aera operations
 - Low visibility flight
- 4.4.1 Fixed wing fire bombing pilots shall be considered competent when they hold a Grade 1 Agricultural Rating. There is currently no training protocol in NZ for fixed wing fire bombing. (See also 4.3.1)
- 4.4.2 To assure competency, each helicopter pilot who does not hold an Agricultural Rating shall demonstrate competency to a fire fighting lead pilot who is instructor rated and has been recommended for this task by his/her peers. When the instructor is satisfied that the pilot is competent he shall advise the local RFA in order that they can issue a card certifying to which category the pilot is competent.
- 4.4.3 The instructors used to satisfy 4.4.2 shall be selected by NZHA and a register of these instructors shall be maintained on the NZHA Website.
- 4.4.4 For flight by night pilots shall hold night privileges and night currency. See also Section 10 Operations by Night.

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5. Underslung fire buckets

5.1 Operations

- 5.1.1 Pilots shall operate the helicopter in accordance with the AFM in respect to any limitations when fire fighting. Pilots shall also comply with any limitations imposed by the underslung fire bucket manufacturer. Speeds should be built up slowly to below the maximum permissible airspeed to assess both aircraft handling and bucket behavior under the prevailing conditions.
- 5.1.2 At water filling points extra care shall be exercised when more than one helicopter is dipping in company with other helicopters that have buckets with different length strops.
- 5.1.3 Pilots shall exercise care when dipping from rivers, tidal streams and the sea as the current can drag the helicopter downstream into hazards like wires and trees and excessive drag can come from wind chop and/or soft bottom.
- 5.1.4 To maintain an adequate reference when dipping from a large water body e.g. a lake, dipping shall be carried out near the shore and if that is not possible, pilots should consider mooring a boat to provide a reference near where the dipping is to take place.
- 5.1.5 Pilots shall never fly above another helicopter with a bucket attached.
- 5.1.6 To prevent the spread of harmful aquatic pests, helicopter underslung buckets and any other equipment that has been in contact with a waterway shall be washed down and cleaned of all aquatic organisms, away from any waterway before leaving the fire site.

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6. Deployment of AOP

6.1 Deployment Criteria

An AOP shall be engaged when one or more of the following circumstances occur:

- When more than three helicopters are attacking a fire
- When helicopters of different type (large heavy lift vs medium lift) are working on the same sector
- When a fixed wing aircraft is deployed to a fire where any number of helicopters are also deployed
- At the discretion of the lead pilot for example when terrain and visibility create unacceptable risk
- In any fire situation where the Person in Charge suspects there may be concerns around safe, efficient and effective aircraft use

6.2 Operations

The AOP shall remain at a level above the fire fighting aircraft and at a height agreed in consultation with the lead pilot. The AOP circuit direction should be opposite to that of fire fighting aircraft. Where the AAS requires a closer ground-truthing of fire fighting safety, effectiveness and efficiency or requires a landing at any point, the AOP shall inform aircraft on the sector of these requirements. The AOP will maintain radio communications with other aircraft including the Lead Pilot and utilize a safe approach and departure profile to the target as agreed.

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7. Communications

7.1 General

Communication at fires shall be kept to a minimum. Unnecessary transmissions are a distraction that not only contributes to fatigue but can be a safety issue as well. The Lead Pilot shall be the interface with the person in charge. The person in charge and the lead pilot shall communicate regularly to ensure that all requirements of the aircraft operation are being met.

Radio communications with ground based fire crews will typically be made with the AAS. Ground crews will typically use hand signals, flagging tape or other visual cues to direct close-order drops onto specific targets where required. Aircraft should use discrete company frequencies to arrange fuel, ops, crew etc whilst maintaining a listening watch on ESX009 or one of the other frequencies below if so directed. Discrete inter aircraft frequencies can be arranged to suit.

Pilots transiting to the fire base shall broadcast their intentions to alert other traffic.

