AN INTRODUCTION TO REMOTE AREA FIRE FIGHTING IN THE BLUE MOUNTAINS

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Introduction

In this introductory paper 'remote area' fire fighting means fire fighting in areas which cannot be reached by wheeled vehicles. The terrain is usually trackless, rough and steep.

Although remote area fire fighting existed long before the introduction of the helicopter, this aircraft has dramatically changed our ability to suppress fires in remote areas because of its capabilities:-

1. As a means of transport.
2. To carry out aerial surveys.
3. To ignite large areas quickly with many small fires.
4. To cool fire fronts and hot spots using the water bucket or belly-tank.

The purpose of this paper is not to argue the case for the extinguishing of all remote area fires. The simple answer to that problem is that we can rarely afford to risk allowing any fires in the Blue Mountains to burn unchecked during the fire season. All of our disastrous wildfires had simple beginnings.

The paper is intended to acquaint brigade personnel with knowledge gained from the group's involvement, especially during the past eight years, in remote area fires.

This paper was written by Jim Chivas and approved by a meeting of senior field officers of the Blue Mountains Group of Bush Fire Brigades, the Blue Mountains Bush Fire Prevention Association and National Parks and Wildlife Service.

September, 1984.

1 THE REMOTE AREA FIRE FIGHTER

FIGHTING A REMOTE AREA FIRE IS LIKELY TO BE ONE OF THE MOST PHYSICALLY EXHAUSTING TASKS YOU WILL EVER UNDERTAKE.

The initial attack crew at the Mt. Cloudmaker fire (1976) worked on the fire front from 1000 hours to 2200 hours, rested until 0430 hours the next morning and continued until mid morning when relief crews took over. Although this is not typical of the effort remote area crews are normally required to make, it can never be assumed the job will not be physically demanding. In the Blue Mountains you should expect to do a lot of climbing up and down steep slopes. Your ability to tolerate heat stress should be better than average.

If you are sure you are sufficiently fit and capable of moving around in steep, rough terrain, able to use hand tools over long periods and prepared to walk out or camp on the job if it is not possible to airlift you as scheduled, you have the basic attributes to be a member of a remote area ground crew.

As a remote area fire crew member you should also be:-

1. Experienced in dry fire fighting techniques and fire behaviour.

2. Especially careful about mopping up and able to complete the task properly without supervision.

3. Self sufficient in that you are:-
   - * Unlikely to get lost - able to use map and compass in the field.
   - * Unlikely to be injured through carelessness or needlessly risky actions.
   - * Unlikely to panic or make rash decisions.
   - * Able to pace your physical activity so that you can continue to work effectively for long periods.
   - * Equipped with your own essential food, water and gear.
   - * Able to carry out necessary procedures without direction.

* At home in rough terrain, equipped to camp on the job if necessary and mindful of the environment (take your garbage home with you).

4. Possessed of a good sense of humour and able to accept hardships without complaining about them.

5. Know the essentials of helicopter safety.

6. Have basic first aid knowledge.

The following skills are not essential for all crew members, but may be those required of initial attack crew or senior field officers:-

7. Knows how and where to construct a helipad.

8. Is thoroughly experienced in safe chain saw operation, maintenance and tree felling.

9. Can abseil confidently, be winched from a helicopter and knows the correct signals for winching.

10. Can direct the use of a helicopter water bucket.

11. Can survey an area and blaze a workable rake hoe trail for following crew to complete.

12. Can assess fuel type and quantity, weather and terrain and predict associated fire behaviour with reasonable accuracy.

13. Distinguish between relatively safe and really dangerous situations - knows when to retreat.

14. Can assess fire area and potential from the air and plan appropriate strategies.

FOOTWEAR

Comfortable socks and boots are essential. Don't try to break in a new pair of boots: break them in before you wear them to a remote area.

A little foot powder inside your socks can help foot comfort.

Have a few band aids or sticking plaster handy. If a sore spot develops don't wait until it has become a blister, attend to it as soon as possible. A spare pair of clean socks is a good idea. Some like gaiters for ankle protection.

CLOTHING

Synthetic (nylon) underwear and socks should never be worn by firefighters (you are likely to perspire a lot more than usual) apart from the complications of melting of the synthetic material in burn cases.

A cotton string singlet worn under your overalls permits good ventilation.

An old lightweight pullover is worth having if you do have to stay out overnight.

A ground sheet will keep the rain off if the weather turns wet or you can sleep on it.

MISCELLANEOUS GEAR

A light face cloth has a variety of uses - Tied around the neck it stops sparks getting inside the collar of your overalls.

Goggles - Can save you getting on eye full of cinders.

Gloves - Save unnecessary burns on a 'dry' mop up.

Water bottles - You may use as much as four litres of water or more in an eight hour day. Under severe conditions your body may evaporate as much as a litre per hour. (Budd, "Heat Stress on Fire Fighters" volume 6, no. 1, 1984 Bush Fire Bulletin; this article should be read by all brigade personnel, especially those contemplating remote area fire fighting).

