Discussion Paper

Aerial appliance fleet and capability

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Introduction

Context

Aerial capability is one of a number of key elements of Fire and Emergency response, used to resolve incidents, protect and preserve lives, property and the environment. Aerial capability is made up of aerial appliances, trained personnel and supporting operations and procedures. It is used to perform a range of functions at both fire and non-fire incidents to meet operational need, address known risks and meet community expectations for response to generally larger scale emergency incidents. Aerial capability also provides at times a specialist capability to other agencies, across the emergency management sector. Understanding community needs and the associated risk profiles are important factors in determining Fire and Emergency's response capability for the future which includes specialised equipment like aerial appliances.

Background

The last aerial appliance strategy, adopted in 2003 informed the purchase of the 32 metre 'Bronto' aerial ladder platforms (type 5 and type 6) and heavy pump aerial appliances (type 4). New Zealand's population has grown by 1 million people since 2003 and the country has experienced sustained economic growth between 2003 and 2020[1]. The community needs and risk profiles of our cities have changed over this time as new residential, commercial and industrial buildings have been added to the legacy building stock. In addition, the organisation responds to an increasingly diverse range and number of incidents, including medical and support requests from other agencies, potentially extending the use of aerial appliances to more than just built environment fire incidents.

There is an expectation that our operational capability meets the needs of our communities now and in the future, emphasising the need to regularly review our asset strategies in a timely and effective manner.

Strategic Alignment

Aerial capability brings a specialist and valued resource to an incident commander's toolkit for use in de-risking and managing incidents. In combination with other tools, it is used to help meet Fire and Emergency's obligations under the Fire and Emergency New Zealand Act 2017 (the Act).

Our National Strategy 2019-2045 (National Strategy) sets out our national strategic direction and intentions as required by the Act. The National Strategy emphasises our changing environment with shifting expectations, technological advancements and climate changes that adversely impact New Zealand and its communities. Updating the aerial appliance strategy aligns to the *'Keeping pace with change'* strategic priority within the National Strategy, by ensuring our capabilities are appropriate to our work and that our capability appropriately matches local risks and needs.

Purpose

The purpose of this discussion document is to provide research, analysis and rationale on key elements that support aerial capability to inform discussions and feedback for a future revised aerial appliance strategy. This document aims to illicit input, comment and feedback from a range of

[1] Note that at the time of writing the economic impacts of the recent Covid-19 pandemic are yet to be fully realised and understood.

personnel across Fire and Emergency and various of our partner agencies. The intent is to use such feedback to assist in developing the Fire and Emergency aerial capability strategy for the next 20 years.

Input of advisory groups

A working group was established in late 2019, to initiate the thinking for a revised aerial appliance strategy. The working group's rationale, research and analysis are provided within this document to support discussions to further develop the thinking required to develop and confirm our aerial strategy. A limited number of workshops / interviews with selected Fire and Emergency aerial capability knowledge holders were held and a desktop review and current state analysis of the following was undertaken:

- aerial types,
- policies,
- operational use,
- allocation,
- relief appliances,
- availability,
- training,
- cascade plans,
- aerial appliance siting for optimal operational response,
- high-level assessment of the impact of any built environment changes and community needs on aerial demand,
- research on international aerial appliance allocation & use (particularly Australia & Europe) and;
- identification of new developments/ technologies in aerial operations and/or technologies that are complimentary to aerial operations.

Key discussion points

We are seeking views on key discussion points as below. Questions are provided at the end of each section to help guide thinking and responses.

- Issues with current aerial capability
- Aerial replacement options
- Aerial allocation
- Relief appliances
- Training

Aerial Appliance Use

While the primary purpose of aerial appliances is to provide firefighting and rescue capabilities at heights, they are also used to perform a range of other functions to meet the operational needs of Fire and Emergency and to provide assistance to other agencies. These functions include:

1. Aerial use by Fire and Emergency as lead or sole agency

Use	Description
Observation	• Command and Control decision making • Operations monitoring and safety planning
Removal or mitigation	• Structure materials for access • Structure materials for safety • Gas hazard • Vegetation hazards
Recovery	• Fallen patient • Medical patient (incl. mental health/suicidal)
Provision	• Emergency lighting • Mechanical Ventilation • Telemetry Breathing Apparatus repeater • Salvage materials • Ingress for staff • Mass decontamination • Emergency evacuation of staff • Emergency evacuation of occupants • Post fire investigation access
Supply suppression media	• Monitor • Low pressure delivery • Foam delivery • Emergency riser main
Use as a crane with chains, strops etc. for	• Lifting equipment • Lifting patient • Stabilising vehicles or structure • High Anchor Point

2. Aerial use by Fire and Emergency as supporting agency

Use	Description
Observation for another agency	

Action for another agency	• Access for operations e.g. sensitive negotiation
	• Recovery
	  ○ Fallen patient
	  ○ Medical patient
	  ○ Deceased
	• Photography from heights by Police at MVA/crime scenes/suspicious fires

Aerial Appliance Fleet

Fire and Emergency have a national fleet of 28 aerial appliances, 23 in the frontline fleet and five in the relief fleet, allocated to large and medium size cities across New Zealand. The fleet includes:

(i) 10 heavy aerial appliances (7 in frontline fleet, 3 in relief fleet) with the capability to reach heights between 28 and 32 metres. These are allocated to the larger cities around New Zealand.

(ii) 18 heavy pump aerial appliances with the capability to reach heights up to 17 metres. These are made up of 18 heavy pump aerials (16 in frontline fleet, 2 in relief fleet). These are allocated to large and medium sized cities and towns around New Zealand

There is also a pump/foam tender with an elevating monitor, in the frontline fleet. While this appliance has an elevating boom, it is considered a specialised foam tender rather than an aerial and it is not included as part of the aerial allocation. Information on the aerial appliance types is provided in the following section and a list of aerial appliances is provided in **Appendix A** of this document.

The current Fleet Strategic Plan[2] identifies the following target asset lifetimes/replacement ages for aerials:

Aerial type	Target Life
Heavy Pump Aerials (Type 4)	20 years
Heavy Aerials (Type 5 and Type 6)	25 years

These target lifetimes/replacement ages are based on factors including the appliance remaining fit-for-purpose, optimising total cost of ownership and the safety and comfort benefits of new technology. The following aerial replacement schedule has been calculated using the target asset lifetimes of 20 years (type 4 aerials) and 25 years (type 5 and type 6 aerials).

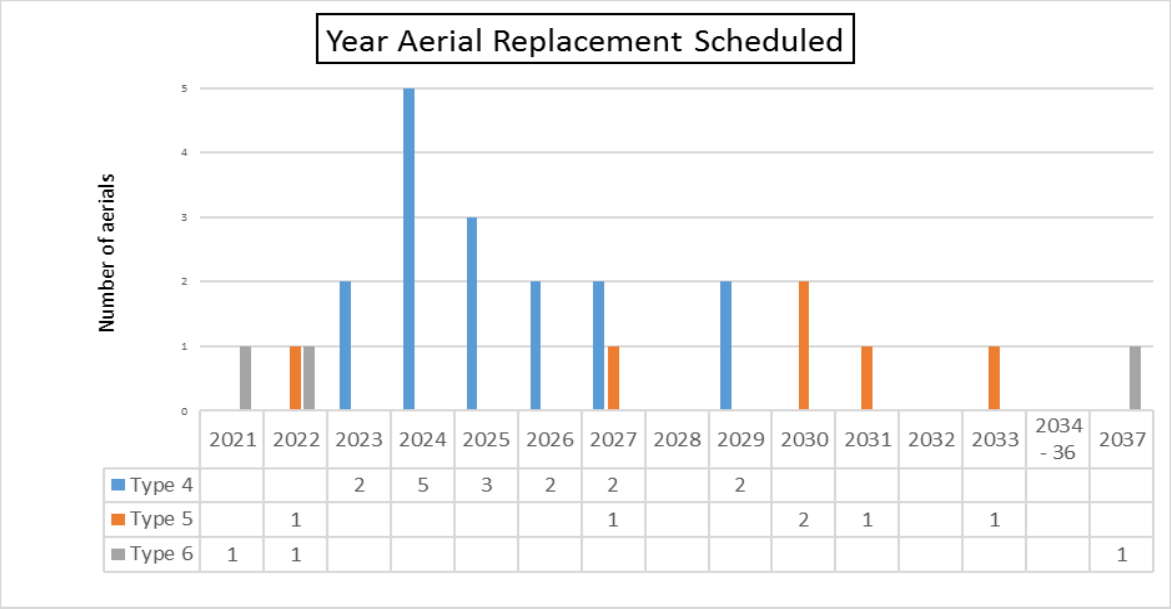


Fig. 1: Projected replacement schedule for aerial appliances (calculated using fleet sourced data)

[2] New Zealand Fire Service Fleet Strategic Plan, October 2015.

Heavy Pump Aerial, Type 4,

The type 4 Heavy pump aerial is a multi-purpose appliance which combines a heavy pump with the aerial capability to reach heights of up to 17 metres. The pumping capability enables the type 4 to supply its' own aerial monitor and provides the flexibility to be operated as a heavy pump or as an aerial pump appliance, depending on the nature of the call. The type 4 has a 17 metre telescoping turntable ladder with an elevated high-volume monitor and a small operator stand near the top of the ladder.

Aerial Appliance	Number	Aerial component	Dates put into service:	Locations:
Type 4	18 (16 + 2 reliefs)	Bronto Skylift F17CTL;	2004 – 2010	**Te Hiku** (Region 1): Whangarei, Ellerslie, Te Atatu, Papatoetoe;
				Ng ā Tai ki te Puku (Region 2): Mount Maunganui, Rotorua, Gisborne;
				Te Ūpoko (Region 3): Avalon, New Plymouth, Whanganui, Napier, Palmerston North;
				Te Ihu (Region 4): Christchurch city, Timaru, Nelson;
				Te Kei (Region 5): Invercargill

Table 1: Aerial configuration and location of the type 4 fleet (data source: fleet).

When operated as an aerial, it is predominately used as a water tower. It has some observation and rescue capability. The Type 4 has an operational weight of 22,000kg and its' water tank capacity is 1,350 litres. It can operate its' aerial on road gradients up to 7^{O} and it has a lifting/crane capability of 1,000kg with the first section of its boom. The Type 4 can carry a crew of four.

Vehicle stabilisation and elevation for aerial operation is provided by a combination of A frame hydraulic jacks in the middle of the vehicle and H frame hydraulic jacks near the rear of the vehicle. The type 4 frontline appliances and the two relief appliances have a similar configuration.

Heavy Pump Aerial, Foam Tender with Elevating Monitor

This appliance is a specialised pump/foam tender with aerial capability. Designed as a water tower, its' pumping capability allows the appliance to supply its' own elevated monitor. It has water/foam mixing capability and an elevated reach of 17 metres. It does not carry a fixed ladder.

The aerial pump/foam tender has an operational weight of 21,500kg. Its' water tank capacity is 2,000 litres.

When put into service in 2002 by the NZ Fire Service, the boom superstructure was second-hand and had been used for a considerable time on a similar appliance at NZ Refinery, Marsden Point.

Vehicle stabilisation for elevated monitor operation is provided by A frame hydraulic jacks, mid vehicle. This appliance is deployed as a frontline appliance. It can carry a crew of four.

Aerial Appliance	Number	Aerial component	Date put into service:	Location:
Aerial pump/ foam tender	1	Snozzle P50A 17m elevating monitor	2002	Seaview, Hutt Valley

Table 2: Aerial configuration and location of foam tender with elevating monitor (data source: fleet).

Heavy aerial: Type 5, Aerial Ladder Platform

The type 5 is a specialised aerial appliance that can reach heights of up to 32 metres and depths of up to 4 metres, below ground level. Depending on the Bronto Skylift model, the lateral reach of the primary fleet appliances is up to 18 metres (F32RLH) and up to 22 metres (F32RLX).

Once sited, the articulated boom provides superb manoeuvrability over and around obstacles (e.g. power lines, building awnings etc.). It provides an excellent observation and working platform, water tower capability and is good for rescue within the weight capability of the platform. The aerial platform has a maximum load rating of 400kg (F32RLH) and 500kg (F32RLX).

The type 5 requires a type 3 pump appliance to supply the water for its high-volume monitor as the type 5 does not have a pump or water storage. While the type 5 is theoretically capable of delivering 3,500 litres/minute through the water monitor, in practice the water volume delivery to the water monitor at full aerial extension is in the region of 2500 litres/minute, when supplied with water at 1500kPa.

The type 5 has an operational weight of 21,500kg and it can operate on road gradients of up to 7^{O}. The Type 5 has a lifting/crane capability of up to 2,000kg with the first section of the boom and up to 400kg from the platform. It can operate in winds up to 45km/h and carries a crew of two.

The type 5 primary fleet appliances are fitted with 32 metre articulating booms and the three Bronto Skylift models (F32RLH, F32RLX and F32MDT) have different configurations and capabilities. The Dunedin type 5/6 has a type 6 configuration with a pump and a crew cab. It is most often operated with a crew of two.

Vehicle stabilisation and elevation for stable aerial operation is provided by H frame hydraulic jacks located in the middle and near the rear of the vehicle. When fully extended, the hydraulic jacks increase the vehicle operating width to between 5.5 (F32RLH) and 6.2 metres (F32RLX). There is the capability in some situations, for the operating width to be reduced by "short setting" the hydraulic jacks on the "non-working side" of the vehicle.

The type 5 reliefs have different configurations to the frontline fleet. The Christchurch relief is fitted with a 28 metre articulating boom and the Dunedin relief is fitted with a 30 metre turntable ladder with a detachable platform. Note, the Dunedin relief is outside the aerial fleet allocation. It is considered an extra and is therefore not due for replacement under the current policy.