7.2 Frequency

Communications between the person in charge and all aircraft shall be on F-CTAF ESX009. (Fire Services Fire 4) Aircraft arriving at the fire shall make their inbound call with the person in charge on this frequency unless a different frequency was advised at the time of call out. This is the primary channel.

To enable communication with Fire Ground Crews Fire 1, 2, 3 shall be used.

Name	Fire No.	Transmit	Receive
ESX66	Fire 1	143.82500	143.82500
ESX63	Fire 2	143.78750	143.78750
ESX34	Fire 3	140.92500	140.92500
ESX009	Fire 4	140.61250	140.61250

Routine traffic calls shall be made on a frequency as instructed by the Lead Pilot or the person in charge.

Nothing shall prevent the parties from using other frequencies if required but all fire fighting aircraft shall have the above frequencies as a minimum.

Any aircraft suffering a communication failure shall stand down until communications have been restored.

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8. Carriage of Passengers

8.1 Overview

Passengers shall not be carried during firebombing operations. At other times aircraft are used to recce the fire or to transport fire fighters to fire fronts. Any operator providing this service shall be authorized by a CAA Part 119/135 Certificate.

8.2 Briefings

The pilot or his delegated person (e.g. aircraft ground crew) shall deliver a safety briefing to all passengers prior to take off. The basic briefing shall be in accordance with CAR Part 91.211. In addition, passengers shall be briefed on any special conditions and techniques. E.g. disembarking/embarking from the hover or a single skid landing.

8.3 Competency

Prior to travelling in a helicopter at a fire, Fire Authority personnel shall have demonstrated knowledge of the booklet *Aircraft Safety – Fire Management – working with the aviation sector*. Personnel boarding the helicopter shall hold Unit Standard 20388 or be under the direct supervision of someone who does hold this unit.

8.4 Flight Manifests

A list of names of passengers shall be recorded for each flight. The person in charge shall arrange this through his chain of command. Pilots shall not be required to complete Flight Manifests.

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9 Fatigue Management

9.1 Operator Responsibilities

An aviation organisation shall not permit a fire fighting operation to be performed unless:

- A fatigue risk management scheme, that is commensurate with the size and scope of the organisation has been established for the management of fatigue for each pilot; and
- The fatigue risk management scheme includes the following elements:
 - a) Employee participation and responsibilities
 - b) Fatigue awareness, flight and duty time limitations, countermeasures, and risk management training
 - c) Identification, assessment and control of fatigue hazards, development of work practices that mitigate fatigue risk, and personnel fatigue assessment
 - d) A system for minimising, managing and monitoring planned and actual work hours, and to monitor compliance with the fatigue risk management scheme
 - e) Procedures for detecting fatigue related impairment, and responding to reports of fatigue
 - f) Procedures for ensuring that fire fighting requirements do not contravene flight and duty time limitations contained in the scheme
- The fatigue risk management scheme accounts for flight time and duty time accumulated by each pilot, including duties and flying that is accumulated in operations other than fire fighting operations; and
- An organisation shall keep records in respect to pilot flight duty hours

9.1.1 An aviation organisation shall not permit a pilot to operate an aircraft if the organisation suspects that the pilot is suffering from, or is likely to suffer from, fatigue that may endanger himself/herself or others.

9.2 Pilot responsibilities

A pilot shall not perform a fire fighting operation if:

- The pilot knows or suspects that he/she might be suffering from such fatigue that the aircraft or other persons are endangered
- The flight and duty time limitations specified in the scheme required by 9.1 will be exceeded

9.2.1 A pilot performing a fire fighting operation shall undertake a fatigue assessment when requested by either his/her own organisation or the person in charge or his/her delegate if there is reasonable grounds to believe that the pilot may be fatigued.

9.2.2

9.3 Stand down

The amount of fatigue to which a pilot is exposed will vary significantly depending on all those factors listed on the risk assessment form at Appendix 2 – particularly those that apply to the operational area. Pilots are therefore required to monitor their own performance and when the onset of fatigue is recognised, they are encouraged to stand down after consulting the Lead Pilot and the person in charge.

Pilots shall regularly take water and food to stay hydrated and lessen the onset of fatigue.