A small lightweight rucksack is useful to keep essentials with you at all times. Matches should be carried by each member of the crew.

Useful first aid items are:-

An elastic bandage for sprains or as a tourniquet.

Band aids and antiseptic for minor cuts etc.

Burn dressings (some very good ones are available).

A clean bandage.

Tweezers to remove splinters or thorns.

Tablets for headache.

Tablets for upset stomach (diarrhoea).

Eye wash/drops (can be purchased in small amounts).

Salt tablets are not now recommended on medical grounds although very small amounts of preparations like 'Staminade' or table salt, can be taken to replace salts lost through excessive sweating. You should just be able to taste the staminade or salt in a mug of water and one such drink should be sufficient for the day. Don't add anything to drinking water unless you are sure you can drink a gallon or so without ill affect. Water bottles should not have staminade added to the water so that you have to drink the additive all day. Your need is for water not salt.

FOOD

Tastes vary considerably but the following points should be noted:-

* The best diet is one which is reasonably well balanced, close to your normal diet and palatable.

* You need to keep up your body's fluid requirements and foods containing a high proportion of fluid, such as fresh or tinned fruit, salad or a plate of stew, are more palatable than dry biscuits or sandwiches.

* You don't need an excess of "energy food". Too many sweets or too much chocolate may give you a headache. The bushwalker who tried to exist for a week-end on a packet of glucose gave himself severe diarrhoea.

* Excessive amounts of nuts and raisins beyond the amounts you normally eat will probably upset your stomach. Your mates may even banish you to a remote corner of the remote area fire!

* Convenience is important, there is rarely time for complex cooking and easy food preparation is appreciated when you are tired and hungry. A pre-cooked meal which has only to be heated in one billy saves time and effort. If it is in a sealed container you can even avoid any washing up.

* The weight advantage in carrying dehydrated foods is only an advantage if you don't have to carry the water to add to them. Your situation is not quite the same as that of a bushwalker who might walk for eight hours and camp at a pre-determined spot where water is available. You may have to carry your drinking water but you can usually leave the bulk of your gear at a base camp.

* Don't rely on someone else for drinking water or food, carry your own.

FIRE FIGHTING TOOLS AND EQUIPMENT

A good balance of equipment for a six man initial attack crew would be one axe (or half axe), five rake hoes, a medium sized chain saw with 18" bar, a drip torch and two VHF packset radios. A small shovel is useful to bury hot spots when no water is available and an empty knapsack is worth having if there is any water reasonably close to the fire, but it is not usually worth carrying water other than drinking water very far in difficult terrain. Dont forget chain adjusting spanner, file and guide.

Unless there is a specific need for it, a brush hook is too limited in its range of use to take the place of a rake hoe or an axe. A half axe is much lighter to carry than a full axe, less tiring to use over a long period and will do most jobs just as efficiently e.g. blazing tracks and cutting saplings.

The need for a drip torch varies with strategy. Once the operation is under way, the senior field officer can call for any additional equipment which may be needed.

* BLUE MOUNTAINS INITIAL ATTACK KIT CONTAINS:-

5 McLeod Tools

1 Brush Hook

1 Axe

1 Strobe Light and 4 Batteries

3 Torches and Batteries

5 Pair Gloves

5 Goggles

2 Flat Files

2 Chain Files

1 Spare Chain Saw Chain and Tool Kit

1 Drip Torch

1 First Aid Kit

1 Sling Psychrometer

1 Helmet

2 Cyalume Light Sticks

1 Pouch (various items)

1 Chain Saw

Chain Saw Fuel Container

Chain Saw Oil Container

Water Containers (knapsack type)

Heavy duty brushcutter /fuel /tools /spare cutting head

2 THE HELICOPTER

The Helipad

2.1 Stack gear on one side of the pad ready for convenient loading without delay. There should be no loose light objects which could be blown into the rotor blades.

2.2 Keep vehicles well clear. Some types of rotor blades could be damaged by a fibreglass whip aerial.

2.3 At all times KEEP WELL CLEAR OF THE TAIL ROTOR and within the pilot's field of vision.

2.4 Know your destination before you board the aircraft.

2.5 Strobe lights are much more visible than other electric lights.

Boarding and Leaving the Helicopter

2.6 ALWAYS APPROACH FROM THE FRONT WITHIN THE PILOT'S FIELD OF VISION but do not approach from the uphill side as rotor clearance is reduced.

2.7 DO NOT APPROACH THE AIRCRAFT UNTIL SIGNALLED BY THE CREWMAN.

2.8 Never wear your hat or other loose objects which could be picked up by the rotor blades.

2.9 Keep as low as you comfortably can. Move without delay but walk rather than run. In some weather conditions rotor blades can flex downwards.

2.10 Carry long objects horizontally.

2.11 Helicopters are lightweight and expensive machines - don't step on parts not designed for this. Load equipment carefully so that no damage is caused to the aircraft.