Aerial Appliance	Number	Aerial component	Date put into service:	Locations:
Type 5	1	Bronto Skylift F32RLX	2009	Newtown, Wellington
Type 5	1	Bronto Skylift F32RLH	2007	Parnell, Auckland
Type 5	1	Bronto Skylift F32RLH	2006	Christchurch City
Type 5	1	Bronto Skylift F32RLH	2006	Thorndon, Wellington
Type 5	1	Bronto Skylift F28-2T1	2003	Relief, Christchurch
Type 5/6	1	Bronto Skylift F32MDT	1998	Dunedin City
Type 5	1	Metz 30m Turntable Ladder	1988	Relief, Dunedin

Table 3: Aerial configuration and location of the type 5 fleet (data source: fleet).

Heavy aerial: Type 6, Aerial Ladder Platform with Pump

The type 6 is a specialised aerial appliance that can reach heights of up to 32 metres and depths of up to 5 metres. It is equipped with a similar articulated boom and platform to the type 5 and shares the same observation, working, lifting and rescue platform capabilities. The type 6 can operate as a pump or as an aerial. It has an on-board pump to supply the water for its elevated twin high volume water monitors. The pump can also supply initial attack lines when the appliance is operated as a pump.

The type 6 has an operational weight of 24,100kg and its aerial platform has a maximum load rating of 400kg (reduced from 500kg due to the fitting of two monitors). It's water tank capacity is 400 litres. The aerial can be operated on road gradients of up to 7^{O}.

Vehicle stabilisation and elevation for stable aerial operation is provided by H frame hydraulic jacks located in the middle and near the rear of the vehicle. When the hydraulic jacks are fully extended, the vehicle operating width is 6.2 metres. Where required, the hydraulic jacks on one side of the vehicle can be 'short set', as per the Type 5. The Type 6 has a crew cab and can carry a crew of four.

Aerial Appliance	Number	Aerial component	Date put into service:	Locations:
Type 6	1	Bronto Skylift F32RLX	2013	Auckland City
Type 6	1	Snorkel SCA200 (Pump Elevating Platform) - fitted to Spartan Monarch	1998	Hamilton
Type 6	1	Ladder Towers Inc. QS104 (Turntable Ladder with pump) - fitted to Spartan Charger	1997	North Island Relief, Auckland

Table 4: Aerial configuration and location of the type 6 fleet (data source: fleet).

Developments related to Aerial Capability

There have been several significant developments in the aerial capability space since Fire and Emergency purchased their current frontline aerial fleet.

New aerial appliance designs that offer different capability to current Fire and Emergency aerials

Metal alloys and improved designs have enabled aerials to be built that are light, strong and capable of reaching new heights. Higher platform aerials include aerial ladder platforms (ALP's) that can reach heights of 112m and turntable ladders (TL's) that can reach 68m.

New turntable ladder designs are more versatile and now provide similar access capability to aerial ladder platforms. They incorporate an articulated fly boom with a pivoting 'basket' (platform) that allows the 'basket' to be placed over building parapets and to be closely positioned against exterior building faces. Technology improvements have enabled the remote (wireless) operation of water monitors, thermal imaging and video cameras in the aerial 'basket'.

(i) Turntable ladders with articulated "fly booms" and pivoting platforms include:

- Rosenbauer Metz L32A XS Aerial Ladder[3]

  New rescue cage[4]
- Magirus M32L-AS articulated turntable ladder

  Four-part ladder unit and single extension system, 32m height, 16,000kg, 2,500l/min, good for use in narrow city centre streets, industrial facilities and below ground-level areas[5]

(ii) Heavy pump aerial with platform

- Bronto Skylift F28ALR – first response pump unit with platform, rescue ladder, 28m height, 20m reach, 17,000kg[6].

(iii) "Snozzle": Heavy pump aerials with extendable turret/monitor

- Emergency One 'Scorpion'
  Multi-purpose heavy pump with 17m high reach extendable turret and piercing tool that incorporates a spray nozzle for internal fire suppression. Can deliver up to 6000l/min[7].
- Rosenbauer AT Stinger
  Multi-purpose heavy pump with 16.5m high reach extendable turret and a hydraulically actuated piercing tool that incorporates a spray nozzle for internal fire suppression. Can deliver 4,500l/min over 85metres[8].

[3] https://www.youtube.com/watch?v=A-7zdZrB1Ro&feature=youtu.be

[4] https://youtu.be/D1KHYDVC7Ys
https://www.rosenbauer.com/en/int/rosenbauer-world/vehicles/aerials/aerial-ladders

[5] https://www.magirusgroup.com/de/en/products/turntable-ladders/m32l-as/
(video also shows the remote operation of the water monitor) https://www.youtube.com/watch?v=pmjR_gKiEu4

[6] https://brontoskylift.com/product/f28alr/

[7] https://ukfiremag.mdmpublishing.com/e1-scorpion-emergency-one-launch-their-innovative-e1-scorpion-appliance/

[8] https://iffmag.mdmpublishing.com/the-uk-fire-appliance-helping-to-change-the-face-of-firefighting/

Equipment complimentary to Aerial Appliance capability

(i) Drones. Currently Fire and emergency use drones to:

- Observe at incident sites - Capture thermal and/or normal video images and stream these to the drone console, mobile device, command unit or central control.
- Take samples of air inside building for chemical analysis or take samples of fire material for forensic analysis.

Drones may be flown independently or tethered to an appliance at an incident site. As drones are being used for many applications, drone applications that may be of interest to Fire and Emergency include:

- High speed stability while filming complex action movie photography.
- Ability to work in high wind conditions
- Ability to transport small items over long distances e.g. researchers from Galway University, Ireland used a drone in September 2019 to transport insulin vials from a mainland airstrip to an island, 18km offshore.

e.g. DJI drones[9].

(ii) Integration of DJI drone visual imaging data with Rosenbauer operations system to provide richer information to fire operations command centres for situation assessment and informed decision making regarding safe and efficient deployment of personnel[10].

(iii) Drones are also being adapted for external firefighting on high rise buildings. In this application, the drone is tethered and its' water monitor is supplied by hoses connected to ground water supplies[11].

(iv) Robotic fire extinguishing vehicle LUF 60

Remote-controlled vehicle LUF 60 extinguishes fires with water or foam.

The stable crawler chassis permits precise driving and turning manoeuvres, designed to overcome stairs and ramps up to an angle of inclination of approx. 30°, can remove movable obstacles if necessary.

Can deliver up to 2,400 litres of water-per-minute at a distance of 60m through an atomised water jet. The throw distance with foam is approx. 35 m[12].

(v) Industrial "Typhoon fan"

Large industrial fan, it can create and blow a fine water mist into large internal spaces e.g. large warehouses. It can cover all inside spaces, cool building and cool/quench the fire. Range of fans can be powered by petrol, water or electricity[13].

[9] https://www.dji.com/nz/matrice-200-series/applications#m200s-app-s1

[10] https://www.dji.com/nz/newsroom/news/dji-rosenbauer-partnership

[11] https://www.aerones.com/eng/firefighting_drone/

[12] https://www.luf60.at/en/extinguishing-support/robotic-fire-extinguishing-vehicle-luf-60/ and https://www.alphr.com/the-future/1002221/meet-taf20-the-turbine-aided-firefighting-robot-of-the-future

[13] https://www.leader-group.company/en/firefighting-equipment/fire-ventilators/large-flow-fans

https://www.leader-group.company/en/firefighting-equipment/fire-ventilators/hydraulic-fans/water-driven-fan-mh260-79900-m3h

(vi) Ultra-High-Pressure Water Cutter [14] "Cobra, Cold Cut"

The Cutting Extinguisher uses a mixture of water and cutting agent flowing through a special nozzle at 250+ bar pressure to cut through all known building and construction materials, from the outside of the fire location.

Once a roof, wall, door, casing, car body, hull, silo wall, or other construction, has been penetrated, water only is applied through the thumbnail-size hole in the form of a very finely distributed mist, filling the interior with water vapour and reducing the temperature

(vii) "PV Stop" - inert barrier film[15]

Designed to be sprayed on solar PV panels to electrically isolate the panels and stop them charging so firefighters can access and apply water to the building or roof without the danger of electrical shock. (PV panels continue charging when exposed to light, even after the interior circuits are disconnected.

PV stop is used by firefighters in London, Europe, New South Wales and the Northern Territories. It can be applied using a hand held "extinguisher" type device from 10m away e.g. from an aerial platform. Alternatively, it can be fixed to an aerial or a drone.

Once the fire has been extinguished and the building is safe, the PV stop inert barrier film can be peeled off so the panels can start working again.

(viii) 3D visualisation to assist with the analysis of new aerial appliances[16]

The use of 3D visualisation and photo-realisation provide the opportunity to visualise new aerial appliances ahead of time and to simulate their use in our urban environments. This type of visualisation/augmented reality tool could be a very helpful in communicating the look and usability of new appliances (between potential suppliers, fleet procurement and stakeholders).

(ix) Rosenbauer Aerial Ladder Tactical Simulator[17]

(x) Rosenbauer Firefighting trend maps[18]

Rosenbauer have prepared a series of maps that identify changing societal trends that may impact the future design of firefighting services.

[14] http://www.coldcutsystems.com/about-coldcut-cobra

[15] http://www.pvstop.com.au/products/

[16] https://www.rosenbauer.com/blog/en/3d-visualization-of-aerial-ladders/

[17] https://www.rosenbauer.com/en/at/rosenbauer-group/press/specialist-press/press-detail/nd/neuer-drehleiter-simulator

[18] https://www.rosenbauer.com/blog/en/cat/innovation-en/firefighting-trendmap/

***Question 1**: Should complementary equipment such as drones be considered in the revised Aerial Appliance Strategy or should these assets be assessed within a wider revised National Fleet strategy?*

***Question 2**: What should the time horizon of the revised Aerial Appliance Strategy be? e.g. 10, 15, 20 years and why?*

Issues with current Aerial Capability

The following issues were raised by the working group.

Operational Issues: Heavy aerials

- Over several months in 2019/20 Auckland city had only one of their two allocated Heavy aerials on the run. Their second Heavy aerial, a Type 6 required some major work and was replaced by the North Island relief (a Spartan TTL Type 6).
- Some questions have been raised about the hydraulic efficiency of the Type 5 aerials. Type 5s are supplied by separate pump appliances with water at 1500kPa (15 bar) pressure to deliver approximately 2500l/min from their monitor, at full aerial extension. This is less than the manufacturers rated 3,500l/min.
- There are some concerns around the ability of the connecting hose and connections to safely supply high pressure water from the pump to the aerial.
- Where practicable, designated crews should not be separated and left alone and unsupervised. The Dunedin Type 6 is normally operated with a crew of two. There is a risk if the officer is assigned away from the appliance at an incident, that the appliance may be operated by a single aerial operator.
- There are challenges in managing and maintaining training and staff qualifications for aerial operators.

Operational Issues: Heavy pump Aerials

- While the Type 4s provide useful and versatile pump and aerial capability. Their 17 metre height limits their use when responding to incidents in major cities and in large footprint commercial and tilt slab buildings, where the appliances must be sited a distance from the building.
- The absence of a safe working platform on the Type 4 limits their use at incidents – no platform to enable firefighters to work more flexibly and safely at heights.
- There is a perceived variation in the knowledge and skill of Bronto Skylift servicing agents outside Auckland. Better support for service personnel from Bronto Skylift, is needed to provide nationally consistent outcomes and speedier fault diagnosis.
- Aerial availability data for individual appliances, which is important data for reliability and service delivery performance measurement, is not available from SMS. When appliances are taken off the run for long periods (K0), their call sign is assigned to the relieving appliance. This substitution, while required for the provision of the required capability and efficient appliance dispatch can make it difficult to obtain dependable availability data for individual aerials to support reporting on individual aerial reliability.
- The importance of having up-to-date strategies including allocation and replacement plans was emphasised by the aerial strategy workshop participants.
- The significant population growth and urban development especially in Auckland, is impacting the current demand for Fire and Emergency's aerial capability.
- The age profile of the existing aerial fleet is unevenly distributed. The scheduled replacement of the aerial fleet is due from 2023 (heavy pump aerials) and from 2022 (heavy aerials) as the

appliances reach the end of their respective 20 and 25 year lifecycles. Significant capital investment will be required to replace the current aerial fleet.

- The aerial appliance strategy workshop participants agreed that the service life of 25 years for heavy aerials and 20 years for heavy pump aerials is probably too long.
- It was considered that there is a need to update the aerial attendance guidelines for high rise residential buildings. It was noted that London Fire Brigade added aerials to their first alarm PDA's for high rise buildings in 2017 in the wake of the Grenfell tower fire.

Note: Several issues were raised during the first aerial strategy workshop[19] to record individual comments on the perceived positive and negative features of aerial appliances. While some comments may reflect the views of more than one participant, a consensus view from all workshop participants was not obtained during the workshop (refer **Appendix B**).

***Question 3**: Are there additional risks or challenges with current aerial capability that have not been captured here?*

***Question 4**: Do you think the current assumed lifespan of our aerials (20 and 25 years) are appropriate? If not, why not, and what do you think they should be and why?*

[19] Aerial strategy workshop 1, Wellington, 21 Nov 2019

Aerial Fleet Replacement and Allocation

The working group proposed that a comprehensive approach to aerial replacement and allocation be adopted. This would see a risk based assessment of community needs/risks and an appraisal of the role aerials and specialist appliances have within operational tactical response plans. This discussion paper touches on some of these elements but more detailed analysis is required.

The following model was developed by the Cornwall Fire and Rescue Service, UK, for procuring future operational assets. Historically their approach to procuring appliances was replacing like for like. This has now transformed to taking a comprehensive view of current and future operational needs, user requirements and community needs and innovation.

Model for procuring future operational assets:
All operational assets will be procured whilst considering a number of factors, as demonstrated in the below model.

