AIRCRAFT CONTROL BURNING GROUND MARKING PROCEDURE.

by G.W. vanDidden.

Introduction:

The controlled burning of large areas of forest, to reduce the fuel accumulation and thereby reduce the fire hazard, is one of the methods used to protect West Australian hardwood forest from damage through wildfires.

Aircraft burning to achieve this aim is only relatively new in this state, yet the growth has been rapid. Since the inception in 1965, when 53,000 acres were burned, annual acreage has now risen to 188,363 acres. The proposal for 1967 is aimed at approximately 411,000 acres.

This rapid growth is mainly due to the large areas which can be burned successfully under suitable weather conditions with controlled rates of spread and minimumfire damage. In the lower south-west there are large areas of forest with thick scrub, mixtures of forest types and sparse roading. Annual grid ignition where possible can be costly, difficult and sometimes dangerous, therefore aerial ignition has been found a safe alternative.

Equipment:

The aircraft used in the operations during 1965 and 1966 was a Cessna 337 Twin Engine push-pull Skymaster. The aircraft proved satisfactory during the 1965 season so was again chosen for the 1966 season. This season lasted longer and brought out one of the drawbacks of the Cessna 337. Under full load and high temperatures the Cessna would barely climb on the front motor, or at only 200 f.p.m. The decision was therefore made to change over to a Beechcraft Baron B55 for the 1967 season. This aircraft is a twin engine cantilever monoplane with retractable landing gear. It has two six-cylinder engines rated at 260 h.p. where as the Cessna has a rated horsepower of 210 per engine. The B55 being more powerful will provide a higher safety margin in climb performance on one motor.

Dropping Machine:

The initial burns in 1965 were started with a priming device for injecting ethylene glycol into capsules, by the operator pulling a lever, causing a hypodermic needle to puncture the top of the vial and delivering a liquid charge of 1.5 ml into the capsule. After a few moments the operator could feel a pulse from the plate on which the incendiary was placed. This was the signal to drop the capsule out through an ejection pipe. The machine was fatiguing to operate so changes were made for the 1966 model.

The 1966 model consisted of an eight station rotating turntable, geared and timed to an automatic injection syringe. It was electrically driven from

The aircraft's internal electrical system. The regulation of turntable speed and capsule ejection rate was controlled through a large twin coil rheostat, mounted on top of the machine. This gave a range of speeds from one ejection every two seconds (or five chains) to one every six seconds (or 15 chains if travelling at 100 knots). The machine was 24" wide x 18" deep and 36" high with an all-up weight of 145 lbs. The position for mounting was on the right hand side of the plane, taking the position of the centre seats.

The left hand side in the centre was taken up by a metal cabinet containing trays for 1,850 incendiaries, this being sufficient for 9,250 acres at a spacing of 10 chains by five chains.

Pre-burning Preparation:

Inspection: The areas planned for control burning are inspected as for normal burn. Quantity of fuel must be even, to allow the incendiary capsules a chance to ignite surrounding fuel.

Perimeter tracks: Should permit the rapid movement of transport for marker vehicles and suppression forces.

Edge Preparation: Any swamps or flats with ti-tree and paper-bark, crossing an external track receive particular attention when putting an edge burn of 2 to 5 chains deep around the whole area. This is done with a flamethrower, mounted on a four-wheel-drive vehicle or a tractor. The edge burn may not be necessary if the adjoining area is recently burned.

Index table: All areas inspected for the proposed burns have a prescription written to suit the particular area. The prescription is related to the crown height of potential crop trees. The areas are then summarised into an index table, an example of which is shown, for Spring 1966.

[See over page for Index Table]

Index Table

Table shows area, prescribed fire danger, fuel age and job number,

Job Number	Green					Blue					
	Age Years					Age Years					
	4	5	6	7	Acres	4	5	6	7	Acres	Division
		1			5312	3				2880	
		2			8704			6		5120	Shannon
		4			15040		7			10368	
			5		7040						
			8		7000						
					6208		9			7488	Pemberton
		11			7040						
	13				6912	12				10624	Manjimup
	14				17344						

N.B. Where 4 year-old = 2.5 to 3.0 tons/acre fuel.
5 year-old = 3.0 to 3.5 tons/acre "
6 year-old = 3.5 to 4.0 tons/acre "
7 year-old = 4.0 to 4.5 tons/acre "

The index table is the basis for selecting daily programmes which are obtained by consultation between the O.I.C. concerned, the F.C.F. and the Fire Control staff.