2.12 Climb into the aircraft carefully and avoid sudden transference of weight.

2.13 The crewman will usually fasten your seat belt and close the door. If he doesn't, be sure you do it carefully - a replacement door for a Gazelle is worth $7000! If you pull the red jettison lever instead of the door handle, the door will fall off!

2.14 A belt buckle left banging against the fuselage can damage the aircraft.

2.15 You will only be able to speak via sign language or the intercom. The microphone should be close to your mouth.

If you don't have headphones you should wear ear muffs because of the noise.

2.16 Keep clear of all pilot controls at all times.

2.17 Don't undo your seat belt or leave the aircraft until directed.

2.18 DON'T LINGER UNDER REVOLVING ROTORS! Move to the side within the pilot's field of forward vision and well clear of the aircraft. If you are not involved keep well clear of the helipad area.

2.19 WINCHING - (N.P & W.S. helicopter directives)

Remove loose objects e.g. spectacles.

Stand directly under the boom.

2.20 SIGNALS

Extend one (1) arm - 'I am OK to be winched'.

Extend both arms, raised a little - 'I am OK to go up'.

YOU WILL NOT BE WINCHED UNTIL THIS SIGNAL IS RECEIVED.

(Front seat winch passenger is out first and in last).

Crossed arms (or a 'panic dance') means 'NO don't do it'!

The beeper means 'freeze' - look at the helicopter for directions. A message bag may be lowered.

If you begin to spin there is not much you can do other than holding your arms out.

Don't open the left rear door of a Gazelle when the winch is attached.

The maximum winch load of a Gazelle is 300 lbs. and its cable length 30 metres (100 feet). An Iriquois has 70 metres (240 feet) of winch cable. It takes at least 4 minutes to lower one man 30 metres.

2.21 Cargo nets are normally released from the aircraft (don't untie the rope at the cargo end, it will be released from above).

2.22 Weight is an important factor in helicopter operation.
The maximum load of a Gazelle is 1460 lbs. including fuel.

Height above sea level and air temperature affect lift.

When the water bucket is being used keep clear of the drop area. The senior field officer will need to indicate the drop zone to the helicopter pilot. If radio communication is not available a helmet should be waved in the appropriate direction.

A helicopter safety booklet has been produced by the National Parks and Wildlife Service since this chapter was written. It is available from the National Parks and Wildlife Service and should be read in conjunction with this paper.

HELICOPTER LANDING POINTS

2.23 If you are involved in clearing a helipad remember the rotors create a strong wind. Don't uproot plants and grass which will help to hold the soil. Freshly disturbed bare earth causes considerable dust which obscures the pilot's vision and can even cause engine failure.

2.24 The general requirement for the size of a helipad is the legal length of the helicopter plus 7 metres. For a Gazelle this is 19 metres by 17 1/2 metres.

Clear anything over about 0.3 metres (1 foot) in height.

Leave nothing that might puncture the underside of the aircraft.

The landing skid area is approximately 3 square metres and should be firm, as well cleared as possible but not dusty.

Approach and departure angles for N.P. & W.S. helicopters should be a minimum angle of 40 degrees from the edge of the pad to a height of 300 feet but an angle down to 10 degrees is ideal.

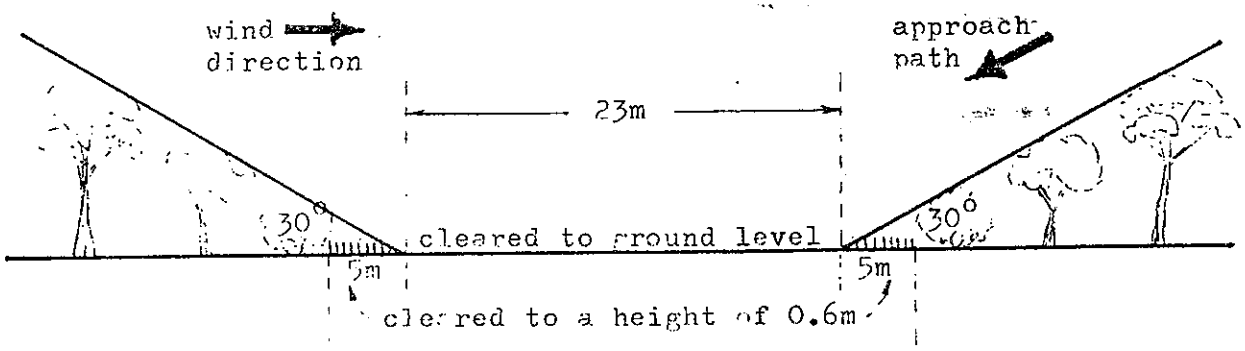
The pad should be as level as possible but the maximum slopes are:-

Military usage - 7 degrees.