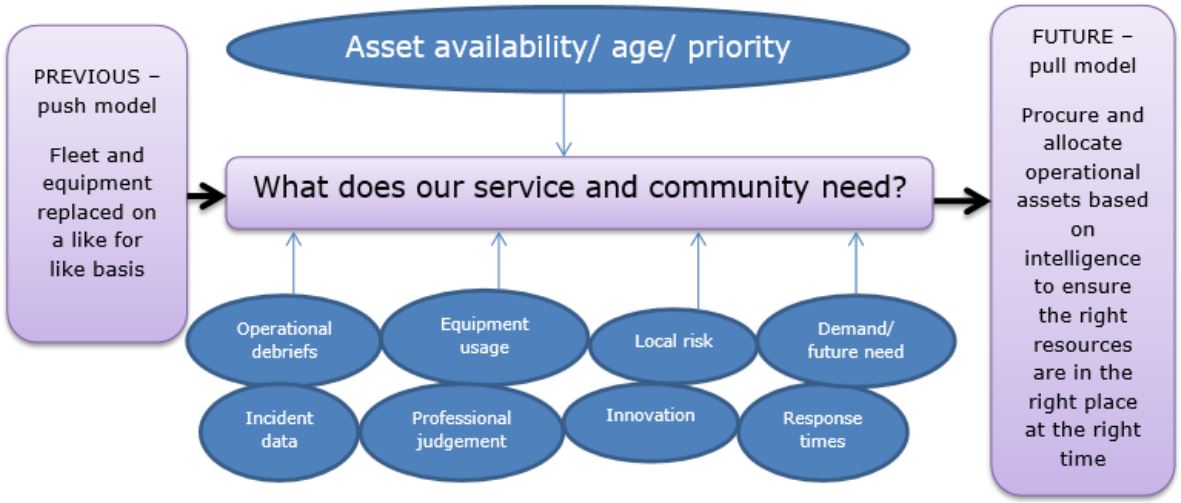


Fig. 2: The Cornwall model for procuring future operational assets

The following principles were identified as important for new aerial appliance selection.

Fit for Purpose

The ability of aerial appliances to add value by delivering solutions that meet end-customer needs and to do so sustainably while being responsive and safe for operators to operate.

Integration

The ability of all parts of the system to work together effectively and in a coordinated way for incident response. This holistic approach considers the tactical use of aerials at incidents and their ability to work seamlessly with other appliances to achieve the desired outcome.

Affordability

Adopting a strategic view of appliance whole of life costs and the total cost of ownership over aerials in service lifespan.

Aerial appliance replacement – Possible options overview

Initial issues and risks have been identified on page 12 and 13, more are expected to arise through the discussion process. These will be assessed and addressed during strategy development. Subject to evaluating the identified issues and risks, the following four options are provided for potential aerial replacement. These are:

Option	Title	Summary Description
Option A	Maintain current aerial capability	'Like for Like replacement" of heavy aerials (32m ladder platforms) and heavy pump aerials
Option B	Vary current capability 1	New Increase height 24m. heavy pump aerials; New heavy aerial (32m ladder platforms) with an on-board pump
Option C	Vary current capability 2	New increased height 24m heavy pump aerials; New 32m ladder platforms + new 32m turntable ladders, with an on-board pump
Option D	Vary current capability 3	New increased height 24m heavy pump aerials; New taller, 32m+ ladder platform aerials; possible addition of "Snozzle" pump aerial appliance

All four options require a change from the current state. The level of change required increases from option A to option D. The aim is to provide an aerial capability that integrates smoothly with Fire and Emergency's operations and has the flexibility to meet changing community needs.

Option A, maintaining the current aerial capability involves the smallest amount of change as aerials are replaced largely on a "Like for Like" basis, while taking advantage of any technology upgrades at the same time. A "Like for Like" replacement does not consider the degree of fit for purpose of the current aerials or the changing community needs since the time the current aerials were commissioned. Assuming a "Like for Like" replacement is possible, this should be relatively straightforward when it comes to replacing the heavy pump aerials as that fleet has a uniform configuration. Having an aerial fleet with similar models is appealing from an operational training, maintenance and relief management perspective. The main changes would potentially come from incremental changes manufacturers have made since the current appliances were built.

In contrast, in the heavy aerial fleet only three of its seven frontline aerials have the same configuration so a "Like for Like" replacement would involve either replacing each of the current appliances with similar appliances or building a new aerial fleet with aerials of similar configuration. This could work if the current community needs were met and there was a mechanism to build flexibility into tactical operational plans (including aerial operations) to meet changing community needs.

Possible appliance configurations for aerial appliances with assumptions, pros and cons for each option are provided in the following pages.

Assumptions or considerations common to all options

- No change to current crewing levels
- All new aerials will be fitted with thermal and video imaging technology
- The form of replacement appliance for type 6 aerials is to be agreed.
- A root cause analysis of the issue relating to the supply of pressurised water by a pump appliance to a major aerial should be undertaken before procurement is finalised, to understand the issue and propose solutions.
- Aerial allocation is based on local need/risk profile. Local needs and risks are known for medium sized and large cities where aerials are likely to be located. A mix of aerial appliances could be provided to meet these needs.
- The different aerial appliances complement one another and other fleet appliances to provide the potential for extended capability.
- Heavy pump aerials could potentially be used as first response multi-purpose appliances if required.
- Where possible, use of a common platform or aerial operating system would simplify training
- Where possible, similar appliances should be present in the frontline and relief fleets.
- Implementation planning for all options should include (i) Training material preparation (approx. 6 months) and (ii) a review of operational tactics to achieve smooth integration with other teams e.g. Service Delivery and ComCen, update operational tactics as required.

Option A: Maintain current aerial capability	
Description:	• Replace Like with Like • Major aerials replaced with newer models of the current 'Bronto' ladder platforms. • Heavy pump aerials replaced with newer models of a similar configuration e.g. 17m turntable ladder.
Assumptions:	i) The current Bronto ladder platform and heavy pump aerials are fit for purpose appliances. They perform a variety of functions to meet community needs, are dependable, integrate well with the Fire and Emergency fleet, are safe to operate and offer good value for money over their lifetime. ii) The current aerial allocation policy is applied iii) Replacement Bronto aerials will have a similar operating system to the current Bronto aerials, while incorporating improvements made since the current aerials were made. Improvements in the newer Bronto aerials are limited to those provided by Bronto. iv) Older major aerial appliances will be retired and replaced with ladder platform aerials. This would see us have similar Bronto aerials in our frontline and relief fleets. The Spartan appliance in Hamilton would be replaced by a newer Bronto aerial.

	v) Heavy pump aerials will continue to be first response multi-purpose appliances. vi) Future events will require the same capability as past events. vii) Wider footpaths in cities, following incorporation of cycle lanes and expected Covid-19 measures, will impact aerial siting and require a longer reach than previous, to be effective.
Pros	• The current aerial fleet capability would be maintained. It would have the same capability as it does now with a mix of older and newer appliances. • Bronto aerials are a known quantity. Major aerial and heavy pump aerial crews are familiar with the operating systems and capability of the ladder platform appliances. • Having all models of each aerial type essentially the same, is a good thing from an aerial training (operator training and certification management) perspective. Operator training for frontline and relief aerials can be streamlined. Training guides can be updated promptly. • Little change to major aerial operator training for centres e.g. Auckland, Wellington and Christchurch where current major aerial models are located. • The newer models will introduce only a small amount of change. • The new fleet would largely mirror the current aerial fleet (excluding Hamilton's Spartan aerial) with the benefit of model upgrades and improvements made since the current aerials were purchased. Current frontline aerials can be used as relief appliances for new fleet. • The new aerials can be accommodated at the same stations as the current aerials. • The current heavy pump aerial is a sturdy, powerful and popular multi-purpose appliance • New heavy pump aerials will have an option of wireless remote operation of aerial
Cons	• Concerns around the current aerials are likely to continue, therefore, the current work-arounds to manage shortcomings are also likely to continue e.g. o Bronto major aerials will continue to require a pump appliance to supply water to the aerial monitor/s. High pressure in connecting hoses and fittings is a concern. o The 17m height of the heavy pump aerials will continue to limit their safe use at medium height buildings and large tilt slab buildings – aerials need to be sited safely away from the buildings and their reach to be long enough to be effective. o No basket on the heavy pump aerial will impact the work that can be safely completed at a height o Operational limitations relating to wind speed (45km/h) and slope (7^0) continue. • Training impact for aerial crews in Hamilton and Dunedin not familiar with Bronto appliances.

	• There is no additional capability provided in terms of height, reach, manoeuvrability so if future events differ from past events there is limited flexibility available to respond to the changing needs. • Wider footpaths in cities, following incorporation of cycle lanes and the expected Covid-19 measures, will impact the siting of aerials and require a longer reach than previous, to be effective.

Option B: Vary Current Capability #1	
Description:	• Aerial Fleet Capability increased from current capability and "Like for Like" option. • Major aerials replaced with new Bronto 32m ladder platform aerials, fitted with an on-board pump for own waterway (i.e. no capability to feed hoses for ground operation). • Heavy pump aerials replaced with heavy pump aerials of greater reach e.g. 24m, with a 'basket'.
Assumptions:	i) The current Bronto ladder platform and heavy pump aerials are fit for purpose appliances. They perform a variety of functions to meet community needs, are dependable, integrate well with the Fire and Emergency fleet, are safe to operate and offer good value for money over their lifetime. ii) Replacement Bronto aerials will have a similar operating system to the current Bronto aerials, while incorporating improvements made since the current aerials were made. iii) Adding an on-board pump to major aerials will increase their water monitor capability while reducing risk from high pressure connecting hoses from a pump appliance. The new appliance weight, balance and ergonomics will be optimised to accommodate on-board pump on major aerials. This assumes that the root cause analysis has confirmed an on-board pump is required. iv) Older major aerial appliances will be retired and replaced with Bronto ladder platform aerials. This would see us have similar Bronto aerials in our frontline and relief fleets. The Spartan appliance in Hamilton would be replaced by a newer Bronto aerial. v) Future events will require a different capability to past events. vi) Wider footpaths in cities, following incorporation of cycle lanes and expected Covid-19 measures, will impact aerial siting and require a longer reach than previous, to be effective.
Pros	• The aerial fleet capability would have more capability than it does now. • Providing extended reach and a 'basket' for heavy pump aerials will increase the range of incidents that they can safely and effectively respond to. A major aerial will no longer be required for every incident where a working platform is required. • New capability for heavy pump aerial improving effectiveness at industrial & commercial fires (including tilt slab buildings). • Bronto aerials are a known quantity. Major aerial crews are familiar with the operating systems and capability of the ladder platform appliances. Aerial training (operator training and certification management) for appliances

	with an on-board pump should not be too different from current training. Training guides can be updated promptly. • Crews familiar with features and capabilities of current major aerials; incremental training to major aerial operator training for Auckland, Wellington and Christchurch major aerial crews • Current frontline aerials can be used as relief appliances for new fleet. • The new major aerials can be accommodated at the same stations as the current aerials. • The current heavy pump aerial is a sturdy, powerful and popular multi-purpose appliance • New heavy pump aerials will have an option of wireless remote operation of aerial.
Cons	• The new heavy pump aerials will be different to the current heavy pump aerials, even if they are from the same supplier. • New maintenance programmes will be required for new heavy pump aerials and major aerials • The new major aerials with on-board pumps are non-standard (i.e. bespoke) appliances. • Siting for the relief major aerials will require different logistical arrangements to the major aerial frontline appliances. Communication with incident commanders, by major (relief fleet) aerials enroute to an incident will be essential to ensure there is a pump appliance available to supply water for its monitor. • The new heavy pump aerials may require a different station space to current appliances. • The Bronto operational limitations relating to wind speed (45km/h) and slope (7^{o}) continue. • Training impact for aerial crews in Hamilton and Dunedin not familiar with Bronto appliances. • There is no additional major aerial capability provided in terms of height, reach, manoeuvrability so if future events differ from past events there is limited flexibility available to respond.

Option C: Vary current aerial capability #2	
Description:	• Aerial Fleet Capability increased from "Increase aerial capability 1" option. • Some major aerials replaced with 32m Bronto aerials with on-board pump for own waterway. • Rest of major aerials replaced with 32m Turntable ladders with on-board pump for own waterway • Heavy pump aerials replaced with heavy pump aerials of greater reach e.g. 24m, with a 'basket'.
Assumptions:	i) The current Bronto ladder platform and heavy pump aerials are fit for purpose appliances. They perform a variety of functions to meet community needs, are dependable, integrate well with the Fire and Emergency fleet, are safe to operate and offer good value for money over their lifetime. ii) Replacement Bronto aerials will have a similar operating system to the current Bronto aerials, while incorporating improvements made since the current aerials were made. vii) Adding an on-board pump to major aerials will increase their water monitor capability while reducing risk from high pressure connecting hoses from a pump appliance. The new appliance weight, balance and ergonomics will be optimised to accommodate on-board pump on major aerials. This assumes that the root cause analysis has confirmed an on-board pump is required. iii) Older major aerial appliances including the Spartan appliance in Hamilton will be retired and replaced with either a ladder platform or a turntable ladder with an on-board pump. iv) Future events will require a different capability to past events. v) Turntable ladder operating system will be easy for Bronto aerial operators to grasp and use. vi) Wider footpaths in cities, following incorporation of cycle lanes and expected Covid-19 measures, will impact aerial siting and require a longer reach than previous, to be effective.
Pros	• The aerial fleet capability would have more capability than it does now. • Adding turntable ladder aerials will allow greater agility and fast response in narrow, sloping city streets. Their smaller footprint, ability to operate on slopes greater than 70 and in higher winds increases the range of tactical options at significant incidents by providing different but complimentary capability to Bronto major aerials. • If ladder platform and turntable ladders are supplied by the same manufacturer, they will share similar (not identical) operating systems, which will simplify operator training. • Providing extended reach and a 'basket' for heavy pump aerials will increase the range of incidents that they can safely and effectively respond to. A major aerial will no longer be required for every incident where a working platform is required. • New capability for heavy pump aerial improving effectiveness at industrial & commercial fires (including tilt slab buildings). • Bronto aerials are a known quantity. Major aerial crews are familiar with the operating systems and capability of the ladder platform appliances. Aerial

	training (operator training and certification management) for appliances with an on-board pump should not be too different from current training. Training guides can be updated promptly. • Crews familiar with features and capabilities of current major aerials; incremental training to major aerial operator training for Auckland, Wellington and Christchurch major aerial crews • Current frontline aerials can be used as relief appliances for new fleet. • The new major aerials can be accommodated at the same stations as the current aerials. • The current heavy pump aerial is a sturdy, powerful and popular multi-purpose appliance • New heavy pump aerials will have an option of wireless remote operation of aerial. • Many of our stations can accommodate 32m aerials.
Cons	• The new heavy pump aerials will be different to the current heavy pump aerials, even if they are from the same supplier. • New maintenance programmes will be required for new heavy pump aerials and major aerials • The new major aerials with on-board pumps are non-standard (i.e. bespoke) appliances. • The new heavy pump aerials are also likely to be bespoke appliances to meet NZ road rules. • Siting for the relief major aerials will require different logistical arrangements to the major aerial frontline appliances, where the reliefs are different to the frontline appliances. Communication with incident commanders, by major (relief fleet) aerials enroute to an incident will be essential to ensure there is a pump appliance available to supply water for its monitor. • The new heavy pump aerials may require a different station space to current appliances. • The Bronto operational limitations relating to wind speed (45km/h) and slope (7^{o}) continue. • Training impact for aerial crews in Hamilton and Dunedin not familiar with Bronto appliances.