There shall be awareness that if passengers are to be carried pilots shall comply with CAR Part 135 Flight and Duty limitations.

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10 Operations by Night

10.1 Overview

Under normal circumstances aerial fire fighting operations shall be curtailed during the hours of darkness.

Fire fighting operations during the hours of darkness pose additional risks and shall only be carried out if life or significant property is threatened. Night flying requires the direct approval of the Incident Controller. When so approved night operations shall only be carried out following a robust risk assessment. This assessment shall include but will not be limited to the following:

- The ability to maintain continual visual reference to the ground
- The position of smoke relative to the aircraft's flight path
- The number of aircraft engaged on the fire front as pilots have to concentrate more on their actual flying leaving less resource for dealing with congestion
- Pilot fatigue as the increased concentration level required at night can prematurely bring on the affects of fatigue

It is vital that no lights are shined at the aircraft or pilot during any phase of the operation – including refuelling. The Lead Pilot shall recommend to the person in charge the maximum number of aircraft to be used at the fire front.

For night operations there shall always be at least two aircraft deployed. Aircraft shall display navigation and anti-collision lights during the hours of darkness.

The following requirements shall be observed by non NVG equipped pilots:

- No pilot shall commence fire fighting on a new fire front during the hours of darkness. It is important that fire fighting commences during the hours of daylight when all hazards can be identified
- When flights into darkness are anticipated pilots shall pay particular attention to circuit patterns and climb profiles relative to terrain so that when the hours of darkness arrive, pilots know the lie of the land and have established their flight paths to provide adequate clearance from terrain and other hazards
- The fill point shall be illuminated with lights that are positioned so as not to compromise the pilots' night vision. To this end vehicle lights shall be dipped and rotating hazard lights switched off
- Unless instructed otherwise by the lead pilot, lights at the fill point shall remain on constantly until flying operations are terminated as these lights provide a reference that is critical to the pilots
- The pattern pilots fly shall enable them to see either the fill point or the fire front at all times

- Passengers shall not be carried unless the operator is appropriately authorised by CAA, the aircraft is equipped for night flight, the pilot meets night currency requirements and the passengers briefed. If no such operator is available at a fire, recce flights and AOP flights shall be terminated at Civil Evening Twilight. (30 minutes after sunset)

The following requirements should be observed:

- If dipping by night is undertaken a reference point (e.g. shoreline, stopbank etc) close to the fill point shall be illuminated with lights that are positioned so as not to compromise the pilots' night vision

10.2 Use of NVG

The use of NVG is a mitigating factor to many of the risks associated with flight by night and their use is recommended. Nevertheless, before attempting a night NVG operation pilots shall carry out a robust risk assessment in accordance with Chapter 11.

When NVG are utilized:

- The operator shall hold an AOC
- The pilot shall meet NVG currency requirements
- The aircraft shall be certified for NVG use
- Operations shall be carried out in accordance with AC91-13

For operations under NVG pilots may require different lighting requirements to those for unaided night operations.

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11 Operational Risk Management

11.1 Overview

Firefighting operations take place in a volatile and hazardous environment. In order to assess and mitigate the risks associated with the fire environment, some form of risk management procedure is required. The aim of the operational risk management system is to provide a process that documents things that an experienced pilot will do intuitively. Individual companies may well have risk management processes that can be used to document such assessments. If such material is not available the form at Appendix 2 may be used.

11.2 Operational Risk Management System

The fundamental principle is that the pilot's authority to modify, decline, postpone, cancel, divert or terminate a task overrides any decision of other parties to accept or continue a flight.

It is preferable for operators to identify the risks in fire fighting and develop standard operating procedures that address those risks in the months prior to the fire season.

If pilots want to carry out a risk assessment at the time of call out, the following may be helpful.

