



Aerial Strategy Discussion Document

Executive Summary

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

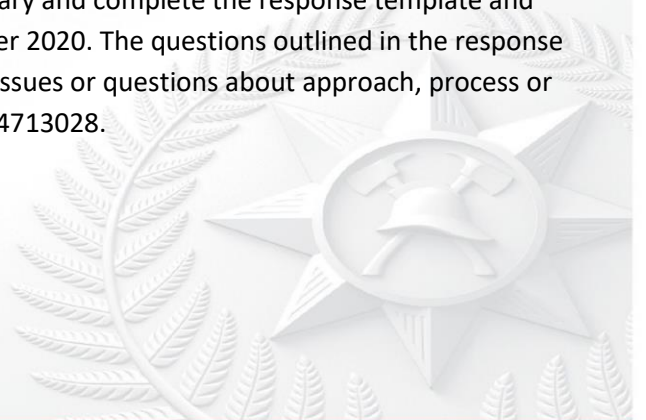
Fire and Emergency's target lifespan for aerals are between 20 and 25 years, therefore an aerial strategy tends to be long-term. The last aerial appliance strategy, adopted in 2003 informed the purchase of the 32 metre 'Bronto' aerial ladder platforms (type 5 and type 6) and heavy pump aerial appliances (type 4). New Zealand's population has grown by 1 million people since 2003, community needs and risk profiles have changed as have our number and diversity of incidents. With the release of Our National Strategy 2019-2045 in late 2019, now is an appropriate time to review our aerial strategy to ensure our capabilities are future-proofed and that capability appropriately matches local needs and risks. To initiate the thinking for this future strategy, a working group was established in 2019 to develop a discussion document to provide analysis and rationale on key elements that support aerial capability. The views of the working group are reported within this Executive Summary and used as a basis to illicit input, comment and feedback from a range of personnel across Fire and Emergency and various of our partner agencies.

Purpose

The purpose of this Executive Summary, is to provide a summary of the Aerial Appliance Fleet and Capability discussion document, to engage a wider audience to gather input, comment and feedback to inform a future revised aerial appliance strategy.

Feedback approach, process and timeline

You will find a high-level process and timeline at **Appendix A**. The timeframe to gather feedback is between October and December 2020. We ask that you review this Executive Summary and complete the response template and email to aerialstrategy@fireandemergency.nz by the 15th December 2020. The questions outlined in the response template are also provided within this document. If you have any issues or questions about approach, process or timelines, please contact Rebecca Scott; Chief Advisor DCE on 0274713028.



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:

- Observation
- Removal or mitigation
- Recovery
- Provision
- Supply suppression media
- Use as a crane with chains, strops etc.

Current State

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:

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

The current Fleet Strategic Plan¹ identifies the following target asset lifetimes/replacement ages for aerals:

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 aerals) and 25 years (type 5 and type 6 aerals).

¹ New Zealand Fire Service Fleet Strategic Plan, October 2015.