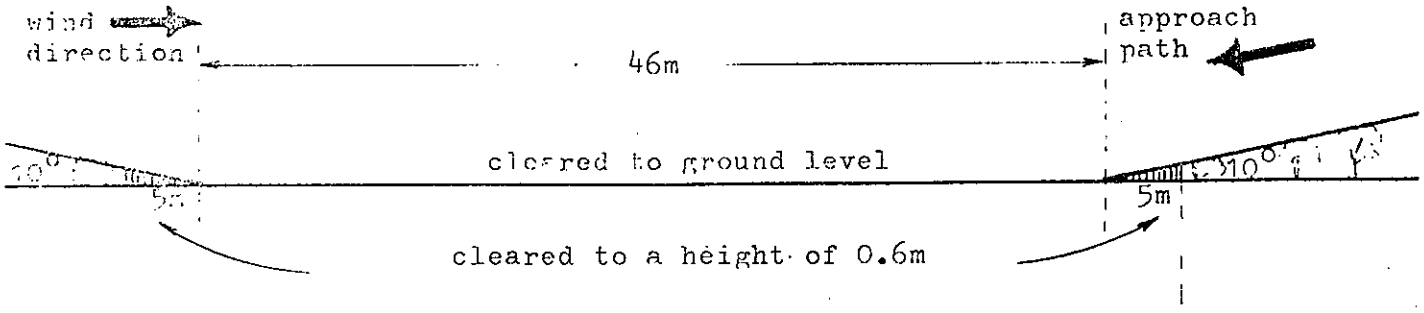
N.P. & W.S. usage - 9 degrees laterally, 12 degrees fore and aft.

MINIMUM DIMENSIONS FOR AN IROQUOIS LANDING POINT

Requirement by Day



Requirement by Night



3 GETTING TO THE FIRE

3.1 Before you leave a vehicle or helipad to walk to the fire front, temper any urge to get there without delay against the need to check your location and intended direction carefully. Don't assume anything.

3.2 Check that portable radios are switched to the correct channel and functioning properly.

3.3 Don't overlook small but essential items such as chain saw files, spanner and screwdriver. One of the most essential items is DRINKING WATER.

3.4 Loads should be sensibly shared and the group should keep together. Don't leave the slowest member or the one with the heaviest load to tag along behind.

3.5 The fire is not usually visible from ground level at the helipad unless the pad is on a ridge with a good view. The initial attack crew will usually have the longest walk to the fire and the greatest need to use map and compass. The usual practice is to cut new helipads closer to the fire so back-up crews don't have to waste time and energy getting to the fire and back to the pad.

3.6 Care in carrying tools saves unnecessary accidents; covers should be used on axe heads and chain saw bars. Rake hoes are awkward and potentially dangerous in rough country, especially when over sharpened by an over enthusiastic equipment officer. The raking teeth should never be sharpened. A rake hoe dropped over a ledge can bounce several feet if it springs off the blade. The Blue Mountains Group now have rake hoes with detachable heads for the initial attack crew.

3.7 If walking in indian file keep clear of the man in front. Small branches flicking back as he pushes past can then catch you in the face or even cause an eye injury.

3.8 If you are wearing a hat (as you should be) you may not see a branch at head height if your gaze is fixed on the ground. Glasses restrict your field of vision even more.

3.9 If others are below you, take care to avoid dislodging stones.
In basalt country large rounded stones may become loose after several people have moved over the same spot loosening the soil holding the stones in place.

3.10 Crews moving to and from the helipad can often check an area that has been mopped up en route. Advising incoming crews about the location of piped trees or other potential re-ignition points may save a lot of effort later on.

3.11 If you are moving through a burnt area watch carefully for trees or limbs which might fall at a later stage. Make a mental note of anything that should be checked out, especially areas which may become dangerous. As a new crew relieves you, pass on information of this kind.

3.12 If you need to use a fixed safety rope, check that it is properly secured to a reliable anchor point. Put the rope over your shoulder rather than rely solely on hand grip. Learn to abseil properly - it is not difficult. If a caving ladder has to be used, a belay rope should be used if possible.

3.13 When lowering tools, secure them properly. Rake hoes are likely to turn head down and slide out of a sling if not well secured.

4 FIGHTING THE FIRE

One rule must always be kept in mind:-

YOU MUST ALWAYS HAVE A SAFE AREA TO MOVE INTO IF NECESSARY.

Direct Attack

The immediate advantages of a direct attack on the fire, if the fire front is not too hot are that:-

4.1 The burnt area is not far away if you should need to move into it for safety.

4.2 There is not usually a large amount of unburnt fuel between the fire fighters and the flame front in which the fire can build up intensity due to a sudden gust of wind or a change in fuel state.

4.3 The obvious advantage of keeping the fire contained within the smallest possible area is appreciated when the perimeter has to be patrolled on foot.

4.4 Because you are close to the fire you can deal with problems and assess fire behaviour more accurately. You can frequently rake fuel away from hazards, such as dead trees, log heaps and rough barked trees. before the fire reaches them. A few minutes spent in this way can save hours of extra work.

