BEING PREPARED FOR LOW FREQUENCY MAJOR AVALANCHE RESCUES

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ABSTRACT: From a risk and search management perspective, an avalanche Search and Rescue (SAR) response contains many factors that increase the complexity and risk while potentially decreasing the safety of the responders and effectiveness of the operation. These time critical, medical emergencies require highly skilled teams to assess and manage the avalanche and other alpine hazards plus they have the potential to be multi-causality events requiring high numbers of responders from multiple agencies. They are low probability/ high consequence events that rescuers and management do not experience often however SAR teams are required to be prepared to best manage the risk and maximise the chance of finding people alive. Key components to increase the chances of a safe and successful operation include; robust planning, reviews and updates, competent Field and Incident Management Team (IMT) personnel, regular and realistic training. To meet these requirements a series of nationally coordinated and funded exercises have been carried out in New Zealand over the last several years so that a number of rescuers and organisations get experience in the key roles and are better prepared to respond. This has been done through carrying out realistic exercises in the field utilising the full support that would be applicable to a major incident and through running desktop exercises where incident management teams and field teams interact.

KEYWORDS: Rescue, avalanche site control, training

1. CONTEXT

New Zealand has a large amount of avalanche terrain with potential for major avalanche rescue events. There are normally several avalanche rescues each year but these have mainly been single or double burial. The rescues are usually quickly carried out by those nearby.

Individual and small party rescue skills are well taught. Those working in the snow industry and rescue teams practice these skills regularly but due to the low frequency of rescues and in particularly large complex rescues there are limited opportunities to develop the experience and the specialist skill sets needed for large complex avalanche rescues at real events.

Large scale multiple casualty avalanche incidents pose a range of different logistical, management and site control issues from small party rescue events. While good individual skills are vital responding too large multi casualty events needs far more preparation, more organisation on site and a different on site management style than small party rescue.

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2. PURPOSE

The purpose of having an avalanche rescue response capability is to maximise lives saved when people are caught in avalanches.

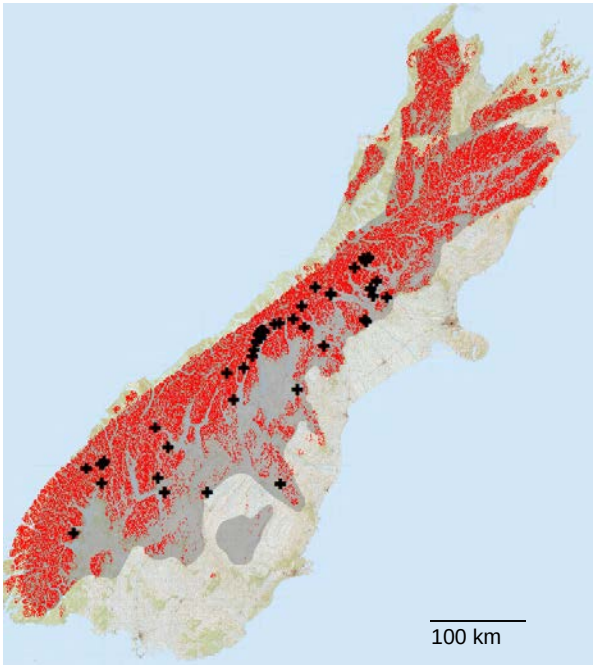

Fig 1 South Island New Zealand showing extent of winter seasonal snow (grey), slopes steep enough to be start zones (red) and avalanche fatality sites

3. CRITICAL ISSUE

The critical issue is how to be prepared for low frequency major avalanche rescues?

4. THE SOLUTION

In June 2010 a national multiagency workshop organised by the New Zealand Search and Rescue (NZSAR) Council was attended by the organisations likely to be involved in a large scale avalanche rescue to address this critical issue.

The New Zealand Search and Rescue (NZSAR) Council has a mandate from the NZ government to provide strategic leadership to the New Zealand Search and Rescue Sector.