Pilots should assess each relevant line in the Risk Assessment example in Appendix 2 (or equivalent form) and consider the likely risks associated with that element. If the risk is assessed as low, do nothing. If the risk is either medium or high write a 1 in the appropriate box. When finished total the scores at the bottom of the page. These scores are only a guide and do not indicate total risk or the nature of the risk. The pilot should make a judgment on how the combination of risks will affect the safety of the likely tasks. As a guide, if all the risks total more than 12, then the pilot should consult with the person in charge and consider modifying the task or declining it altogether. Particular consideration should be taken of high risk scores and declining or modifying a task should be considered at scores above 12 or if high risk scores are present at all. The table shall be reviewed throughout the task. It doesn't have to be modified if that is impractical but it should be used as a starting point for mentally risk assessing any changes to the task or conditions during the task.

One significant risk especially for less experienced pilots is to get caught up in the fire incident and push boundaries in the belief that the situation calls for such a response. This is *never* the case. Experienced pilots can also be led into an unsafe course of action because of the phenomenon of heuristics when past experience and observations can influence his/hers mind model of the incident – and this may be different from the actual reality. All should

understand the phrase: *Optimism Bites* (See Appendix 3 Principles of High Reliability Organisations)

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12 Aircraft Refueling

Refuelling of aircraft shall be carried out in accordance with CAR Part 91.15. This rule permits the “hot” refueling of turbine powered aircraft provided no occupants are on board but precludes “hot” refueling piston powered aircraft. Refuelling shall be carried out only by pilots and/or their ground crew.

One fire extinguisher of at least 4.5 kg capacity shall be within 15 metres of the refueling operation.

Care shall be taken to avoid spills of fuel. In the event of a spill the Ground crew shall control, contain then clean up the fuel.

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13 Environmental Considerations

The environmental risks to consider in respect to aerial fire fighting activities are:

- Erosion from concentrated drops of water
- Adverse effects to environment and its ecology from the use of fire retardant, water enhancers and suppressants. (Some fire retardants enhancers and suppressants have a half life in the soil that prevents some species from establishing and can promote unwanted growth, especially in exotic organisms)
- Adverse effects to water quality from fire retardant enhancers and suppressants
- Noise

These environmental hazards shall form part of the hazard plan. It is the responsibility of the person in charge to manage these risks by weighing up the negative effects to the environment of fire fighting versus the negative effects to the environment of the fire.

Following a risk assessment the person in charge shall authorize one of the following:

- Unrestricted fire fighting. (Only fire suppressants, retardants and water enhancers listed on the current or previous USDA-approved schedule shall be used.)
- Fire fighting with restrictions (e.g. no foam/suppressant/retardant or some restrictions on where they cannot be used eg. Where run-off to a waterway is likely)
- No fire fighting

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14 Administration

14.1 Records

Completing a Daily Flight Record is mandatory to comply with CAR's. To verify the hours flown on fire fighting operations is an additional requirement of the fire management industry.

- New Zealand Air Operations – Flight Summary form shall be completed for every day an aircraft is operated at a fire incident. The minimum amount of detail required for daily flight operations is a flight record (one line on the summary form) for every fuel cycle on the fire. Additional records are required if the flight operations profile is changed e.g. if an aircraft switches from fire bombing to carrying passengers or equipment or if the aircraft is on ferry from its base to or from the fire incident. Additional information over and above these minimums may be required by the Person in Charge.
- If the aircraft is fitted with a time in service recorder, this may be verified at any time during the fire operations by the Person in Charge or his/her delegate. For the purposes of defining a time in service recorder (TiSR) this is a device that records flight time when the collective is raised (helicopters) or when the air switch is activated (aeroplanes.)

14.2 Chargeable time

Chargeable time for helicopters is skids or wheels off the ground to skids or wheels on the ground and for aeroplane is the start of each takeoff roll to the completion of each landing roll.

Aerial operators shall provide an invoice for their services within 10 business days of a fire event.

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Appendix 1**UNDERSLUNG FIRE BUCKET MAINTENANCE SCHEDULE**

BUCKET No.....

The following checks are required annually or more regularly depending on amount of use. The Company is responsible to track all servicing.