4.5 In light fuels a small raked trail can be very effective when there is a slow rate of spread and low intensity. When you are raking unburnt fuel away from the burning edge it is easy to drag an ember onto the unburnt side. The drier the state of the fuel, the greater are the chances of a re-ignition. A grass stem glowing at one end is all it takes to rekindle a flame in very dry fuel. The chances of this kind of re-ignition are reduced if you push or rake burning fuel back into the fire and check the edge you have just raked as often as possible.

4.6 Spotovers from any source likely to give off sparks and rolling embers in steep country make constant patrolling of raked trails essential. Burning roots under the soil can cause a re-ignition hours or even days later.

4.7 DISADVANTAGES OF DIRECT ATTACK

Working on the fire line is hot, smoky and uncomfortable. Fire fighters become more fatigued and more prone to dehydration due to the increased temperatures close to the fire front. There is often a sense of urgency about the work and the fire fighter may become preoccupied and overlook the need for regular fluid intake. Drink a small amount every fifteen minutes or so.

4.8 Avoid the temptation to fill an overheated gut with a long drink of very cold water. Don't overlook the need for a regular intake of suitable food. An excess of refined carbohydrates (chocolate, sweets etc.) won't give you extra energy, but will probably give you a headache.

4.9 Whenever possible, shield yourself from radiant heat and don't exhaust yourself with unnecessary physical exertion. If you are feeling the affects of heat stress don't try to prove a point by pushing yourself to the point of collapse - rest before that happens.

4.10 Pay constant attention to the fuel types, weather conditions and terrain. Fine fuels such as dry grasses or ti tree can flare dangerously and are very much affected by wind. The rate of spread in fine fuels with good access to oxygen increases greatly. If the fire is below you, conditions may be very uncomfortable as you are more exposed to heat and smoke.

4.11 In steep terrain when the fire is above you, there is the constant likelihood of burning material rolling into unburnt fuel. Banksia is especially problematic as the seed pods roll and smoulder like cigars. It is sometimes necessary to build gutters to trap rolling embers.

4.12 Working below a fire in steep country can be dangerous. Trees can fall further than would normally be expected. Large stones and small boulders are also likely to roll as timber holding them in place burns away.

Remote area fires are usually fought using a combination of direct and indirect methods.

Indirect Attack

4.13 ADVANTAGES OF INDIRECT ATTACK

Working away from the fire front is more comfortable and less tiring for the crew.

There is more time to make decisions and prepare tracks prior to backburning and make use of natural features such as wet creeks, water courses, ridges and lightly fuelled areas.

There is time to consider the expected intensity of the backburn and as far as possible, by pass trouble spots or reduce the fuel to be burnt in critical areas.

4.14 DISADVANTAGES OF INDIRECT ATTACK

* The area of the burn is increased.
* Possible danger to crew.

WHENEVER THERE IS UNBURNT FUEL BETWEEN THE FIRE FRONT AND THE CREW, THE POSSIBILITY THAT THE FIRE COULD BUILD UP TO DANGEROUS INTENSITY MUST BE CAREFULLY CONSIDERED.

4.15 The time of day is an important factor. As the day grows hotter and humidity drops, the fire can be expected to increase in intensity. Wind, slope and fuel state must all be constantly assessed. However accurate assessment of the fire's behaviour is crucial to successful remote area operation. There is no place for foolhardiness in fire fighting, but

the remote area crew that is over cautious to excess may fail to take advantage of opportunities to contain the fire when the real danger is minimal.

4.16 FACTORS AFFECTING REMOTE AREA STRATEGY

* Time of day and corresponding air temperature and relative humidity.
* Type and quantity of fuel and dryness of the fuel.
* Slope.
* Prevailing or expected wind conditions.
* Proximity of safe areas.

One of the main aims of remote area strategy is to keep the fire as small as possible. Each hour of delay means an increase in the size of the fire and the work to be done. Experience in the Blue Mountains has shown that once it has been decided to suppress a remote area fire, an initial attack crew should get to work as soon as possible. If a fire is spotted late in the afternoon there is an advantage in flying crews in before dark. Even if they can't do much work on the fire until the following day, they will be on hand to start work at first light; the best time for suppression and mopping up after the fire has been cooled by the night air and increased night time humidity.

They will usually be able to do some work on the most essential areas of the fire before bedding down for the night.

4.17 If there is no other suitable safe area for a base camp, the crew can sleep within the burnt area, provided it has been thoroughly checked for dangerous trees or limbs likely to fall during the night.

4.18 The policy of putting the first crew in at 'first light' on day two of the fire has usually resulted in their not reaching the fire front until mid morning when the fire is beginning to build up intensity, flame height and

rate of spread. The initial attack crews at Cloudmaker in 1976 and Mt. Martindale in 1980 reached those fires at approximately 1000 hours on day two. Time has to be allowed for the helicopter to get mobile and fly from its base to the pick-up point, for crews to be ferried in and walk to the fire. In later fires, e.g. Scotts Main Range, although the crews did not reach the fire until dark, they were able to contain most of it before standing down for the night. By mid morning they were able to complete the initial mop-up and cut a helipad at the site. Relief crews were able to continue mopping up and patrolling a contained fire. The man hours and helicopter flying hours were considerably reduced because the fire was contained during the hours most suited to the fire fighters.