They help improve the overall co-ordination, cohesion, capability and leadership of search and rescue by working alongside the key organisations and individuals providing search and rescue services throughout New Zealand.

As a result of that workshop a number of initiatives occurred. A national template for regional avalanche rescue response plans was created. The emphasis in these documents is one of avalanches as medical emergencies and the need to get the right resources to the rescue site as soon as possible. Each snow sport operation has their own immediate response plan. Sitting over top of these are overarching regional plans for multiagency response under the control of the coordinating authority.

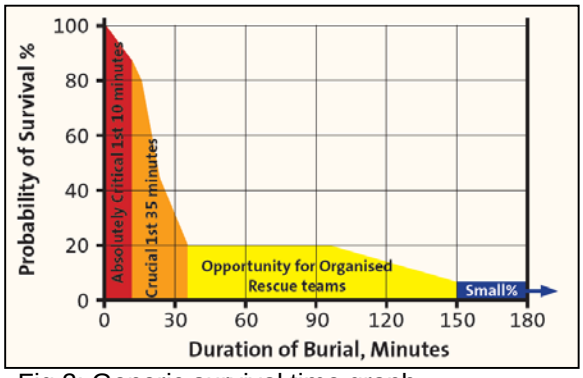

Fig 2: Generic survival time graph

A generic survival graph that emphasises the 4 phases of avalanche burial was adopted. This is used as a rescue planning and teaching tool to promote the desired behaviours by rescuers and search planners. While the survival percentages may not be exact for the New Zealand situation the four phases will exist. 1 – The absolutely critical first few minutes where those at site can make the most difference. 2 – The critical first 35 minutes that those on site have to do their utmost to find and recover people. 3 – The period where a well organised and fast responding rescue team can improve the survival of buried victims. 4 – The need to keep going to give anyone buried the possibility of being found while still alive.

A series of incident management team (IMT) and avalanche site control (ASC) training sessions and exercises were held around the country.

Multiagency realistic field scenarios involving, Police, Department of Conservation, Ski Areas, Mountain Guides, New Zealand Airforce, commercial helicopter operators and LandSAR were held to test plans and provide experience for IMT and ASC personnel. These exercises were supported with funding from NZSAR so helicopter support similar to what would be needed at real events could be provided. All of the exercises were carried out with observer/assessor's present who rated the exercises against key performance indicators. These reports are available online at www.NZSAR.org.nz.

Fig 3: Helicopter support for rescue exercise on Fox Glacier

Fig 4: CPR being performed from digging out right through heli evacuation in exercise

The main lesson learnt from the first of these large multiagency exercises is that while rescuers have good individual skills that even experienced team leaders with good small party avalanche rescue skills struggle when dealing with large complex situations where resources are constantly arriving by helicopter and rescuers can be spread out over hundreds of metres of avalanche debris.

In order to improve this situation avalanche specific IMT training and ASC training was incorporated into a pre exercise training day for the subsequent large regional exercises. A Rescue training day was also added to the bi-annual Southern Hemisphere Avalanche Conference as an optional pre conference workshop. By timing these workshops adjacent to the Police SAR controller's annual meetings Police, SAR and snow industry professionals were able to attend.

Training for avalanche rescue at these opportunities and in the professional avalanche safety management programme has put its emphasis on avalanche as a medical emergency. This has included incorporating logistics problems like the following into training in order to promote understanding with Incident Controllers and other rescue managers about how to get the right resources to site in the time and order that maximises lives saved.

Logistics Problem
A large avalanche occurs at site X. You start sending resources at T = 25. (T = avalanche occurred) You have the following resources available.