The forecasted fire danger is matched with the prescribed fire danger and the result is then matched with the index table to select the days programmes.

Day to day Operations:

1. Day before the burn. Tentative planning of the area for burning by matching the forecasted fire danger to the index table.

2. Day of burn - 0745 forecast to confirm previous day's planning or alter if fire danger is different.

3. 0745-0800. Planning to involve the level of suppression forces, calculation of strip widths and direction of flight lines.

4. Flight plans were drawn up in the office after establishing the required factors, such as strip width and direction of flight lines.

The majority of plans were drawn up individually, this job being most time consuming. Nannup Division produced the ideal plan. These were sun-prints made from a single master sheet, showing in weather details, flight lines and numbers, control point position, patrol sectors for suppression crews and marker crews. These will be generally used during 1967.

5. O.I.C. suppression and O.I.C. markers depart 0800 for areas to be burned.

On arrival of the aircraft at the area to be burned it was found that the following were a great advantage in helping to identify the starting flight line. The marker crews had a hot log fire going and some five minutes prior to E.T.A. over the burn, threw green branches or material on the fire to produce a dense smoke. Alternatively, the co-pilot could call for a flare from whichever marker was nearest to the aircraft.

More powerful beacon transmitters will be used during 1967, and these will assist also in finding the area to be burned.

On receiving take off instructions from ground control, the aircraft would take off and set a heading for the burn.

Ground Marking: On arrival in the burning area the aircraft would do a complete circuit of the area to familiarise the crew with the shape and layout.

It was always the practice to receive the go-ahead from ground control before commencing the first flight line.

On receiving this signal it was found an advantage to make the first flight line a dummy run to enable the Pilot and the co-pilot to assess the wind drift, to determine the amount of Flame trajectory they could expect to see, and to note the strength of the marker beacons. All these factors were variable in the various areas but remained reasonably constant in any one area. This practice was found particularly useful in the southern Karri areas with their greater tree height and more undulating terrain. It was found that the following standard practice could be adopted for bombing runs of from $2\frac{1}{2}$ to 6 miles.

With the aircraft approaching from north on a north to south run the co-pilot calls "North beacon on " then "south flare" the marker on the south side fires his flare, and calls "flare fired". Co-pilot replies "flare sighted" "south on" "north off" (see diagram). The north marker shifts to the next position. The distance will be measured by a speedo graduated in chains, which was developed by the staff from the Manjimup workshop from a second hand Austin 70 speedo (design by Mr. L. Marshall). The speedo runs from either a Jeep or Landrover brakedrum by means of a polythene wheel transmitting the movement through normal speedo cable to the speedo.

Once the north marker is in position he advises the aircraft "north on line 2 " or as the case may be. As soon as the aircraft has passed over the south marker he shifts to the next flight line. The south marker should reach his position as soon as possible as the plane needs only 60 to 70 seconds to complete the turn and be over the starting point on the next flight line. As soon as the southmarker is in position he should call the plane by notifying "south ready". Three to five seconds after the plane has passed overhead the beacon should be switched off. The co-pilot will then call for "north-on" or "north flare". If only a flare is called for the beacon is still switched on.

The beacons are essentially small wireless transmitters with a frequency of about 1.7 m.c. and on R.F. power of 25 watts. The plane is fitted with A.D.F. equipment to accept the required frequency, broadcast by the radio beacon. The A.D.F. is fitted with a rotating aerial which locks on to the signal from the beacon on the marker vehicle.

The rotating aerial is coupled to a dial graduated into 360^{o}, the needle pointing to the direction from which the strongest signal is received.