The head of the fire would have moved up a very steep ridge during the night if the crew had not been there to contain it.

4.19 PREPARING PERIMETER TRACKS

The first point to assess is the proximity and progress of the fire you are trying to contain. There must be enough time to safely complete the perimeter tracks and put in the backburn before the fire front is too close. This decision will normally be made by the senior field officer. The change that takes place in the behaviour of the fire front can be quite dramatic between 0800 and 1100 hours.

4.20 A flame height of 10 cm at 0700 hours may become a crown fire late in the morning. This must be kept in mind whenever fire fighters move ahead of the fire to cut tracks.

SURVEYING PERIMETER TRACKS

This should be done by experienced personnel as several factors need to be considered and most of them involve prediction of fire behaviour.

4.21 FUEL TYPE AND QUANTITY

The conditions the backburning crew will have to face must always be kept in mind. Fuel levels should be sufficient for the fire to carry itself but not excessive. The amount of radiant heat likely to be emitted shortly after ignition must always be considered. Ti tree is likely to flare and can sustain a crown fire without the support of ground litter. Fine fuels such as well cured grasses and eucalyptus litter can produce suprisingly large flame heights for short periods. The remote area fire fighter who is surveying a perimeter track must be able to assess these factors on sight. If the fuel is too heavy it can be modified by removing some of the fuel on the side to be burnt, otherwise the track will have to be re-located.

4.22 EASE OF CUTTING

The amount of manpower and effort required to cut a satisfactory perimeter track is an important factor in remote areas. The use of natural features such as rock ledges, rocky outcrops and lightly fuelled areas can save work. The shortest distance between two points is not necessarily the most easily raked. Rough, stony ground may have light fuel loading, but it is difficult to rake. It is often better to make a slight detour to avoid awkward spots but sharp corners or zig zagged sections may cause problems for the crew lighting the backburn, especially in steep terrain.

4.23 TREATMENT OF POTENTIAL TROUBLE SPOTS

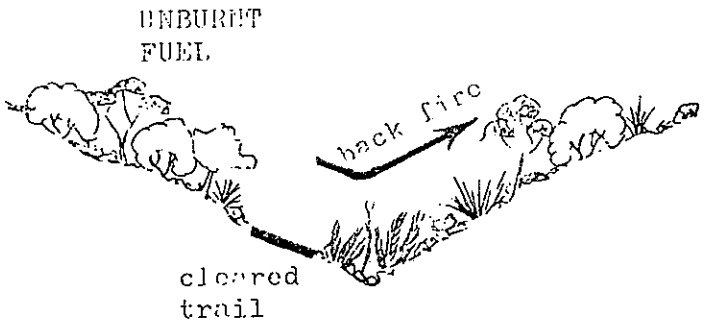
A little thought and extra work when the track is being prepared can save a lot of work later on. Raking fuel away from the base of piped trees before the backburn may save having to fell them at a later stage. Detouring around the end of a large fallen log or reducing excessive quantities of fuel on the side of the track to be burnt makes the job of lighting and mopping up the backburn easier.

A single twig or path of dry litter centimetres wide is enough to carry the fire across the track, especially in very dry conditions.

4.24 SLOPING GROUND

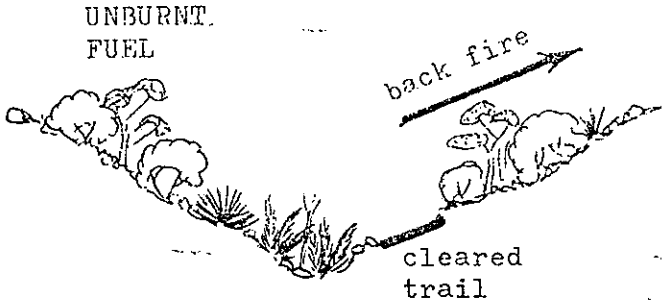
Whenever a perimeter track is below a fire in steep country, there is the potential for burning embers to roll across the track and re-ignite the fire. Where a dry watercourse is being used as a perimeter it can often be used as a gutter to trap rolling embers.

(a)



This back fire may be a little more difficult to light but much easier to patrol later as embers will be trapped within the burnt area.

(b)



This back fire may be easier to light as the fire is moving uphill, away from the crew, but it will need more mopping up as embers can roll across the tracks into unburnt fuel.

Dry Backburning

4.25 Night time is the best time to put in a 'dry' backburn during the fire season. The cooler night air and slightly increased humidity reduce the fire intensity and potential for spotting. Falling timber does not usually become a problem until some hours after the backburn has commenced and mopping up is taking place in daylight. If perimeter tracks have been well located and carefully prepared, many potential problems such as piped dead trees will have been eliminated.