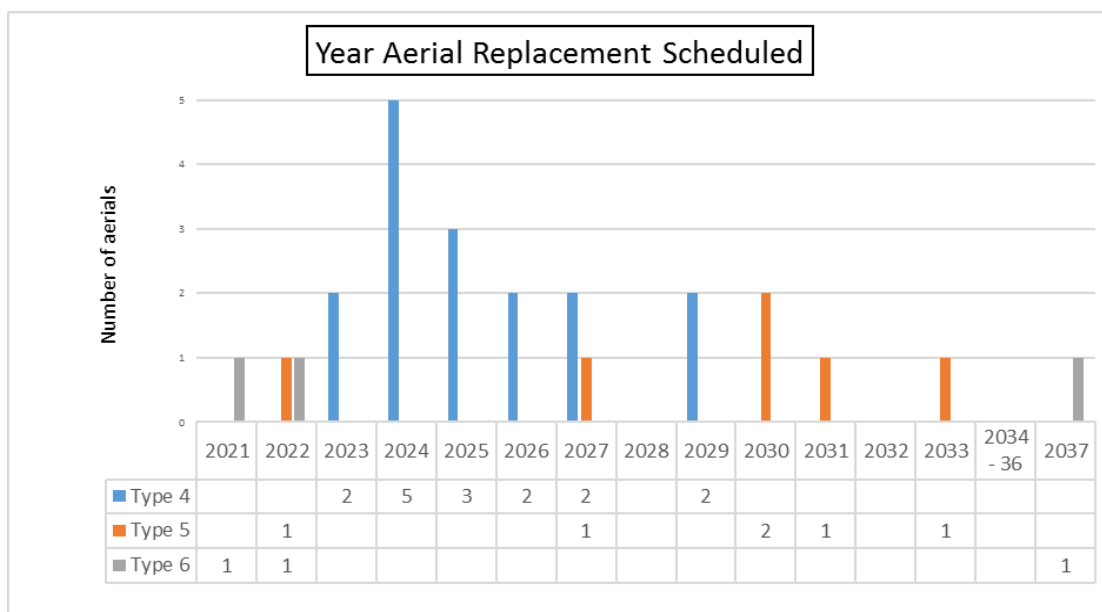


Fig. 1: Projected replacement schedule for aerial appliances (calculated using fleet sourced data)

Aerial Capability Developments

There have been several significant developments in the aerial capability space since Fire and Emergency purchased their current frontline aerial fleet, these can be found at **Appendix B**.

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 aeriels

- Auckland city have only one of their two allocated Heavy aeriels on the run. Their second Heavy aerial, a Type 6 has been broken for several months and has been replaced by the North Island relief (a Spartan Type 6).
- There are questions around the hydraulic efficiency of the Type 5 aeriels. Type 5s' are supplied by 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 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. 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 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 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 (KO), their call sign is assigned to the relieving appliance. This substitution, while required for the provision of the required capability and efficient appliance dispatch makes it very difficult to obtain dependable availability data for individual aerials is required to calculate 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 were united in their opinion that the service life of 25 years for heavy aerials and 20 years for heavy pump aerials is too long.
- There is a need to update the aerial attendance guidelines for high rise residential buildings, particularly in the wake of the Grenfell disaster in London and the subsequent learnings. We note that London Fire Brigade added aerials to their first alarm PDA's for high rise buildings in 2017, after a long absence.

Note: Several issues were raised during the first aerial strategy workshop² 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.

² Aerial strategy workshop 1, Wellington, 21 Nov 2019

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 aerals (20 and 25 years) are appropriate? If not, why not, and what do you think they should be and why?*

Aerial appliance replacement - Options overview

Initial issues and risks have been identified in the previous section, more are expected to arise through the engagement 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 aerals (32m ladder platforms) and heavy pump aerals
Option B	Vary current capability 1	New Increase height 24m. heavy pump aerals; New heavy aerial (32m ladder platforms) with an onboard pump
Option C	Vary current capability 2	New increased height 24m heavy pump aerals; New 32m ladder platforms + new 32m turntable ladders, with an onboard pump
Option D	Vary current capability 3	New increased height 24m heavy pump aerals; New taller, 32m+ ladder platform aerals; possible addition of "Snuzzle" 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 aerals 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 aerals or the changing community needs since the time the current aerals were commissioned. Assuming a "Like for Like" replacement is possible, this should be relatively straightforward when it comes to replacing the heavy pump aerals 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 aerals 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.

Possible appliance configurations for aerial appliances with assumptions, pros and cons for each option are provided forthwith.

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:	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> 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

	<p>frontline and relief fleets. The Spartan appliance in Hamilton would be replaced by a newer Bronto aerial.</p> <p>v) Heavy pump aerials will continue to be first response multi-purpose appliances.</p> <p>vi) Future events will require the same capability as past events.</p> <p>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.</p>
Pro's	<ul style="list-style-type: none"> • 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
Con's	<ul style="list-style-type: none"> • Concerns around the current aerials are likely to continue, therefore, the current work-arounds to manage shortcomings are also likely to continue e.g. <ul style="list-style-type: none"> ○ 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. ○ 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. ○ No basket on the heavy pump aerial will impact the work that can be safely completed at a height ○ Operational limitations relating to wind speed (45km/h) and slope (7°) continue. • Training impact for aerial crews in Hamilton and Dunedin not familiar with Bronto appliances.