A. 1 Heli with 5 seats available immediately
   1 Heli with 4 seats available at T = 45
B. 1 Heli with 4 seats available immediately
C. 6 rescuers
D. 1 Medic
   1 dog and handler
   12 rescuers
E. 1 Medic
   1 dog and handler
   8 rescuers

- The times on the diagram are one way times that include landing, unloading, loading.
- Your plan calls for you to get all rescuers, dogs and medics to the site. The ASC, at least 4 other rescuers and both dogs need to get there as fast as possible and the first medic should arrive in the next load after the 1st dog and ASC get there. The dogs can go in as well as the 4 or 5 passengers in a helicopter they do not need their own seat space.
- Write a transport plan that shows which helicopter takes which resource to the site and what time each resource arrives on site.

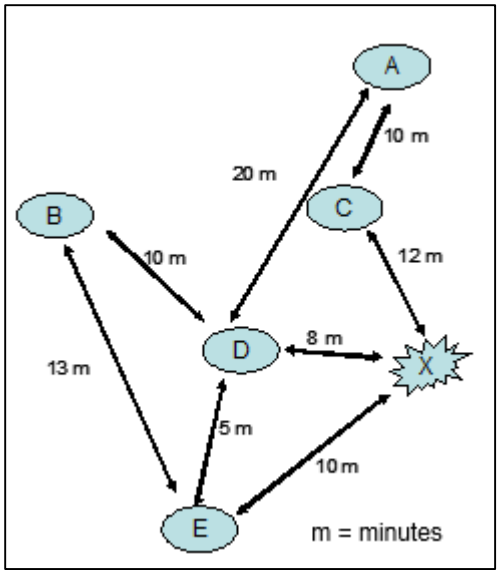

Fig5: Logistics problem

An interactive incident management and site control exercise was run on a pre-conference training day. This involved Police Incident controllers, Snow industry practitioners, Department of Conservation and LandSAR. As part of this training day pre exercise presentations were given on avalanche as a medical emergency and lessons from previous exercises.

The exercise was designed to provide people who could fill key roles at a major avalanche rescue event with an opportunity to work with people from other organisations in a situation with tight time pressures. The mixture of tight timeframe, working with peers from other organisations, the noise and busyness of the event created a sense of urgency and realism that helped the participants appreciate the pressure they would be under in a real event.

5. RUNNING AN INTERACTIVE IMT – ASC DESKTOP EXERCISE

Three concurrent exercises with IMT and ASC teams of four all happened in one room with communication between IMT's and ASC's by radios. The exercise ran in real time from T = 20 through to T = 90 where T = 0 is the time the avalanche occurred at. In order to give each of the teams the opportunity to get ready they were given 15 minutes to think through how they would handle a large scale avalanche incident. This was done without the teams knowing the details of what the incident involved or where it would be. The IMT team also had to prepare a list of resources that would be available in the region they had been as-

signed for the exercise. Team members were pre-selected so the right mix of regions, skills and agencies were in each team.

Fig 6: ASC team with rescue resources on the rescue site

A critical factor with the success of the exercise was having an umpire assigned to each of the IMT and ASC teams. The umpires role was to manage the part of the exercise pertaining to the team they were assigned to. Umpires had a set of instructions but also had the discretion to make decisions relevant to the progression of the exercise.

As the regional avalanche rescue plan template calls for the dispatch of a pre-arranged level of response to any reported avalanche burial situation the exercise starts like a real event would with resources dispatched prior to the formation of a full IMT. When the exercise starts the IMT decides on what extra resources are needed and sends them to site along with responding to requests from the ASC team. The ASC team tasks resources on site and can request additional resources.

#	Comb	Prob
2	1	2.8%
3	2	5.6%
4	3	8.3%
5	4	11.1%
6	5	13.9%
7	6	16.7%
8	5	13.9%
9	4	11.1%
10	3	8.3%
11	2	5.6%
12	1	2.8%
	36	100%

Fig 7: Dice probabilities

Resource availability and whether rescuers find buried victims is governed by an umpire throwing dice. The probabilities of throwing different combinations of numbers are used to decide whether resources are available and whether clues are seen or whether different search techniques find victims.