Don't forget your torch. It gets very dark when the edge of the fire near the track has gone out.

4.26 Backburning should always be carried out or closely supervised by the most experienced available personnel, skilled in predicting the behaviour of the fire they are lighting up. Dry backburning calls for even more experience of fire behaviour when tankers are not available as a control measure. Once dry backburning is commenced, it is usually impossible to contain short of its planned terminating point.

Careful timing is necessary to co-ordinate with other sections of the backburn and to keep the burn under control. Lighting up too much perimeter too quickly is easy to do but can result in much too big a fire front. One bad mistake is enough to jeopardise the whole operation when you have no water available to help rectify the mistake. The burn should only be deepened when it is necessary to do so and when it is quite safe to leave the perimeter track.

A competent drip torch user constantly watches the progress of the fire and 'shapes' it according to his needs. He is patient and will not take unnecessary risks which could place him and other crew members in danger. Any novice at his first fire can set fire to dry fuel, but skilled backburning calls for experience and judgement.

4.27 BEFORE LIGHTING UP ENSURE THAT:

* The cut off point for your fire has been decided, surveyed and prepared as far as possible.
* Perimeter tracks have been completed or are well enough advanced to ensure they will be completed before you need to light up from them.
* Difficult or heavily fuelled sections have been adequately prepared to make the burning operation as safe as possible.
* Co-ordination, starting and proposed completion times have been decided and you are working according to the plan devised by the senior field officer.

The crewman lighting up should have at least one other crew member nearby, preferably with a knapsack for emergency use and he must always consider his situation if the burn gets out of hand. He should never be lighting up away from a track in anything other than very light fuels, especially at night.

5.9 NIGHT TIME MOPPING UP

In remote area fires it is even more essential than usual to take the maximum advantage of conditions which favour the fire fighters. This may mean working throughout the night to contain and mop up the fire so that there is no active front to combat when the next day warms up, usually from about 1000 hours. A fire front which is too hot to work on at 2200 hours will usually be much worse by 1000 hours the next day unless fuel and weather conditions have altered dramatically.

Once the fire has been contained, or if it is not likely to move far during the night, it may be possible for most of the crew to rest and re-commence work at first light. However night time mopping up is usually necessary, although there are problems related to the darkness once the flame front has been extinguished.

* It is much harder to spot potential dangers such as rock ledges or smouldering trees which may fall.
* Each crew member needs a torch and working by torch light is awkward, even if the torch is fixed to your helmet like a caver's lamp.

However the advantages of night time operations will almost invariably outweigh the difficulties.

The aim should be to have the fire sufficiently well mopped up before 0800 hours the next day to ensure that it can be contained during the heat of the day. It should be expected that a re-ignition is likely somewhere along the perimeter during the day. Re-ignition is common in remote area fires because it is much more difficult to attain a complete black-out when restricted to "dry techniques".

Constant patrolling and work on potential hot spots is the only safeguard in remote areas.

If you are involved in a night time mop up:-

* Don't work alone.

* Move with extra care.

* Cast your torch beam above and around you for limbs or trees which may be likely to fall.

6 COMMUNICATIONS

Effective radio communication is essential for safety, efficient operation of the ground crews and the passing of information to the control centre which can direct helicopter operation and acquaint the planners at control with projected needs.

The Blue Mountains Bush Fire Brigade Organisation now has:

1. A mobile base which can be flown to the helipad, or the best location available at or near the fire. It is the link between packsets in the field and control.

2. A series of VHF packsets which are used by groups and field officers on the ground. Penlight batteries have been found to be more convenient and more reliable over long periods than nickel cadmium batteries. Ferrying nickel cadmium batteries back to control for re-charging is not always convenient.

3. Facilities for communication between helicopter and mobile base and/or packsets are especially useful for the direction of water bucket operation or requests for aerial observation.

If you are using a packset check that it is switched on and set to the right channel with the aerial properly attached. The packset should be held beside your mouth so that you speak across the microphone and not directly into it. Check the operation of the set before you take it to the fire.

Be as specific as you can in your message, especially when working through a relay.

Some of the more prominent fires on which this paper is based are as follows:-

Cedar Creek 1967

Long walk in/walk out. Pre helicopter fire. Small crew camped in Cedar Creek overnight in overhanging cave in complete safety despite the very hot fire above them. Modern techniques of mutliple aerial ignitions would have resulted in a less intense back fire. The exercise was not an initial attack on a small fire, but backburning and patrolling four kms. of Cedar Creek.

Cloudmaker 1976

The first helicopter remote area fire. Lasted for four days and involved many crew changes. Very steep terrain posed problems in containing fires which continually rolled beyond the raked perimeter. One large scree slope proved hazardous as large rocks were released in the burnt area above. The initial attack crew did not reach the fire front until mid morning and had a very hard days work. The reduction in intensity of the active fire fronts at 0500 hours the next morning was quite marked. Most crews had far too little drinking water. The inital attack crew was sustained by having one crewman moving along the line with a clean knapsack full of drinking water. The initial aerial survey was deceptive. The job proved much more difficult than it looked from the air.