Option D: Vary current capability #3	
Description:	• Aerial Fleet Capability increased from "Increase aerial capability 2" option. • A small number of major aerials replaced with 32m+ Bronto aerial ladder platforms. • Rest of major aerials replaced with 32m Turntable ladders with on-board pump for waterway. • Heavy pump aerials replaced with heavy pump aerials of greater reach, e.g. 24m, with a 'basket'. • Add a lighter pump aerial "Snozzle" like appliance in place of a heavy pump aerial.
Assumptions:	i) The current Bronto ladder platform and heavy pump aerials are fit for purpose appliances. They perform a variety of functions to meet community needs, are dependable, integrate well with the Fire and Emergency fleet, are safe to operate and offer good value for money over their lifetime. ii) On the new ladder platforms, there will be a trade-off between extra platform height, appliance weight, length and height for garaging and the potential extra weight of an on-board pump viii) A mechanism will be found to optimise vehicle weight, balance and ergonomics to accommodate an on-board pump on the turntable ladders. Adding an on-board pump to major aerials will increase their water monitor capability while reducing risk from high pressure connecting hoses from a pump appliance. This assumes that the root cause analysis has confirmed an on-board pump is required. vii) Older major aerial appliances including the Spartan appliance in Hamilton will be retired and replaced with either a ladder platform or a turntable ladder with an on-board pump. viii) Future events will require a different capability to past events. ix) Turntable ladder operating system will be easy for Bronto aerial operators to grasp and use. x) Wider footpaths in cities, following incorporation of cycle lanes and expected Covid-19 measures, will impact aerial siting and require a longer reach than previous, to be effective. xi) A 'Snozzle' appliance could provide very useful capability in larger cities or in areas with lots of metal clad industrial buildings. A piercing nozzle at the end of the boom could be used to pierce the cladding of a burning building and inject water spray to extinguish the fire.
Pros	• The aerial fleet capability would have more capability than it does now. • Adding increased height will add valuable capability for incident response. • Adding turntable ladder aerials will allow greater agility and fast response in narrow, sloping city streets. Their smaller footprint and ability to operate on slopes greater than 70 and in higher winds increases the range of tactical options at significant incidents by providing different but complimentary capability to Bronto major aerials. • If ladder platform and turntable ladders are supplied by the same manufacturer, they will share similar (not identical) operating systems, which will simplify operator training.

	• Providing extended reach and a 'basket' for heavy pump aerials will increase the range of incidents that they can safely and effectively respond to. A major aerial will no longer be required for every incident where a working platform is required. • Bronto aerials are a known quantity. Major aerial crews are familiar with the operating systems and capability of the ladder platform appliances. Aerial training (operator training and certification management) for appliances should not be too different from current training. Training guides can be updated promptly. • Major aerials with pump for own waterway, will improve water pumping efficiency of major aerial & reduce risk from high pressure hose connections to pump appliances., • Crews familiar with features and capabilities of current major aerials; incremental training to major aerial operator training for Auckland, Wellington and Christchurch major aerial crews • Current frontline aerials can be used as relief appliances for new fleet. • The new major aerials can be accommodated at the same stations as the current aerials. • The current heavy pump aerial is a sturdy, powerful and popular multi-purpose appliance • New heavy pump aerials will have an option of wireless remote operation of aerial. • Many of our stations can accommodate 32m aerials.
Cons	• The new heavy pump aerials will be different to the current heavy pump aerials, even if they are from the same supplier. • New operator training programmes will be required for new pump aerials and major aerials • The new heavy pump aerials are also likely to be bespoke appliances to meet NZ road rules. • More expense if similar relief and frontline aerials are required. • Siting for the relief major aerials will require different logistical arrangements to the major aerial frontline appliances. Communication with incident commanders, by major (relief fleet) aerials enroute to an incident will be essential to ensure there is a pump appliance available to supply water for its monitor. • The new heavy pump aerials and the new longer aerial ladder platforms may require a different station space to current appliances. • The Bronto operational limitations relating to wind speed (45km/h) and slope (7^0) continue. • Training impact for aerial crews in Hamilton and Dunedin not familiar with Bronto appliances. • Frontline and relief major aerials will have appliances of different height capability.

Question 5: *Which is your preferred aerial capability option and why?*

Aerial appliance allocation

The 2015 Fleet Strategy describes the allocation of aerial appliances to stations, based on nationally consistent criteria that consider the risk being managed by each station, area and region. It states that new aerial appliances will be allocated to stations in accordance with the FL4 POP aerial appliance policy (refer **Appendix D**).

Within cities, the criteria for selecting suitable fire stations for aerial appliance location include:

- Proximity to areas of highest risk (that require an aerial response)
- Ability to provide timely response to alarms from fire station:
    - ability to access incident site through traffic (within required time),
    - crew availability
- Ability of aerial to be housed in the fire station, including the manoeuvrability of aerial appliance into, out of and around the fire station.

Heavy aerials are allocated to New Zealand's largest cities, namely Auckland, Hamilton, Wellington, Christchurch and Dunedin. Heavy pump aerials are allocated to provincial cities namely Whangarei, wider Auckland region, Mount Maunganui, Rotorua, Gisborne, Napier, New Plymouth, Whanganui, Palmerston North, Lower Hutt, Nelson, Christchurch, Timaru and Invercargill. See **Appendix B** for aerial appliance location maps.

The Fleet Strategy anticipates the development of the National Risk Resource Model (NRRM) will play an increasing role in the future determination of appliance allocation.

Question 6: *When determining aerial appliance allocation, are there additional considerations outside of the current Fleet Strategy (2015) criteria and the NRRM model analysis?*

Relief appliances

The current aerial allocation Schedule FL4 SCa: Schedule of Aerial Appliance Allocations (refer Appendix D), lists the appliance locations and FL4 SCb: Schedule of Relief Appliance Allocations, lists the prioritisation for relief appliance allocation.

The working group consider that the relief appliance policy is not always working as currently documented. The policy indicates that when assigning relief appliances, every effort will be made to provide appliances with similar capability to the appliance being taken out of service will be provided as relief appliances. Consideration is given to the amount of training required to familiarise the aerial crew with the relief appliance so the appliance and its new crew are ready to respond to an incident.

Each island has a heavy aerial relief appliance. These relief appliances are different to the frontline heavy aerials. The heavy pump aerial fleet is more uniform so the frontline and relief appliances have similar configurations.

In the North Island, the heavy aerial relief appliance is a type 6 turntable ladder whose capability can be easily used in Auckland and Hamilton. This relief is seldom used as a Wellington relief as its' configuration and crewing are different to the type 5 normally used in Wellington. The Auckland region workload, the distance from Auckland to Wellington and the need for operator familiarisation training are also issues. However, Fleet have advised that when a relief Type 5 is required in Wellington, the Christchurch crew use the South Island relief, and the Christchurch Type 5 is used in Wellington.

In the South Island, the South Island relief heavy aerial is used in Christchurch and is available for use in Dunedin. Dunedin generally uses an older Metz turntable ladder as its relief aerial, which is nominally due for disposal but is currently being retained in service while it remains fully operational without major repairs. The South Island relief is considered unsuitable for use in the narrow and steep Wellington streets.

There is no documented schedule for cascading type 4, type 5 and type 6 aerial appliances. Appliance types 1, 2 and 3 are cascaded as per Schedule FL3-2 SCb Appliance Cascade Plan and the age based appliance tiers as per Schedule FL2-2 SCa Appliance Allocations Schedule. Prioritised cascade principles that review appliance age and reliability inform the appliance cascade process. The Schedule FL3-2 SCb Appliance Cascade Plan is current to June 2020.

In the first instance, new appliances are placed in the busiest stations to get maximum use during the warranty period. These appliances may then move to other locations where they meet operational need.

Question 7: *Should aerial appliances be subject to a cascading model as is the case currently with Pumps? If so what should be considered in determining the drivers and criteria for cascading?*

Training

The current aerial training programme for aerial operators comprises:

- Completion of study paperwork
- Driver assessment
- Practical assessment (on station, on shift), 40hrs
- Consolidation phase
- Ongoing training

Aerial operators have a lot of skill and knowledge, a great deal of which has been learned from their peers. The aerial training materials have a strong focus on equipment operation i.e. the training materials for appliance types 4, 5 and 6 have lots of detail on vehicle and aerial apparatus operation (siting, levelling, boom operation, hazard avoidance, platform safety, use in high wind etc.).

There is a shortage of information on aerial theory and tactics in the training material i.e. the theory and operational procedures for optimal aerial use at incidents. The aerial theory and tactics communicated with new aerial operators vary depending on the aerial trainer knowledge and experience.

Suggestions to improve aerial training and awareness

The aerial strategy workshop participants identified the gold standard for aerial operator training as a nationally consistent programme, delivered by experienced "hands-on" Fire and Emergency instructors with solid aerial appliance operating experience. It includes the following features: stand-alone course, off-site location, black watch, site training on aerial appliances (each type) and on simulators.

Additional improvement suggestions raised by individual participants included:

- A 40-hour focused training course for aerial operators (3 people at a time with 'hands on' aerial trainer). This course could be run at the National Training Centre (NTC) –or ideally at regional training centres by NTC trainers. The benefits of the regional training include: consistent training, tailored for local environments and completed in a shorter time than present, where training takes up to six months.

  The aerial training course should include tactical training relating to all scenario's, where to use, rescue, feeding risers, water tower, locating aerial, external fire attack, combination attack with other firefighting tactics. Content on fire pathways, wind driven fire and building ventilation should also be considered for inclusion.

  Where practicable, a relief aerial of each type should be available for use by the National Training Centre staff and travel to the regional training centres for aerial training. Aerial crews could be trained in regional training centres on their own frontline aerial and supporting appliances, while the 'NTC' relief is used to 'backfill' the frontline aerial. The following week, the relief could remain in the area while scheduled maintenance on the frontline aerial would be performed. This would facilitate minimum disruption to local operations during training and maintenance.

- Aerial awareness training for officers, Communications Centre (ComCen) and Service Delivery staff to provide more consistent incident responses:
    - Officer training should include information on when and how best to use aerials to support tactical incident response; also, how to select and request the right aerial type for an incident. Post incident data recording (in SMS).
    - ComCen staff training to include aerial types and capabilities with prompt questions to help ComCen dispatch the right aerial capability, first time, every time.
    - Service Delivery training to include aerial use in tactical incident response, with a view to ensure consistency in approach across the country.
- Investigation of the use of training simulators to reduce wear and tear on frontline aerials