The ASC team controls the resources on the game board. It is much like a game of battleships where the players task the resources and the umpire provides feedback about success after timing how long that task would take then throwing the dice. Timing for different search techniques is based on a series of search times tables for the various methods.

When a find is made by searchers the umpire uses a victim table to say how deep the victim is then how long it will take to dig out depending on how many diggers as assigned. When the digging time is up the umpire will use the victim table to say what the victim condition is, then record what sort of patient care and evacuation the ASC team decides on.

At T = 90 all teams are stopped then asked to spend 10 minutes writing up an anticipated scenario development at what their plans would be for that. All teams then take part in a debrief where the discussion is about how did the actions taken meet the purpose of maximising lives saved and what could be done to make things work well in a real event.

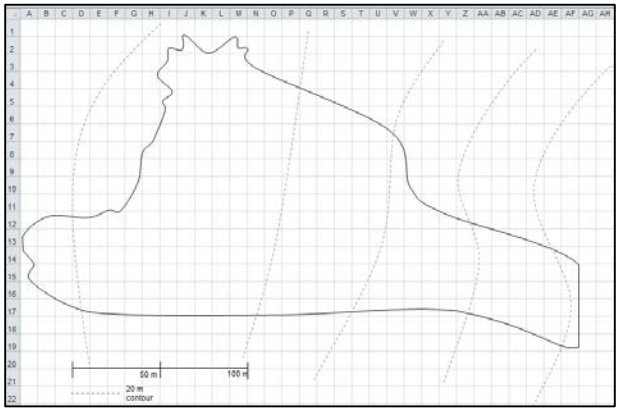

Fig 7: Game board as seen by ASC team

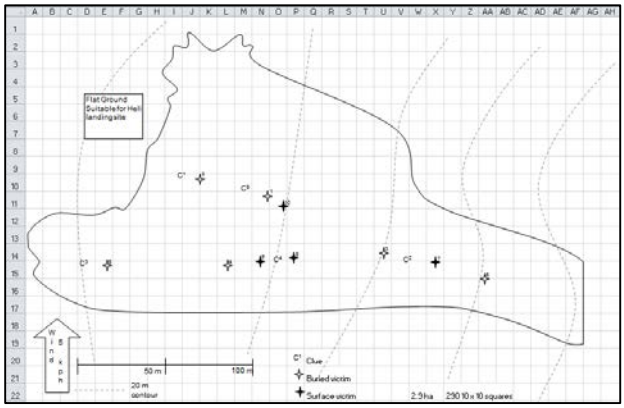

Fig 8: Game board as seen by ASC umpire

Helicopter availability	
2	Not available
3	Not available
4	Available in 10 min
5	Available in 5 min
6	Available immediately
7	Available immediately
8	Available immediately
9	Available in 5 min
10	Available in 10 min
11	Available in 20 min
12	Available in 30 min

Other resource availability	
2	Not available
3	Not available
4	Available in 60 min
5	Available in 60 min
6	Available immediately
7	Available immediately
8	Available immediately
9	Available immediately
10	Available immediately
11	Available in 30 min
12	Available in 30 min

Fig 9: Example of resource availability tables for when IMT ask for resources from umpire

Dog Search. Variable 70% plus	
2	No indications
3	No indications
4	No indications
5	Find
6	Find
7	Find
8	Find
9	Find
10	Indicates throw again
11	Indicates throw again
12	Indicates throw again

Visual Search Clue or Partial Burial 20 m sweep 50%	
2	Nothing seen
3	Nothing seen
4	Spotted Item
5	Spotted Item
6	Spotted Item
7	Spotted Item
8	Nothing seen
9	Nothing seen
10	Nothing seen
11	Nothing seen
12	Nothing seen

Probing - 50 x 50 up to 88% if done well	
2	Strike
3	Strike
4	Strike
5	Strike
6	Strike
7	Strike
8	Strike
9	Nothing found
10	Strike
11	Throw again
12	Throw again