Wentworth Creek 1977 (approximately 24 hours)

The RAAF Iriquois pilot who winched five men into this final western flank of the 1977 fire wanted to know why five men were needed for such a 'small fire'. It takes expertise to gauge the manpower required from an initial aerial survey which is always likely to be deceptive.

Martindale Hill 1980

Some terrain even steeper than Mt. Cloudmaker. The initial perimeter below the fire could not be maintained. One very large tree fell at night narrowly missing a three man crew and emphasizing the extra dangers of working below the fire in steep country. Perimeters had to be cut all the way to the Grose River. Duration four days. Initial attack crews were ready to depart from Medlow Bath at daybreak but the helicopter was delayed and the first crew did not reach the fire until approximately 1000 hrs. Some crews did not reach the fire until 1300 hrs. The fire front was not initially intense but the terrain was difficult and very steep. A marked difference in the fire intensity was experienced on day three when a flame height of no more than half a metre at 0800 became, for a time, a crown fire by 1100 hrs.

Cedar Creek/Cedar Head (24 hours)

Polaroid pictures of the fire taken from the air and used by the initial attack crew were very helpful. A long walk in (1 1/2 hrs.). Initial crew camped in the burnt area and mopped up early the next day. Area unsuitable for construction of a helipad. Some equipment dropped in by helicopter and was carried out.

Scotts Main Range (2 days)

Initial attack crew flown in shortly before dark. Two km. walk in. The head of the fire was pinched out the same evening and first mop up completed early on day two. Second helipad completed early on day two. Over zealous crew cleared it to bare earth creating a dust problem for the pilot on his initial day two flight. The flying in of crews before dark on day one proved much more satisfactory then the Cloudmaker and Mt. Martindale fires.

Bindook 1982

Crews drove in over very rough bulldozed track reaching the end of the driveable track at 2400 hrs. The break out they were to contain was surveyed by a four man party during the night but the sixteen man crew began work on the fire at 0530 hrs. and were able to contain most of the fire by 1000 hrs. The helicopter water bucket was very helpful in cooling hot spots so that ground crew could mop them up. Fire fronts in these areas were too hot for crews to cope with until they had been cooled by the helicopter. Ground to helicopter communication, though of poor quality, was established for the first time. The area was suffering severe drought conditions and crews were inclined to dehydrate easily, but managed to successfully contain the outbreak across Tomah Creek. This area was too inaccessible to use bulldozers.

Zircon Creek - Mt. Wilson 1981

One of several backburn perimeters proved a classic example of a perimeter track not being completed to its ultimate point. The backburning crew boss on the end of a sixteen hour day assumed the excellent track at the top of the ridge had been completed into Zircon Creek, but it had only been taken as far as the first ledge into the softwood. The remaining 400 metres through very heavy litter had to be completed by three men at 2200 hrs.

Wolgan Valley 1983 (approximately 1 week)

Drought conditions prevailed. The fire on the western side was eventually contained by a direct attack on the fire when it moved into lighter fuel. Although this was the third direct attack on this section of the fire it saved backburning through a creek bed which, although it appeared 'wet' from the air, proved from a close inspection to be carrying huge tonnages of very dry litter. Other sections of the fire on the eastern side were extensively backburned.

Nebo Point 1982 (3 days)

The fire was successfully contained by track cutting and backburning. The terrain was much easier than Cloudmaker and Martindale, apart from a steep section on the western side. Four helipads were used, two of them being large flat rocky areas in Erskine Creek. The helicopter water bucket was of great help to crews during a hot outbreak on day two. The portable mobile relay was used for the first time and proved very successful. A fire fighter managed to 'eject' the door of the National Parks and Wildlife Service helicopter by pulling the eject lever (fortunately while the aircraft was on the ground). A crew dropped at the wrong pad showed a need for better communication between the fire crew, the main helipad dispatcher and pilot. Due to this error and the need to put the 'ejected' door back onto the aircraft, the pilot almost ran out of daylight due to errors made by other personnel.

The Duckholes - Blaxland 1982 (12 hours)

A decision by the National Parks and Wildlife Service to divert the Service helicopter from Gingra Range to the 'Duckholes' fire enabled it to be suppressed quickly. The field officer in charge of the initial ground crew was of the opinion the crew could not have contained the fire without the help of the helicopter water bucket. Some areas at the head of the fire were extinguished by the helicopter and were quite 'dead' several hours later without any raking around them having been completed.

In all of the above fires, with the possible exception of the Wolgan Valley/Newnes fire, the mopping up and patrolling after the fires had been contained occupied most of the time and man hours. However, it is essential that final mopping up is completed thoroughly and the fire patrolled until the likelihood of re-ignition has passed, otherwise the initial efforts can be wasted.