***Question 8**: Which suggestions of training improvements have merit and why?*

***Question 9**: What barriers/issues could arise from these suggested improvements?*

***Question 10**: Do you have additional considerations to improve training for aerial operators?*

Appendices

Appendix A: List of Aerial Appliances

Appendix B: Location Maps for Aerial Appliances

Appendix C: Aerial Appliance Policy

Appendix D: Schedules of Aerial and Relief Aerial allocations

Appendix E: Aerial Appliance Allocation and use, overseas

Appendix F: Environmental Scan

Appendix G: Analysis

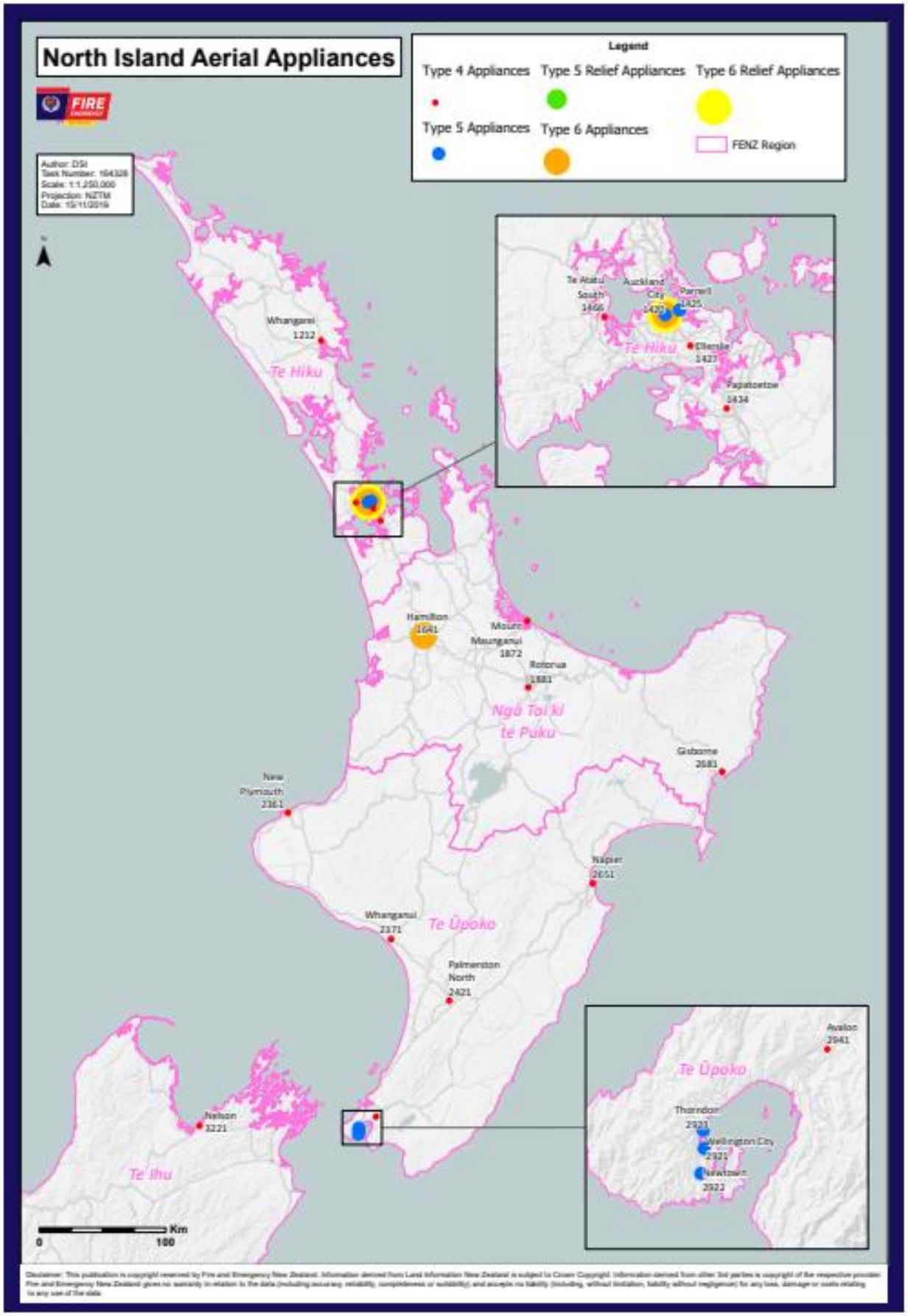
Appendix H: Aerial Fleet Capability – Working group Feedback

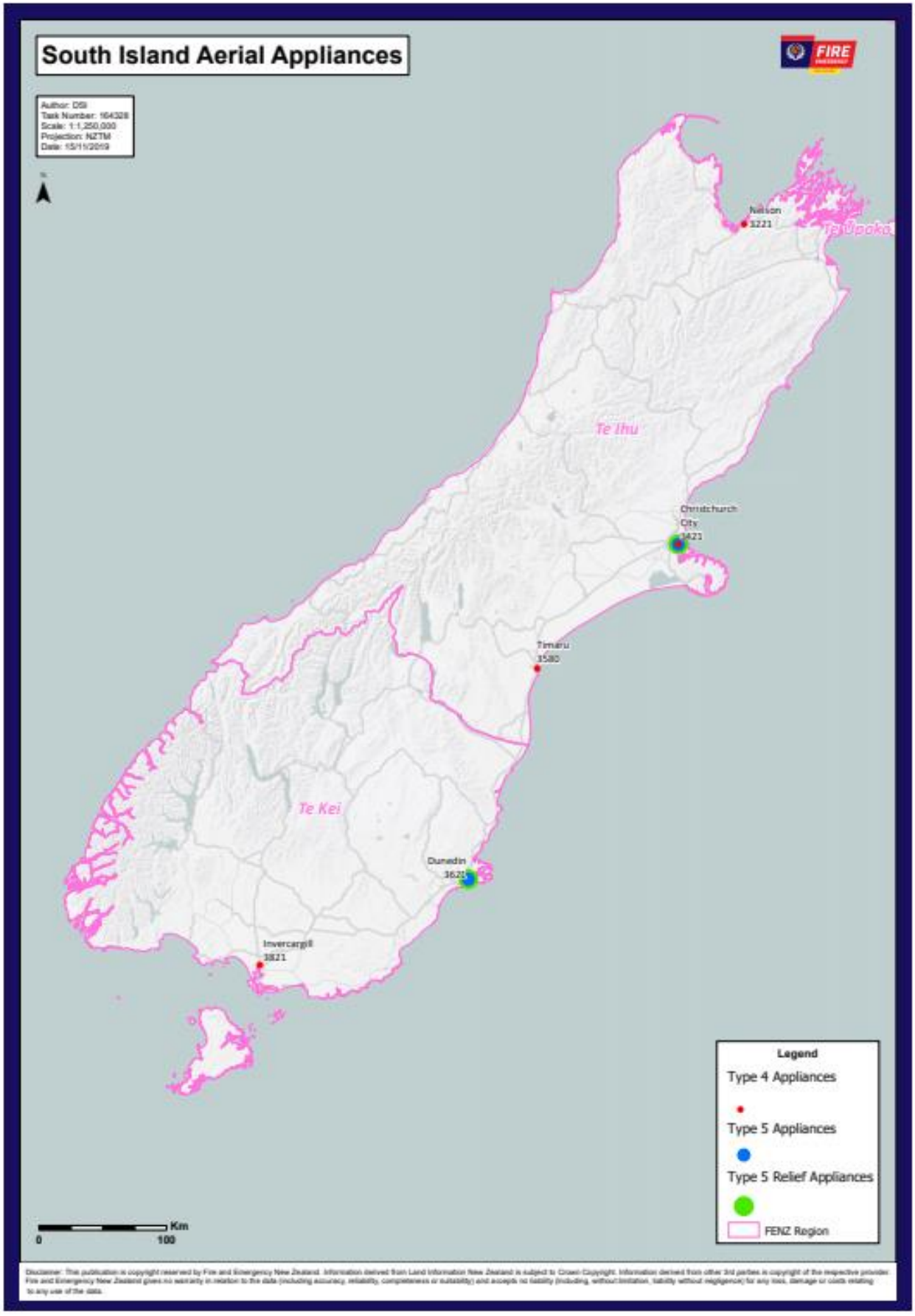
Appendix A: List of current Aerial Appliances

Unit Number	Type	Make & Model	Aerial Component	Date Into Service	Region	Area Description	FENZ - Location Description	Manuf' Date	Call Sign	Equipment Sub Class Description
GPH551	Type 6	Scania P400	Bronto F32RLX	25/03/2013	1RG	Area 4. Auckland City	CITY (AUCKLAND) FIRE STATION	1/01/2013	AUCK205	Aerial PTL - Pump Turntable
XE2122	Type 6	Spartan Monarch	Snorkel SCA200	20/06/1998	2RG	Area 6. Waikato	HAMILTON FIRE STATION	1/01/1998	HAMI415	Aerial PEP - Pump Elevating P/form
WQ8319	Type 5/6	Spartan Charger	Ladder Towers Inc (LTI) - QS104	15/12/1997	DNC	National Fleet	ASSET MANAGEMENT FLEET	1/01/1997	PARN256	Aerial PTL - Pump Turntable
EER891	Type 5	Mercedes Econic	Bronto F32RLH	23/11/2007	1RG	Area 4. Auckland City	PARNELL FIRE STATION	1/01/2007	PARN255	Aerial - Type 5
DDW796	Type 5	Mercedes Econic	Bronto F32RLH	17/03/2006	3RG	Area 16. Wellington	THORNDON FIRE STATION	1/01/2006	THOR235	Aerial - Type 5
FEY849	Type 5	Mercedes Econic	Bronto F32RLX	14/12/2009	3RG	Area 16. Wellington	NEWTOWN FIRE STATION	1/01/2009	NEWT225	Aerial - Type 5
DDW795	Type 5	Mercedes Econic	Bronto F32RLH	17/03/2006	4RG	Area 21. Christchurch Metro	CITY (CHRISTCHURCH) FIRE STATI	1/01/2006	CHRI216	Aerial - Type 5
XB5953	Type 5	Scania 124GB	Bronto F32MDT	30/11/1998	5RG	Area 24. East Otago	CITY (DUNEDIN) FIRE STATION	1/01/1998	DUNE216	Aerial PEP - Pump Elevating P/form
FWM97	Type 5	Scania P92	Bronto F28-2T1	13/03/2003	DNC	National Fleet	FENZ-DEPT OF OPERATIONS & TRG	1/01/1986	SOUT507	Aerial - Type 5
NT7871	Type 5	Mercedes Benz 1625	Metz 30 metre	7/01/1988	DNC	National Fleet	ASSET MANAGEMENT FLEET	1/01/1988	SOUT506	Aerial TTL - Turntable Ladder
CAY428	Specialist Foam Tender	Scania 124G	17m elevating monitor ('snozzle')	4/04/2002	3RG	Area 15. Hutt Wairarapa	SEAVIEW FIRE BRIGADE	1/01/2002	SEAV421	Special - Foam Tender
EES297	Type 4	Scania P420	Bronto F17CTL	6/12/2007	1RG	Area 4. Auckland City	ELLERSLIE FIRE STATION	1/01/2007	ELLE274	Type 4 Heavy Pump - Aerial
EHE617	Type 4	Scania P420	Bronto F17CTL	19/03/2008	1RG	Area 3. Waitemata	TE ATATU VOL FIRE BRIGADE	1/01/2008	TEAT664	Type 4 Heavy Pump - Aerial
FGY576	Type 4	Scania P420	Bronto F17CTL	18/05/2010	1RG	Area 5. Counties Manukau	PAPATOETOE FIRE STATION	1/01/2010	PAPA344	Type 4 Heavy Pump - Aerial
DMJ805	Type 4	Scania 124G	Bronto F17CTL	22/09/2006	1RG	Area 2. Whangarei Kaipara	WHANGAREI FIRE STATION	1/01/2006	WHAN124	Type 4 Heavy Pump - Aerial
CQN976	Type 4	Scania 124G	Bronto F17CTL	23/06/2005	2RG	Area 8. Bay of Plenty Coast	MOUNT MANGANUI FIRE STATION	1/01/2005	MOUN724	Type 4 Heavy Pump - Aerial
FIREYS	Type 4	Scania 124G	Bronto F17CTL	9/08/2006	2RG	Area 9. Central Lakes	ROTORUA FIRE STATION	1/01/2006	ROTO814	Type 4 Heavy Pump - Aerial
GIS814	Type 4	Scania P420	Bronto F17CTL	24/01/2008	2RG	Area 10. Tairawhiti	GISBORNE FIRE STATION	1/01/2008	GISB814	Type 4 Heavy Pump - Aerial
CTS964	Type 4	Scania 124G	Bronto F17CTL	18/08/2005	3RG	Area 13. Whanganui	WHANGANUI FIRE STATION	1/01/2005	WANG714	Type 4 Heavy Pump - Aerial
DFP510	Type 4	Scania 124G	Bronto F17CTL	21/04/2006	3RG	Area 11. Hawkes Bay	NAPIER FIRE STATION	1/01/2006	NAPI514	Type 4 Heavy Pump - Aerial
CLR280	Type 4	Scania 124G	Bronto F17CTL	16/03/2005	3RG	Area 12. Taranaki	NEW PLYMOUTH FIRE STATION	1/01/2005	NEWP614	Type 4 Heavy Pump - Aerial
EDH767	Type 4	Scania P420	Bronto F17CTL	6/11/2007	3RG	Area 14. Manawatu	PALMERSTON NORTH FIRE STATION	1/01/2007	PALM214	Type 4 Heavy Pump - Aerial
CJA343	Type 4	Scania 124G	Bronto F17CTL	13/11/2004	3RG	Area 15. Hutt Wairarapa	AVALON FIRE BRIGADE	1/01/2004	AVAL414	Type 4 Heavy Pump - Aerial
EHE595	Type 4	Scania P420	Bronto F17CTL	4/03/2008	4RG	Area 17. Tasman Marlborough	NELSON FIRE STATION	1/01/2008	NELS214	Type 4 Heavy Pump - Aerial
DCA505	Type 4	Scania 124G	Bronto F17CTL	20/12/2005	4RG	Area 21. Christchurch Metro	CITY (CHRISTCHURCH) FIRE STATI	1/01/2005	CHRI214	Type 4 Heavy Pump - Aerial
DJD131	Type 4	Scania 124G	Bronto F17CTL	21/04/2006	4RG	Area 22. South Canterbury	TIMARU FIRE STATION	1/01/2006	TIMA804	Type 4 Heavy Pump - Aerial
FGY533	Type 4	Scania P420	Bronto F17CTL	27/04/2010	5RG	Area 25. Southland	INVERCARGILL FIRE STATION	1/01/2010	INVE214	Type 4 Heavy Pump - Aerial
BSY908	Type 4	Scania 124G	Bronto F17CTL	14/02/2004	DNC	National Fleet	FENZ-DEPT OF OPERATIONS & TRG	1/01/2004	AREA2104	Type 4 Heavy Pump - Aerial
CPP612	Type 4	Scania 124G	Bronto F17CTL	10/05/2005	DNC	National Fleet	ASSET MANAGEMENT FLEET	1/01/2005	NTCR1554	Type 4 Heavy Pump - Aerial

Table List of Aerial Appliances (as at 01 August 2019)

Appendix B: Location Maps for Aerial Appliances




South Island Aerial Appliances
FIRE
Author: DSI
Task Number: 164328
Scale: 1:1,250,000
Projection: NZTM
Date: 15/11/2019
Nelson
3221
Te Upoko
Te Ihu
Christchurch
City
3421
Timaru
3580
Te Kei
Dunedin
3620
Invercargill
3821
Legend
Type 4 Appliances
Type 5 Appliances
Type 5 Relief Appliances
FENZ Region
Km
0
100

Appendix C: Current Aerial Appliance Policy

NEW ZEALAND FIRE SERVICE Whakaratonga Iwi

POLICY

Aerial appliances
FL4 POP

Aerial appliance policy

This policy describes the requirements for NZFS aerial appliances.