	<ul style="list-style-type: none"> • 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.
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Option B: Vary Aerial Capability 1	
Description:	<ul style="list-style-type: none"> • 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:	<ul style="list-style-type: none"> 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.
Pro’s	<ul style="list-style-type: none"> • 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

	<p>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.</p> <ul style="list-style-type: none"> • Crews familiar with features and capabilities of current major aerals; incremental training to major aerial operator training for Auckland, Wellington and Christchurch major aerial crews • Current frontline aerals can be used as relief appliances for new fleet. • The new major aerals can be accommodated at the same stations as the current aerals. • The current heavy pump aerial is a sturdy, powerful and popular multi-purpose appliance • New heavy pump aerals will have an option of wireless remote operation of aerial.
Con's	<ul style="list-style-type: none"> • The new heavy pump aerals will be different to the current heavy pump aerals, even if they are from the same supplier. • New maintenance programmes will be required for new heavy pump aerals and major aerals • The new major aerals with on-board pumps are non-standard (i.e. bespoke) appliances. • Siting for the relief major aerals will require different logistical arrangements to the major aerial frontline appliances. Communication with incident commanders, by major (relief fleet) aerals 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 aerals may require a different station space to current appliances. • The Bronto operational limitations relating to wind speed (45km/h) and slope (7°) 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 aerial capability 2	
Description:	<ul style="list-style-type: none"> • Aerial Fleet Capability increased from "Increase aerial capability 1" option. • Some major aerals replaced with 32m Bronto aerals with on-board pump for own waterway. • Rest of major aerals replaced with 32m Turntable ladders with on-board pump for own waterway • Heavy pump aerals replaced with heavy pump aerals of greater reach e.g. 24m, with a 'basket'.
Assumptions:	<p>i) The current Bronto ladder platform and heavy pump aerals 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.</p>

	<p>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.</p> <p>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.</p> <p>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.</p> <p>iv) Future events will require a different capability to past events.</p> <p>v) Turntable ladder operating system will be easy for Bronto aerial operators to grasp and use.</p> <p>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.</p>
Pro's	<ul style="list-style-type: none"> • 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.

Con's	<ul style="list-style-type: none"> • 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°) continue. • Training impact for aerial crews in Hamilton and Dunedin not familiar with Bronto appliances.
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Option D: Vary aerial capability 3	
Description:	<ul style="list-style-type: none"> • 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 “Snuzzle” like appliance in place of a heavy pump aerial.
Assumptions:	<p>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.</p> <p>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</p> <p>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.</p>

	<p>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.</p> <p>viii) Future events will require a different capability to past events.</p> <p>ix) Turntable ladder operating system will be easy for Bronto aerial operators to grasp and use.</p> <p>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.</p> <p>xi) A 'Snuzzle' 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.</p>
Pro's	<ul style="list-style-type: none"> • 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 aerals 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 aerals. • 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 aerals 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 aerals 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 aerals 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 aerals; incremental training to major aerial operator training for Auckland, Wellington and Christchurch major aerial crews • Current frontline aerals can be used as relief appliances for new fleet. • The new major aerals can be accommodated at the same stations as the current aerals. • The current heavy pump aerial is a sturdy, powerful and popular multi-purpose appliance • New heavy pump aerals will have an option of wireless remote operation of aerial. • Many of our stations can accommodate 32m aerals.
Con's	<ul style="list-style-type: none"> • The new heavy pump aerals will be different to the current heavy pump aerals, even if they are from the same supplier. • New operator training programmes will be required for new pump aerals and major aerals

	<ul style="list-style-type: none">• 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°) 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.
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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.

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.

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, 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