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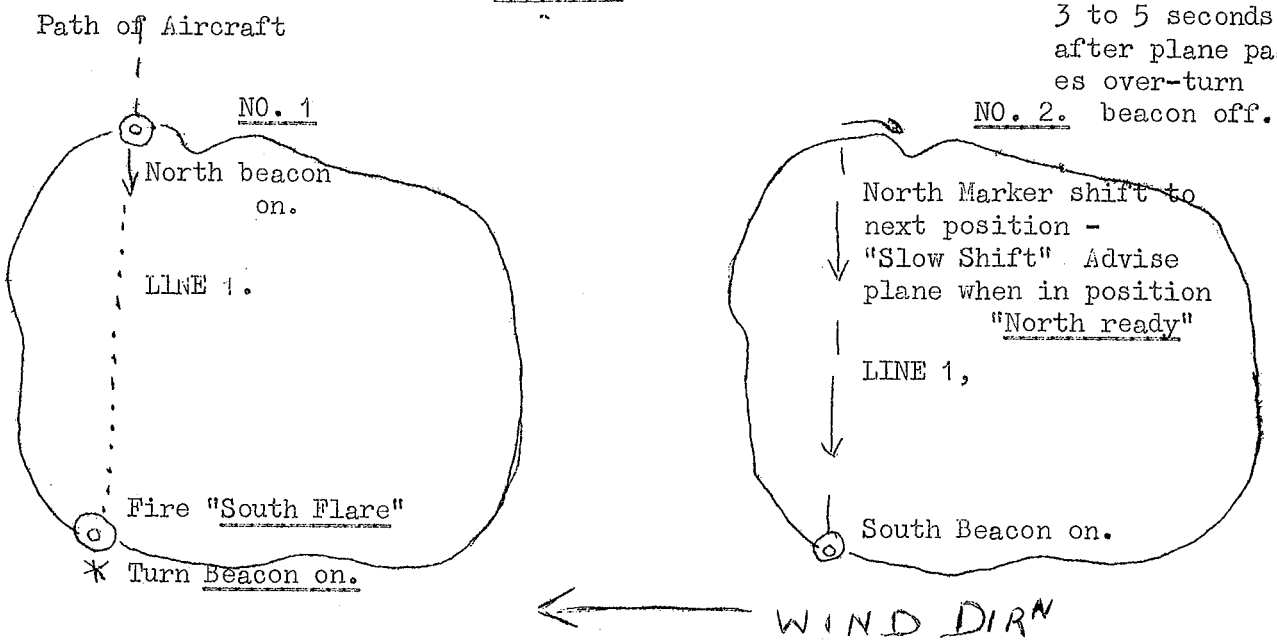
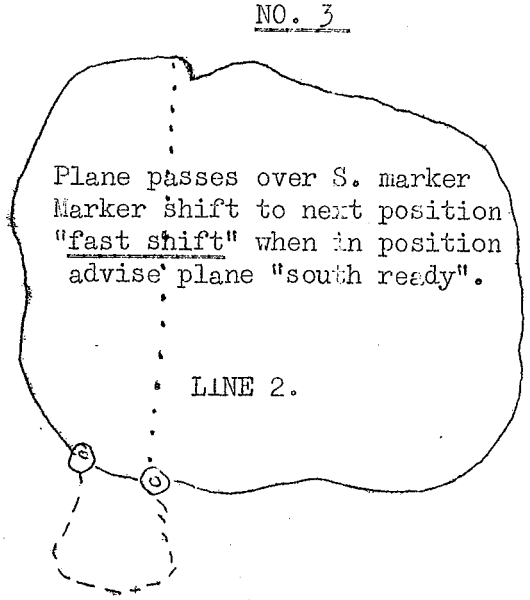
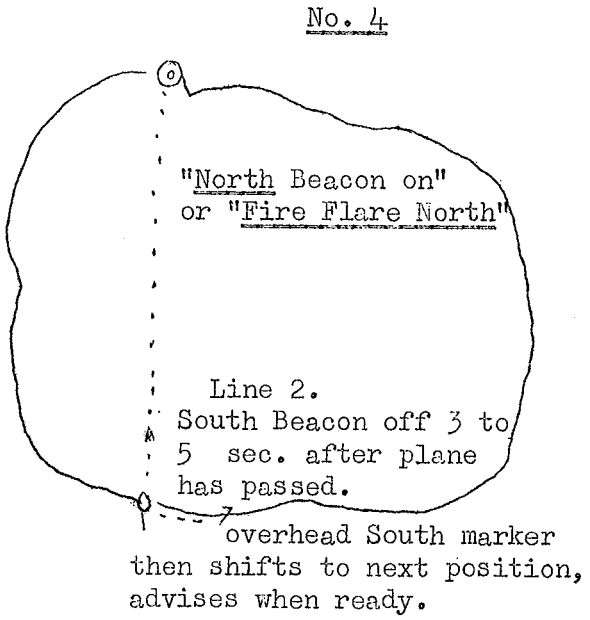
DIAGRAMS







The efficiency of the burn depends to a great deal on the speed of the marker crews and their proficiency. N.B. Speed for the distance measuring meter should not exceed 10 m.p.h.