Check

Lifting strops for wear (broken strands) €
 (Note lifting strops shall be strength tested every year when strops and chains are tested in accordance with CAR Part 133.307)

Rated shackles, nuts and bolts for security (properly wire locked) €

Pneumatic ram for air leaks, ram alignment, setting, shaft to ram locked, correct cushioning effect and damage €

Control hoses (if applicable) for leaks, wear, couplings €

Breakaway connections for emergency jettison €

Bucket liner for holes, wear, leaks, bungs and water capacity marked €

Bucket skirt(s) and adjustable links for wear €

Steel frame for security and condition €

Open/Close valve for sealing €

Overall operation of bucket mechanisms €

Record all repairs carried out below.

Comments:

I certify that the work described above has been carried out in a proper manner and that this underslung fire bucket is fit to return to service.

Signed.....Name.....Date.....

This form is to be filed with the Company compliance records and kept for a period of not less than 2 years

Appendix 2

LOCATION	DATE			AIRCRAFT
Elements	Risk Level			Comments
	Low	Medium	High	
Aircraft				
Serviceable				
Fuel Requirements				
Performance				
Environment				
Visibility				
Cloud				
Wind				
Wires				
Sun				
Temperature				
Pilot				
Experience in role				
Currency				
Fatigue				
Stress				
Workload				
Equipment				
Navigation				
Underslung fire Bucket				
Foam Injection				
Belly tank				
Operating Area				
Wind				
Wires				
Sun				
Smoke				
Turbulence (orographic or convective)				
Terrain				
Altitude				
Density Altitude				
Obstructions				
Emergency landing areas				
Familiarity				
TOTAL				

Signed.....(Pilot) Date.....Time.....

Signed.....(AAS) Date.....Time.....

APPENDIX 3 Principles of High Reliability Organisations (HRO)

We need to proactively develop and maintain a work-safe-culture for all pilots, fire crews, fire crews and the public through risk-aware behaviours and systems.

Aircraft operations on fire incidents need to be working to the essential tenets of risk management. The principles of High Reliability Organisations provide a high reliability approach to risk management. This is currently taught on the fire management courses in New Zealand for Unit Standard 3293 (Lead ground support for air operations at vegetation fires) and 14563 (Supervise the operation of aircraft at vegetation fires). It is now being promoted in the USA's aerial fire fighting operations.

The principles are:

High Reliability Organisations and their participants:

- 1) Doubt what they expect to happen**
If for a moment to to contemplate the unexpected
- 2) Are reluctant to simplify**
Without analysing the consequences
- 3) Are sensitive to operations**
They keep "the big picture" in focus
- 4) Defer to in-place expertise**
They drive the decision-making down to the work area that needs them
- 5) Are resilient to their work culture**
They are prepared to listen from all levels both up and down the organisation and are prepared to modify approaches if needed

An HRO approach to risk requires:

- 1) Everyone to promote a "Work-Safe" environment.**
- 2) Everyone to be "Risk-Aware" in their duties**
- 3) Everyone to be aware of their own safety and that of work colleagues**
- 4) Everyone to "Walk-the-Talk" – to enact the safety messages that are preached**
- 5) Everyone prepared to say "NO" if they are not trained, experienced or comfortable in a work task that has been ordered**

Because we as human beings actively seek (consciously or unconsciously) data that confirms our expectations, we need to guard against pitfalls of **Heuristics – “Rules of Thumb.”**

- **Availability:- *My plan will be based on past experience***
- **Anchoring and Adjustment:- *I work from a known starting point and adjust from there***
- **Representativeness:- *I recognise this person, scenario or incident as part of a group I have constructed from previous experience***
- **Mindfulness:- *I will construct routines to handle this type of scenario from what I have seen before***

“I never saw it coming” is something that needs to be fully analysed and dealt with before the event, not after an accident or incident has occurred.

HRO's use naturalistic decision making processes such as those described above like everyone else but

- **They purposefully doubt their expectations**
- **They know that both experts and novices alike are susceptible to overconfidence**
- **They understand the phrase *Optimism Bites....*”**

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