This policy must be read alongside the *Guidelines for Operational Policies and Procedures*.

What to do

NZFS aerial appliances will meet the requirements of this policy.

Types of aerial appliances

NZFS aerial appliances will have the following designations and attributes:

Attributes	Type 4	Type 5	Type 6
Crew	4	2	4
Aerial reach	17m	32m	32m
Can respond as pump (fitted with pump, water tank and hose reel)	yes	no	yes
Rescue ladder	yes	yes	yes
Platform	no	yes	yes

Allocation

NZFS aerial appliances will be allocated as described in:

- *FL3-1 Aerial appliance allocation schedule*.

Relief for aerials- less than two weeks

When an aerial is expected to be out of commission for less than two weeks, Region/Area management will determine whether it is best to replace the aerial with:

- a pump appliance
- a relief aerial (considering proximity, training issues etc)
- an aerial moved from a nearby location of lesser risk (guided by the priority ratings in:
  - *FL3b Relief aerial appliance schedule*).

Relief for aerials- more than two weeks

When an aerial is expected to be out of commission for more than two weeks, Region/Area management replace the aerial with:

- a relief aerial, if available, otherwise:
- an aerial moved from a nearby location of lesser risk (guided by the priority ratings in:
  - *FL3b Relief aerial appliance schedule*).

Key Personnel and Roles

Region/Area management

Region/Area management have responsibility for:

- deciding on relief for aerial appliance vehicles following the requirements of this policy.

Reference documents

The following documents provide information relevant to this policy:

- *FL3a Aerial appliance allocation schedule*
- *FL3b Aerial appliance relief schedule*.

Record of amendments

Date	Brief description of amendment
Dec 2011	Changed code from FL3 POP to FL4 POP.

Appendix D: Schedules of Aerial and Relief Aerial Allocations

FL4 SCa Schedule of aerial appliance allocations

There are 27 NZFS aerial appliances nationally, consistin

- 18 Type 4, including 2 reliefs
- 8 Type 5, including 2 reliefs
- 1 Type 6.

These appliances are allocated to the following locations:

No	Type	Location
1	4	Whangarei
2	4	Avondale
3	4	Ellerslie
4	4	Papatoetoe
5	4	Mt Maunganui
6	4	Rotorua
7	4	Gisborne
8	4	Napier
9	4	New Plymouth
10	4	Wanganui
11	4	Palmerston Nth
12	4	Avalon
13	4	Nelson
14	4	Christchurch
15	4	Timaru
16	4	Invercargill
17	4	Spare (based Rotorua)
18	4	Spare (based Christchurch)
19	5	Parnell
20	5	Hamilton
21	5	Thorndon
22	5	Wellington City
23	5	Christchurch
24	5	Dunedin
25	5	Spare (based Dunedin)
26	5/6	Spare (based Auckland)
27	6	Auckland City

Note: the current Queenstown aerial appliance (combination pump and elevating monitor) will remain in service until the end of its economic life, but is not part of the aerial establishment.

FL4 SCb Schedule of relief aerial appliance allocations

The relief aerial appliances are allocated to the following locations (one of each type in both the North and South Island):

No	Type	Location
17	4	Spare (based Rotorua)
18	4	Spare (based Christchurch)
25	5	Spare (based Dunedin)
26	5/6	Spare (based Auckland)

All relief aerial appliances may be deployed in any of the aerial appliance locations throughout New Zealand.

The priorities of aerial appliance locations when there is a reduced aerial pool are:

Type 4	
Priority order	Location
1	Tauranga
2	New Plymouth
3	Papatoetoe (Auckland's 1st)
4	Palmerston Nth
5	Napier
6	Invercargill
7	Avalon
8	Rotorua
9	Christchurch
10	Whangarei
11	Nelson
12	Gisborne
13	Wanganui
14	Timaru
15	Avondale (Auckland's 2nd)
16	Ellerslie (Auckland's 3rd)
17	*Queenstown (elevating monitor)*
18	Relief No 1
19	Relief No 2

Type 5 or 6	
Priority order	Location
1	Auckland City (Auckland's 1st)
2	Wellington City (Wellington's 1st)
3	Christchurch
4	Dunedin
5	Hamilton
6	Parnell (Auckland's 2nd)
7	Thorndon (Wellington's 2nd)
8	Relief No 1
9	Relief No 2

Appendix E: Aerial appliance allocation and use, overseas

The following table summarises information on the aerial fleets of Fire and Rescue New South Wales (FRNSW) and London Fire Brigade (LFB)

Topic	London Fire Brigade (LFB)	Fire & Rescue New South Wales (FRNSW)	Other/ Miscellaneous
Aerial use	Aerial appliances are a strategic part of the LFB firefighting capability. Their day to day work involves covering premises which are out of the reach of conventional ladders, allowing access, providing rescue, applying large amounts of water, providing lighting or observing. Their main purpose is not to cover high rise structure fires. The vast amount of aerial appliance work isn't at full extension or full height. It's reaching inaccessible windows, reaching over house roofs, industrial buildings or such like. There is a misconception of their modus operandi as their main purpose is not to cover high rise structure fires. If it was then building regulations would allow for this and ensure there was access for high reach vehicles. [LFB consider high rise buildings to be 18m and above]	FRNSW aerials are primarily used for delivering bulk water at large fires in commercial buildings such as shopping centres, industrial complexes and multi-storey residential buildings. They are also used to undertake rescues and conduct other non-fire operations such as evacuations, as needed. Aerials with an extended reach are best suited for operations involving podium developments (multi-level basement carpark, commercial occupancies at ground level with multiple residential towers of varying heights on the upper levels). These developments are usually large and have various parts to the building that may only be accessible from one location.	The LFB analysis of their historic "got to work" data for aerials indicated that 22% of aerials attending incidents got to work. This work was made up of: Use as an Observation tower (12% of occasions), Use as a water tower (4%), Use to provide access (6%) and Use for rescues (1%). The data is indicative only as there will be issues with data consistency arising from different analysis approaches.
Aerial Fleet/ recent purchases	LFB has a fleet of 15 aerials: 11 frontlines and 4 reserve appliances. All aerials have 2 person crews. The reserves were used to cover frontline aerials when they were removed from service due to maintenance, breakdowns and/or other brigade requirements. Approval to replace all fifteen aerial appliances with a single type was provided in 2016 to simplify the operation, operator skills requirements and maintenance for this fleet of	The FRNSW aerial fleet is currently being updated with new purchases of 4 x Bronto ALP's (45m) and 7 heavy pump aerials (24m) to bring the aerial fleet number to 25 aerials. Both heavy aerials and heavy pump aerials have greater height capability than the previous aerials. Prior to the new fleet additions FRNSW had 22 aerials: 10 heavy aerials made up of ALP's and TL's and 12 x 15m heavy pump aerials allocated	Queensland Fire and Emergency Service (QFES) recently purchased 10 new aerials: 3 x 45m Bronto ALPs and 7 x 32m Rosenbauer Combined Aerial Pump Appliances (CAPA) with rescue basket. The CAPA appliances replace the older 16m Telescopic Aerial (TAP) appliances.

	appliances. Subsequent approval was given in July 2017 for three of the fifteen aerials to be extended range aerials. Magirus/Emergency One won the tender The new aerial fleet will be made up of 3 x 64m extended range turntable ladders and 12 x 32m standard range turntable ladders. Each 32m aerial will have an articulated section of ladder and specialist detachable items for bariatric rescue, multi-person working at height safety restraint and firefighting hose aloft attachment. The previous aerial fleet had a combination of Turntable Ladders (TL's) and Aerial Ladder Platforms (ALP's). The TL's smaller size, lighter weight, height and lateral reach, speed to set up and work and the increased versatility provided by the articulated fly-boom and platform on the new TL's was preferred to ALP's, which were on average 1/3rd heavier than their equivalent TL counterparts.	as operational response units. Their heavy aerials had the following height capability: 1x 44m, 4 x 37m, 1 x 30m, 4 x 27m and 2 person crews.	South Australia (SAMFS) have also been replacing their TAP's with CAPA appliances. Canberra (ACTFR) recently purchased 1 x 44m Rosenbauer ALP and 1 x 25m heavy pump aerial with rescue basket Melbourne FB have 4 x44m Bronto ALP's (two-man crew, no on-board pump) 5 x 17m Heavy pump aerials: Pump aerials (hydraulic ladder); The number of heavy pump aerials is being increased to 10 (2 per district v's current 1); existing appliances being phased out and replaced with pump aerials with a longer reach of 27-30m (will all have dual rear axles). Influenced by building code which allows buildings of 24.9m not to have sprinklers. Flammable cladding on these buildings is also a consideration. Tasmania Fire Service (TFS): Following a tender process throughout late 2018 – early 2019, Rosenbauer was identified as the preferred supplier to
Aerial selection criteria	As the LFB aerial fleet reached the end of their serviceable life and needed to be replaced, a review and comparative trials determined that LFB would be best served by a fleet of turntable ladders. Aerial selection criteria included: manoeuvrability, ability to access properties and undertake a range of rescue and firefighting functions. Key operational requirements for aerials included: • Proven reliability and durability; • A consolidated skills set for all aerial operators and aerial appliances; • Quick and agile system of aerial operation; • Compact design so that appliances that will fit in the Brigade's fire station appliances bays and are able to negotiate	FRNSW place high importance on consistency within the aerial fleet. The benefits they see in having fewer types of aerials include reduced staff training and efficiencies for servicing In addition to rescue & firefighting roles, aerial capability needs to be flexible and versatile to meet a range of needs. They like the TL's capability in tight inner-city areas and its' ability to operate on sloping ground	

	the narrow and congested roads of London; and • Head of the ladder and cage stability when extended. "LFB deemed 32m aerials pre-and post-Grenfell, as the most suitable for everyday use with their balance of height v's reach. Together with super extended height (64m) aerials, the 32m aerials provide the best balance for London's building stock, its' fire stations and its' roads, as they are light, nimble and compact in their packaging". (Source Mike Cotton, Station Manager, LFB)		deliver a new aerial fleet (three new units by August 2020). [In 2019 Rosenbauer sold 14 aerial devices to Australia: Queensland Fire and Emergency Services, Tasmania Fire Service and Australian Capital Territory]. Many European brigades mainly use 30m Turntable ladders, some with cages, some without. Some brigades also have ladder platforms by Bronto.
Operational policy and procedures	All aerials use pump appliances to supply water for their aerial monitors. To do this, pressure at base needs to be as high as 1200KPa (12 bar) for water monitor output of up to 2400 litres/minute Aerial appliances are not normally used for external firefighting in high rise residential buildings until it has been confirmed that there is no longer any life risk in the building. This is because of (i) the danger of jets entering building & injuring occupants or firefighters & (ii) whether a jet or covering spray is used, there is a danger of preventing hot gases & other combustion products from venting from the building and making the conditions inside the building even more difficult for occupants and firefighters, and (iii) the danger of pushing fire further into the building. (source: Ron Dobson statement, Lacknall House Enquiry, 2013)	Heavy aerials use pump appliances to supply water for their aerial monitors. Heavy pump aerials are frequently used as first response appliances, with a number run out of single truck stations. When they arrive first at an incident they assume a pump or an aerial role, depending on what the OIC is confronted with. The heavy pump aerial response to non-fire incidents has been increasing since 2012 due mainly to an increased number of storm events. When responded as an aerial to structure fires, Heavy Pump aerials are mostly used in "defensive" mode.	
Risk Assessment	LFB complete their risk assessment and publish the London Safety Plan (their IRMP) to set out how they intend to use their resources with regard to the three aims of Prevention and Protection, Response and Resilience and People and Resources.	FRNSW assess risks in their environment by considering a combination of population, building types (commercial & industrial area's and higher density residential areas with 3+ storeys), improvements to fire safety, the risks posed by	All fire and rescue services in England are required to develop and maintain a current Integrated Risk Management Plan (IRMP) which identifies and assesses all

	LFB assess local risks and make their assessment information publicly accessible through their 'assessment of risk tool'.	sub-standard elements of the building stock and relevant incident data. For future coverage, they assessed environments where aerials are most likely to be used as: • Industrial, commercial & high density residential area's • Locations where building controls allow heights greater than 10 metres, • Centres identified as 'major' or 'strategic' centres for future growth • Historic data on the location of multiple alarm incidents	foreseeable fire and rescue related risks and sets out how they plan to allocate resources (including aerials) across prevention, protection and emergency response to mitigate these risks.
Training / Qualifications	The simplification of operation, operator skills requirements and maintenance were important factors in LFB's decision to purchase a single (major) aerial type.	The FRNSW aerial strategy (2017) describes how: • Variations within the aerial capability raised problems with qualifications management • Most staff were only trained to operate one type of aerial and could not be used to operate other aerials without additional training. • The logistical arrangements for conducting training often competed with operational demands for access to aerials.	QFES are using a dedicated Aerial Coordinator to deliver comprehensive training for their new aerials, with personnel then returning to their respective regions to pass on their knowledge (train the trainer).
Incident response	In June 2017, an interim change was made to PDA's to include the attendance of an aerial on all high-rise PDA's. Prior to 2017, "aerial appliances were not automatically part of the Pre-Determined Attendance (PDA) for high rise premises. Aerial appliances were allocated to PDA's for high rise premises and locations at the discretion of the borough commander in conjunction with each station manager". (source Ron Dobson statement Lacknall House Enquiry 2013).	In 2017, heavy aerials were responded to 3rd alarms and above [Alarm Response Protocol (ARP)] for structure fires and on demand. At 3rd alarm, there is an automatic aerial response as well as a higher likelihood of the aerial being put to work for their designed purpose. In addition, aerials were responded to 2nd alarm automatic fire alarms (AFA's) at certain high-risk locations.	