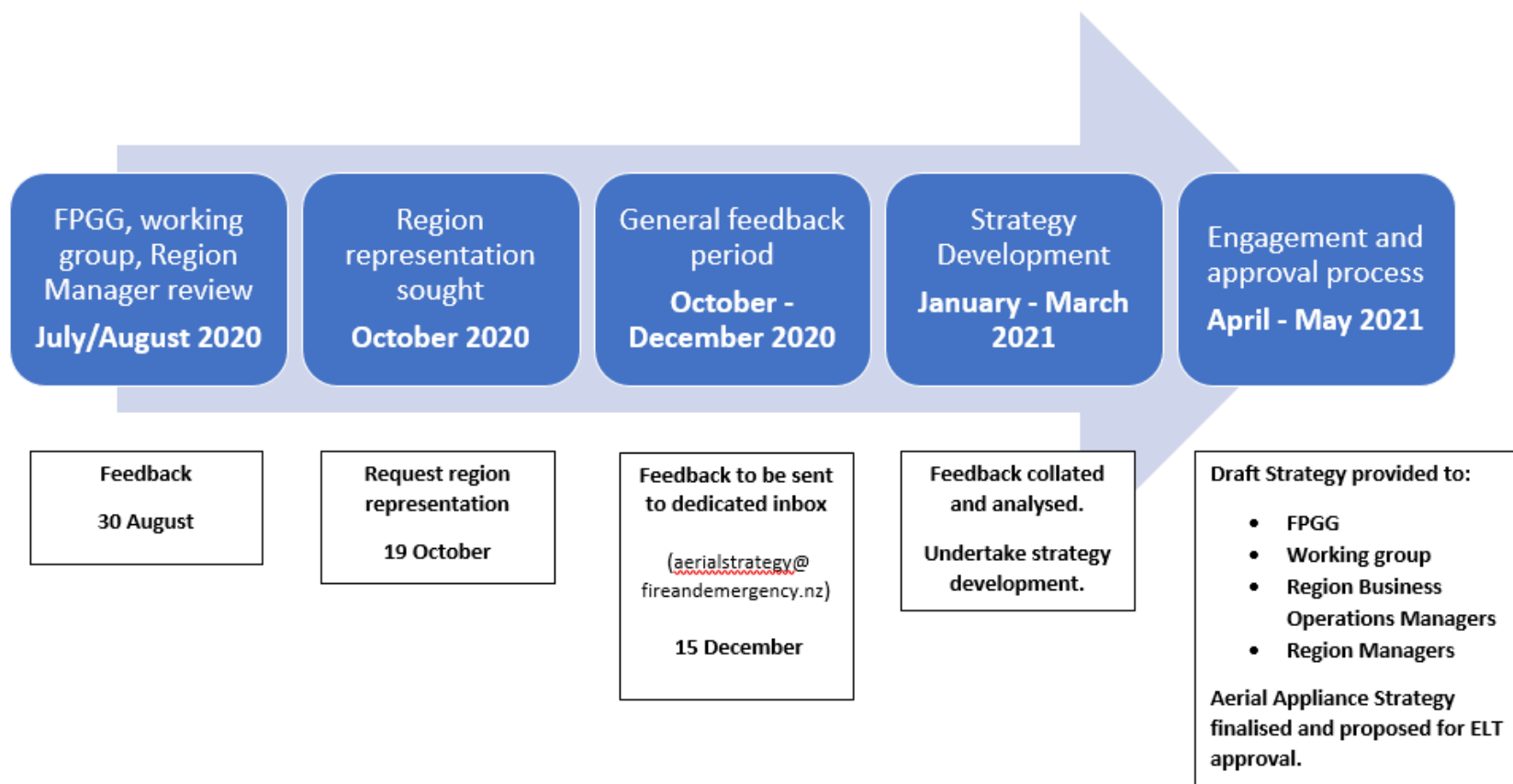
Question 8: Which suggestions of training improvements have merit and why?

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

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

Once again thank you for your time, we appreciate your support with the future development of the aerial strategy. Please complete the response template and email to aerialstrategy@fireandemergency.nz by the 30th November 2020.

Appendix A – Feedback Process and Timeline



Appendix B - Aerial Capability Developments

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

Metal alloys and improved designs have enabled aerals to be built that are light, strong and capable of reaching new heights. Higher platform aerals 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 Ladder³
New rescue cage⁴
- 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 areas⁵

(ii) Heavy pump aerial with platform

- Bronto Skylift F28ALR – first response pump unit with platform, rescue ladder, 28m height, 20m reach, 17,000kg⁶.

(iii) "Snuzzle": Heavy pump aerals with extendable turret/monitor

- Emergency One 'Scorpion'

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

⁴ <https://youtu.be/D1KHVDVC7Ys>
<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/>

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/min⁷.

- 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 85metres⁸.

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 drones⁹.

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/>

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

- (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 personnel¹⁰.
- (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 supplies¹¹.

(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 m¹².

(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 electricity¹³.

(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.

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>

¹⁴ <http://www.coldcutsystems.com/about-coldcut-cobra>

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 film¹⁵

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 appliances¹⁶

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 Simulator¹⁷

(x) Rosenbauer Firefighting trend maps¹⁸

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/>

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