Fig 10: Example of search method success used as resources are tasked to a grid square

			Probers					
M2 of Area to Search to length of probe with 3 probe per step 50 x 50.	m^2	Grid Sq	1	2	5	10	15	20
	100	1	34	17	7	3	2	2
	200	2	69	34	14	7	5	3
	300	3	103	52	21	10	7	5
	400	4	138	69	28	14	9	7
	500	5	172	86	34	17	11	9
	600	6	207	103	41	21	14	10
	700	7	241	121	48	24	16	12
	800	8	276	138	55	28	18	14
	900	9	310	155	62	31	21	16
	1,000	10	345	172	69	34	23	17
	1,500	15	517	259	103	52	34	26
	2,000	20	690	345	138	69	46	34
			Time in Minutes					

Fig 11: Probe time table

	Depth m	Conscious till min	Life signs	Trauma	Airway	Core temp	Outcome
Victim 1	2.5	3	Not detected	Head Injuries	Full of snow	< T = 35 is 35 > T = 35 is 30	Will not survive no matter what treatment
Victim 2	1.8	3	Not detected post 30 min	Serious head injuries.	Clear	< T = 35 is 35 > T = 35 is 31	Will not recover no matter what
Victim 3	0.5	45	Present prior < T = 60 Not detected > T = 60	None apparent	Clear	< T = 45 is 34 > T = 45 is 30	Will recover if found post 60 and sent to ECC Hospital
Victim 4	0.3	60	Present prior < T = 60 Very Weak > T = 60 Not detected > T = 120	Point pain lower back	Clear	< T = 35 is 35 > T = 35 is 32	Will survive if handled gently prior to 120. Will not survive if found post
Victim 5	0.8	3	Not detected	None apparent	Full of snow	< T = 35 is 33 > T = 35 is 31	Will not survive no matter what treatment
Victim 6	1.2	60	Present prior < T = 90 Not detected > T = 90	Fractured arm	Clear	< T = 60 is 34 > T = 60 is 30	Will recover if found post 60 and sent to ECC Hospital

Fig 12: Victim depth and condition table

Depth m	1 digger	2 diggers	3 diggers	4 diggers	5 diggers	6 diggers
0.5	3	2	1	1	1	1
0.8	8	4	3	2	2	1
1.2	18	9	6	4	4	3
1.5	27	14	9	7	5	5
1.8	39	20	13	10	8	7
2.0	49	24	16	12	10	8
2.5	76	38	25	19	15	13
3.0	110	55	37	27	22	18

Fig 13: Digger time table

6. CONCLUSION:

Running large scale regional avalanche rescue exercises in as realistic a fashion as possible that includes providing full helicopter support similar to a real event has a positive effect at an individual and organisational level. A continuation of these events will allow for better analysis of the impact of the training, cement the gains made so far and allow organisations to apply the lessons learnt.

The exercises have improved collaboration between organisations and allowed some people who may only come together in an emergency to work with each other beforehand.

As running the large scale exercises is an expensive undertaking they will requires ongoing support for funding, at a national level.

The development of further training resources would greatly improve individual team members performance and help with maintaining a pool of people who can take the key roles at major events.

As these are low frequency but high consequence events ongoing efforts are needed to sustain the ability to respond in a way that will maximise lives saved.

There is value in a single organisation or group having oversite for the planning, training, analysis and development of the exercises to support consistency and shared learning.

7. BENEFITS:

The exercises and associated training supports effective and safe operations at an individual and organisational level by exposing people to realistic SAR situations, testing and informing planning and developing inter-agency working relationships.

Maintains a pool of people who can take key roles at infrequent major events

Will help meet our purpose of maximising lives saved

CONFLICT OF INTEREST

The author has not received any financial assistance from any organisation apart from his employer when creating this document.

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