	If LFB receive four or more calls about a fire in a high-rise building, they automatically send out eight pumps and an aerial as per the PDA". [LFB website]	FRNSW have since decided to provide for an aerial on the ARP of certain high-risk premises	
Aerial response time/ Attendance standard	There is no LFB attendance standard set for aerials. Aerial appliances are mobilised as either the closest available aerial ((32m & 64m) or on request as an extended height aerial (64m only). A 2018 resource modelling study using data from previous incidents, modelled the average response time by 32m aerials at 8 to 10 minutes and the average response time for 64m aerials at 18 to 20 minutes. LFB has attendance targets for pumps: 1st fire engine to an incident within 6mins, 2nd fire engine to incident within 8mins and to get a fire engine to anywhere in London within 12mins on 95% of occasions	A target aerial response time of 15mins was used to develop the FRNSW aerial resource allocation model. Analysis of incident data in the 2017 strategy indicated that the 15-minute response time was generally being met. However, the aerial category includes heavy aerials and heavy pump aerials. Heavy aerials may have a longer response time of 20-25minutes as they cover a larger area and are not normally a first responding appliance.	
Aerial fleet allocation/ aerial siting	Aerial locations selected based on resource modelling, station bay availability, space for size and weight and professional judgement. The modelling scenarios help map out how the brigade will respond to known risks & the likely demands on its services	FRNSW aerials (major and heavy pump aerials) are located across large city and regional areas. Historically the inner city of Sydney had the highest concentration of multi-level buildings and the distribution of heavy aerials reflected this with most based around the Sydney CBD. As Sydney has grown and new industrial/commercial areas developed, aerial siting has been reviewed and some aerials have been re-sited. FRNSW decided to maintain TL's in inner city of Sydney – to provide aerial capability suited to dealing with narrow streets and hilly terrain.	
Vehicle service life	15 years target lifecycle	FRNSW has a target 20-year lifecycle for its aerials. The main driver for this is the re-certification of the aerial components that are required every 10	Overseas brigades tend to have target lifetimes of 15 to 20 years for aerials

		years. Recertification involves aerials being out of service for at least 2 months and can cost around AU$200k. Due to this the optimal time to replace an aerial is just prior to the second recertification being required.	
Other trends/ changes that impact aerials	Water is a critical resource for LFB and demand is expected to outstrip supply by 133 million litres/day by 2020, in a dry year. LFB is conscious of using water efficiently at critical times, without compromising public safety	• Increase in non-fire incidents. • Incident data from the five years to 2017 shows a decrease in the overall work rate for FRNSW, despite the significant growth in the built environment during that time. Improved fire safety from building code requirements is likely to have influenced this decline.	
Changes following Grenfell disaster		The Australia building authority requires 3-8 storey un-sprinklered buildings to retrofit sprinkler systems.	The UK building regulator is considering a similar requirement MBIE, NZ are not currently considering a similar requirement

Summary from Tasmania Fire Service Aerial Platform and Rescue Firefighting Strategy 2019 -2029.

The Tasmanian Fire Service had a working group that liaised closely with other Fire Services in Australia and New Zealand. They noted that Bronto Skylift aerial ladder platforms were very popular with Australia fire services from the mid 2000's due to design and operation, current market, servicing and support provisions. DFES, Western Australia, for example purchased four Bronto Skylift F32RLX aerials between 2008-2010.

They also noted that since 2014/15 there has been a significant move for Australian fire agencies to examine wider applications for multi-purpose appliances with the capability to combine urban pumper role and aerial capability. Drivers included the consolidation of fleet capability and application of a "fit for purpose" rationale with identified potential cost savings for ongoing operational fleet requirements. Several fire agencies (SAMFS, MFB, NT and CFA and more recently ACT and QFRS) have applied this concept by moving to an 'all-rounder' type of appliance for identified locations with smaller urban response areas containing variable risks. This was appealing to the Tasmanian Fire Service (TFS) as they could see the potential in combining their aerial and heavy pump replacement programmes to provide greater flexibility and capacity within their limited fleet.

While there are a now a number of these combination appliances or multi-response unit appliances in service, some agencies still maintain dedicated aerials for specific risks. There has also been a trend away from the conventional aerial platform to turntable ladders as these offer variations to capability and application, particularly for rescue. This direction in South Australia has seen a significant increase in rescue response for this type of appliance. There has been a recent expansion of big suppliers including Varley, Gimax and Rosenbauer into the market offering these turntable ladder options in direct competition with Bronto.

TFS signed a contract with Rosenbauer in 2019 to replace their three aging Simon Snorkel appliances with a 32m aerial ladder platform for Hobart, a 32m turntable ladder for Launceston and a combination heavy pump aerial appliance. Both heavy aerials were to be fitted with a pumpset so they could operate independently for fire suppression activities.

The combination of heavy aerial types was chosen because of the individual appliance capabilities and their ability to work well together when tackling significant fires.

Their rationale for selecting 32m working height and subsequent outreach was that this would will provide the TFS with the greatest capacity to address the risks identified through their risk profiling process, significantly expand the aerial working area when compared to their aging Simon Snorkel aerials and maintain flexibility and manoeuvrability for a wide-ranging scope of purposes. The independent pumping capacity would allow resources to be distributed with greater tactical capacity to address rescue, exposure protection, containment and extinguishment for major incidents.

When evaluating the possibility of having a greater height capability, they noted that increasing the working height even marginally will come with limitations due to the size of the cab chassis required to house the aerial component. This would inevitably impact their ability to traverse more confined and/or restrictive areas and thereby reduce their capability to operate in the broader urban environment, only addressing the upper 10 percentile of identified risks. The height and length of the larger appliances would also pose issues for stationing the appliances.

TFS applied a holistic approach to their aerial strategy with a balance of prevention, preparedness and response to provide an "effective and responsible fiscal delivery of service".

Appendix F: Environmental Scan

Changes to the Usually Resident NZ Population between 2006 and 2018

Regional Council Area	2006 Population	2013 Population	2018 Population	Percent increase 2006-2018
Northland Region	148,470	151,689	179,076	20.6%
Auckland Region	1,304,958	1,415,550	1,571,718	20.9%
Waikato Region	380,823	403,641	458,202	20.3%
Bay of Plenty Region	257,379	267,741	308,499	19.9%
Gisborne Region	44,499	43,653	47,517	6.8%
Hawke's Bay Region	147,783	151,179	166,368	12.6%
Taranaki Region	104,127	109,608	117,561	12.9%
Manawatu-Wanganui Region	222,423	222,672	238,797	7.4%
Wellington Region	448,959	471,315	506,814	12.9%
Tasman Region	44,625	47,157	52,389	17.4%
Nelson Region	42,888	46,437	50,880	18.6%
Marlborough Region	42,558	43,416	47,340	11.2%
West Coast Region	31,326	32,148	31,575	0.8%
Canterbury Region	521,832	539,433	599,694	14.9%
Otago Region	193,803	202,470	225,186	16.2%
Southland Region	90,876	93,342	97,467	7.3%
Total, regional council areas	**4,027,329**	**4,241,448**	**4,699,089**	**16.7%**

Source: Statistics NZ, Usually Resident Population, census 2018

New Zealand Population Notes:

- In 2003, the year the previous aerial strategy was deployed, the usually resident NZ population reached 4,000,000 people.
- In 2020, the usually resident NZ population is forecast to exceed 5,000,000 people.
- In 2030, the usually resident NZ population is forecast to be:
    - NZ Population 5,500,000 + people
    - Auckland Population: 2,000,000+ people
    - The NZ population is forecast to have:
        - A median age of 40 years

- 1,100,000 (20%) aged over 65 years.
- 137,000 (2.5%) aged over 85 years.

(Source: 2013 census base)

Population

The population of New Zealand has grown by 25% from 4.0 million to nearly 5.0 million, since 2003, when the previous aerial strategy was actioned.

Auckland, Tauranga and Hamilton have experienced high urban growth and a boom in residential and commercial/industrial development, since 2015. Growth is set to continue for the next five to ten years following the Government's recent announcements of priority urban growth corridors between Hamilton and Auckland and between Auckland and Northland.

The New Zealand population is forecast to increase to approximately 5.6 million people by 2030 and to have the following characteristics - that 2.2 million people will live in the greater Auckland area, the average age of New Zealanders will be 40 years, 1.1 million people will be over 65 years old and 140,000 people will be over 85 years old.

The bigger and changing population will drive demand for new residential, commercial and industrial developments to accommodate and provide services for new customers.

Trends

- In cities, there are more people and more buildings closer together but there is not a matching increase in significant fires. Aerial access to building developments is an issue.
- Old industrial sites in central city locations are becoming residential.
- Reach is as important as height for aerial response.
- Aerial appliances are adopting a more general or broader spectrum role.
- Increasing demand for aerials in the suburbs - industrial and commercial operations areas have moved out of the city to suburban/industrial zones where land is cheaper and there is better access to transport networks.
- Increasing demand for aerial support from police and other agencies.
- Firefighters must contend with smoke toxicity and water removal issues from incident sites.

Incident types

The increasing trend in responses to non-fire incidents is forecast to continue and it is expected that medical events and climate change related incidents will likely account for much of this increase.

Medical events include medical and mental health issues. Response to medical issues will be more complex as medical first responders require assistance with the movement of oversize/ bariatric patients into ambulances for transport to hospital.

Mental health issues in the community include dementia in the elderly and stress/anxiety/self-harm in our younger population. Requests for (aerial capability) assistance with patient/person retrieval, from partner agencies are expected to continue.

Storms are expected to be bigger and more frequent as climate change unfolds. To date, aerials have been called upon to make-safe building cladding, signs and other materials at a height that have become loose and present a danger to public safety. This is likely to continue in the future and there is the possibility that the aerial capability to operate at a height and below ground level may also be used to rescue people impacted by storms.

Built Environment

The NZ built environment has a mix of building types with a varied risk profile. Current risks include:

- Legacy high rises (some up to 15 floors with one stairwell), with no sprinkler system
- Buildings with sprinkler system partially or fully shut down or not working
- Large footprint commercial buildings, with no sprinkler system
- Earthquake fixes and fire protection fixes - affordability for building owners
- Building conversions e.g. change of use from commercial to residential
- Leaky Buildings (with fire protection impacted)
- Medium Density, Infill Housing developments (some difficult to access by pumps and aerials)

Additional information on building types is provided in the following tables:

Residential Buildings

Risks to be managed include fire, storm and water damage.

Current State	How this is changing	Implications for aerials
Legacy low rise city buildings In older city neighbourhoods, timber houses of one, two or three storeys are built in close proximity. Houses can be a mix of terraced, semi-detached or detached houses and may have a piped gas connection. Houses have different fire risk characteristics e.g. some century old houses have uninterrupted ventilation paths between the underfloor and the roof cavity that can speed the spread of fire.	The fire risk continues but has been reduced by the use of smoke alarms, a reduction in number of smokers and changes to space heating.	Aerials used to protect exposures of neighbouring buildings from structural fires
Newer suburban houses Houses in newer suburbs (from the 1940s onwards) typically have one or two storeys with a 4+ metre gap between houses and good road access.	Big increase in semi-detached, terraced and medium density housing developments to meet demand.	
Medium Density Housing New Medium Density Housing (MDH) developments typically have four storeys with multiple residential units. A single stairwell per building is common. Timber framing is frequently used in construction and there is no building code requirement to fit sprinklers. Medium density housing developments have a variety of configurations. Some are well laid out with good vehicular access, others have limited vehicular access and buildings in close proximity which can constrain fire appliance attendance.	Change from typical housing -> limited road infrastructure in new developments presents accessibility challenges for emergency services	A fire at or near the bottom of an MDH stairwell may stop residents on upper floors evacuating, leading to a need to assist rescue/ evacuation. Need for more capable and flexible appliances.

Residential Buildings continued

Current State	How this is changing	Implications for aerials
Access Access roads to houses vary according to the city landscape. Some of Wellington and Auckland's older streets are narrow or built on an incline. In some older Wellington and Dunedin central suburbs, wooden houses are built on hillsides, surrounded by trees and bush with pedestrian access only via multiple steps. Some medium density complexes (e.g. Browns Bay development) are enclosed, with access through an archway.	Some infill housing developments have difficult or no access for fire appliances, e.g. in the Browns Bay, Auckland development, there is no suitable access so a ground hose with a 75m+ hose length is required to fight fires.	Aerials can be used to quickly reach buildings on small hillsides with footpath access from the road. Unlikely that aerials can access complexes if pump appliances cannot
High Rise buildings High rise residential buildings are mainly located in the bigger cities. Buildings include purpose built multi-story apartment buildings and re-purposed or converted industrial buildings in city centres.		
Legacy high rise buildings (Pre 1991) There are some "legacy" buildings of up to 15 storeys, built to the 1988 building code which allowed buildings 45.7m tall to be non-sprinklered and to have a single means of escape. While most of these buildings are used for offices, some contain apartments.		Aerial capability can enable tactical solutions with big water, rescue and/or transport of firefighters and equipment
High rise buildings (Post 1991) Under the 1991 revised building code (current code), sprinklers are required for buildings over 25m. Most buildings have two stairwells fitted with fire doors to enable the building occupants to exit safely in the event of fire. Recent attempts were made, under acceptable solutions to the building code to create buildings with two stairwells up to a certain level and then to have a single stairwell for a few top floors above this level. Current determinations rejected the initial attempts.	The Auckland Unitary plan allows 45 suburbs with high rises to 75m. Taller high rises, to greater heights are considered in the Auckland CBD.	Many modern high rises are airtight. It's harder to get into the buildings from outside and this alters the fire dynamics.
Aged Care developments A significant number of new aged care residential developments are being built to meet the needs of New Zealand's ageing population. Depending on the location, these developments may include low rise multi storey, terraced or semi-detached buildings in close proximity.	Increase in number of developments as population ages	Aerials may be called on to assist with patient/ person retrieval following a medical incident

Residential Buildings continued

Current State	How this is changing	Impact for aerials
Combustible cladding An audit of Auckland buildings following the fire disaster at Grenfell towers, London identified 167 multi-storey buildings with potential cladding issues. In Wellington, 88 buildings were identified with potential Aluminium Composite Panel (ACP) type cladding by Wellington City Council, 18 of these buildings are in the high risk category.	Auckland: Twelve high risk category buildings (flammable cladding, no sprinkler, single stairwell) were identified and these are being remediated.	Aerial capability may be required for fire suppression or exposure protection

Commercial/Industrial

Current State	How this is changing	Impact for aerials
In the past few years, there has been significant growth in new commercial/industrial buildings in: • Tauranga: substantial development of new large warehouses on one side of the city and on the other side there has been significant development of new large fruit and vegetable pack houses and new cool stores. • Hamilton: Lots of new large warehouses (10-15,000m2) have been built in the Hamilton area for logistics operations servicing New Zealand's two largest ports in Tauranga and Auckland. • East Tamaki, Auckland has seen an increase in the number of new manufacturing and warehousing premises and Albany has also seen significant growth in industrial units. • Palmerston North has seen a growth in large warehousing projects as it becomes an inland hub for storage and transport. • Christchurch: lots of new warehouses have been built. • Napier: lots of new warehouses have been built to service Napier port.	More, large footprint buildings are being built for logistics, warehousing, commercial and industrial use.	Aerials need sufficient height, lateral reach and water tower capability to put water on top of a building fire and/or to protect nearby building exposures

Commercial/Industrial continued

Current State	How this is changing	Impact for aerials
Construction Commercial/Industrial – several large footprint buildings are being completed in stages, each less than 5,000m² to create what is effectively a large building with individual 'cells' e.g. Synlait in Canterbury and several large footprint buildings in upper North Island, some up to 80,000m². Commercial buildings 5,000m² and above are required to fit sprinklers. By staging, they get around the clause requiring sprinkler installation.		Aerials need sufficient height, lateral reach and water tower capability to put water on top of building fires and/or to protect nearby building exposures
Miscellaneous New buildings – some require faith in new technology building solutions. Some commercial/industrial buildings are using cross laminated timber (CLT) for large structural elements (beams and uprights). CLT is treated with fire retardant chemicals during manufacture. It is unknown how these large beams will age over the expected 50 year building life i.e. there is an unknown level of risk around the possibility the laminate glue may break down over time in hot, humid climates, compromising the structural elements and their fire retardant treatment.	New building construction: CLT is being used for medium density construction (up to four storeys). New technology and designs enable use of CLT timber construction up to 18 storeys.	
Water Supply Auckland has combined its' dual water supply into a single supply. Previously, water was supplied from two different sources, Waitākere and Hūnua storage dams, which each fed a main on either side of the street. With a single water supply, when the water is cut off, sprinklers will be cut off too. Water Pressure – in some locations, street water pressure is dropping and will be inadequate to supply sufficient water for sprinkler systems. Nationally, water supply authorities are reducing the pressure of water supplies to increase the life of the pipes in the system and prevent leaks. New high rise buildings are required to have dual water supplies. This will be via the town mains and on-site water storage tanks to supply their sprinkler systems. These may be on the roof (gravity) or preferably in the basement (pump fed).	Where 25m sprinklered accommodation buildings (people sleeping) are connected to a single public water supply, a risk plan is required to mitigate fire risk before water can be shut off for planned maintenance. There will be an amendment to the new sprinkler standard to allow for combined hydrant riser/ sprinkler systems like the one installed in Melbourne. Dockland fire. This will provide more water & pressure for sprinkler systems.	Potential Water supply constraints

Commercial/Industrial continued

Current State	How this is changing	Impact for aerials
Quality Assurance Sign-Off of Building Fire Protection systems There is a current shortage of Independent Qualified Practitioners (IQP's) to sign off fire compliance for new/renovated builds. Little consistency as there is no formal training. Confidence in current IQP sign-offs is low.	A Training scheme and new qualifications for IQP's are being introduced by the Ministry of Business and Innovation (MBIE) from Feb 2020.	
Building alarm systems It is not uncommon for building alarm panels to have isolated alarms for sections (zones) of the building. Modern alarm systems have ability to transmit building alarm data from the fire alarm panel to Fire and Emergency, providing detail on the type and location of triggered alarms. Fire and Emergency do not currently have the IT capacity within their ICAD system to receive and interpret this data.		Potential for building alarm information to be communicated to aerial crew enroute to incidents via 'mobility device'
Solar PV panels An increasing number of houses are fitting roof mounted solar PV panels to generate electricity for domestic use. The solar panels feed their DC power output to a battery bank or DC/AC inverter which provides power to the house/electricity network. The solar panels cannot be turned off and must be covered to stop generating in daytime. In the event of a daytime fire in or on the house, the current practice is to electrically isolate the solar panels by placing tarpaulins over solar PV panels before water is used. This electrical isolation prevents solar PV panels, metal roofing and guttering conducting electricity and becoming electrically "live". Aerials can be used to safely place tarpaulins/covers over solar PV panels or to apply a "PV stop" inert barrier film to solar PV panels to stop them charging.	Climate change and sustainability concerns, increasing energy costs, marketing initiatives by solar energy installation companies and the increasing uptake of electric cars are driving demand for solar PV systems (with battery banks)	Aerial platforms can be used by firefighters to safely apply PV stop to solar panels

Appendix G: Analysis

Detailed analysis will be undertaken to inform strategy development. The following elements will be considered throughout the development phase:

- Response times
- Call types
- Aerial usage
- Drive-time analysis

The following data informed discussion during working group workshops:

Heavy Aerial incident count and response data, totals for all regions (source SMS).

Major Aerial (Type 5 + Type 6) - Incident Response									
	Incident Count Data					Major Aerial Count Data			
Year	* All Incidents	Incidents Responded To (K1)	Incidents Arrived At (K2)	Incidents On Scene for 1 hour+		** All Appliances	Appliances Responded (K1)	Appliances Arrived (K2)	Appliances On Scene for 1 hour+
2012/13	4283	4227	3860	72		5067	4975	4507	86
2013/14	4243	4185	3771	71		4955	4872	4376	81
2014/15	4214	4157	3709	73		4880	4797	4271	84
2015/16	4243	4167	3779	69		4972	4873	4385	77
2016/17	4256	4120	3680	65		4376	4209	3739	73
2017/18	4389	4253	3679	71		4455	4305	3715	80
2018/19	3630	3427	2842	78		3702	3480	2874	85
Key: * = Total number of incidents that Type5/6 appliances were called to. ** = Total number of Type 5/6 appliances called.									

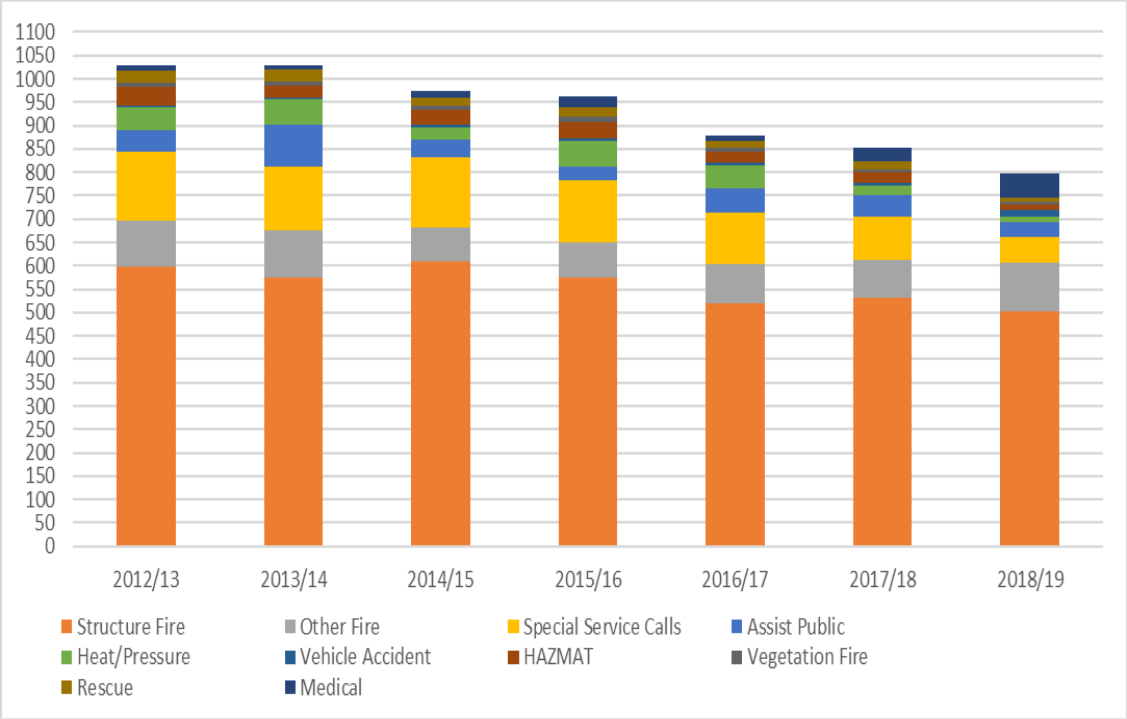
Incidents heavy aerials were called to by alarm level, for all regions (source SMS).

Major Aerial Response by Alarm Level, by Aerial Type														
	2012/13		2013/14		2014/15		2015/16		2016/17		2017/18		2018/19	
Alarm Level	Type 5	Type 6	Type 5	Type 6	Type 5	Type 6	Type 5	Type 6	Type 5	Type 6	Type 5	Type 6	Type 5	Type 6
1	4215	692	4015	789	4021	704	3803	1000	3574	620	3434	860	2811	707
2	101	12	84	15	92	14	98	28	119	16	95	20	99	32
3	29	6	38	4	35	8	32	8	36	5	34	6	30	7
4	9	1	6	2	5		3		4	2	6		10	2
5		2	2										3	
Total	4354	713	4145	810	4153	726	3936	1036	3733	643	3569	886	2953	748

Incidents heavy aerial were called to, 2012/13 - 2018/19, for all regions (source SMS).

Type 5/6: Incident Type		2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
71	False Alarm	4038	3927	3907	4010	3499	3601	2900
11	Structure Fire	597	576	610	576	521	531	503
15	Other Fire	98	100	73	73	83	81	103
51	Special Service Calls	150	135	148	135	109	93	55
30	Medical	12	9	13	23	11	30	53
52	Assist Public	44	91	38	28	54	45	31
21	Heat/Pressure	50	54	27	55	49	20	14
53	Vehicle Accident	2	4	5	7	4	8	12
42	HAZMAT	41	26	33	33	24	21	12
20	Rescue	25	25	18	21	15	16	9
13	Vegetation Fire	10	8	8	11	7	8	6
999	Not Recorded						1	3
	Total	**5067**	**4955**	**4880**	**4972**	**4376**	**4455**	**3701**

Incidents heavy aerials were called to, 2012/13 - 2018/19, excluding "False Alarms".



Appendix H: Aerial Fleet Capability – Working group Feedback

The following information was collected during the first aerial strategy workshop, 21 Nov 2019. The information reflects individual opinions only. It does not reflect a group consensus.

Type 5 (Elevating Platform)

Does Well	Shortcomings/Weaknesses
Short wheelbase	2-person cab
Good platform	No pump* - large volume pump required
Versatile aerial	Unable to achieve required flow rate (Bronto Merc)
Airlines	Dangerous supplying with H.P. feeder
Driveability – ease of use around town	Under powered for hills
Incline set up (some)	Wind loading (limited to 45km/hr)
Rescue ladder	Poor usability in Auckland compared to T6
Easy to set up	Computers (Bronto)
Rescue basket fittings, Riser	

Type 6 (Elevating Platform)

Does Well	Shortcomings/Weaknesses
Easy to drive, very manoeuvrable, modern controls	Big/heavy/Driving around streets
Large Pump	
Full Crew	Locker space, could be better designed
Other Incident response (T3)	No HPD's
Outreach (4m more than Parnell T5 F32RLH)	Tank size (H_2O)
High Flow (Riser)	Fuel tank small
Twin Monitor	Basket layout could be better set-up for Stokes basket
Foam Dunedin A/B compatible AKL B compatible	Poor service schedule has caused long delays in repairs and keeping truck on the run
2 Tonne & 450kg lifting eye	
4-person crew can work 24/7 (self-manage)	
Working on hills	
Airline System	

Bronto service agent response is not 24/7 in Auckland

There was a concern raised that the annual servicing of aerial appliances is not being completed in accordance with manufacturers specifications.

Turntable Ladder (Spartan not Metz)

Does Well	Shortcomings/Weaknesses
Reach * Water Flow	Lack of operation options
- External stairwell for rescue	No platform (some)
Large fuel tank	Bulk air tank (cannot refill on site)
Operation in higher winds	Incline Ops (some): works on slopes of around 9°, (T5 and T6: slopes of around 7°)
Simple to operate	
Robust American build	

Type 4 (heavy pump aerial)

Does Well	Shortcomings/Weaknesses
Good pumping capability	Crew committed to either (mission) loss of capacity
4-person crew enabling offensive tactics	One or other capacity (Pump/Aerial)
Versatility of calls it can attend	Far too short for large footprint buildings + Buildings over 3 floors
Well-built vehicle, large volume pump- dual roles	Jacking system (needs more travel in jacks) plus A-frame (front) counteracts the H-frame (rear)
Good over spec'd cab/chassis	Tethered controller for boom operation
Foam (A)	
Lifting ability (Crane Ops)	
Quick to get to work	

Elevating Monitor

Does Well	Shortcomings/Weaknesses
Quick set up	Limited reach (18m)
Pumps big water	No platform
Crew cab	Lack of operational control (no camera) *
Short wheelbase	Hands-free Comms not standard
Big pump/possible foam tender application	