SESSION 1
PAPER (a)

HELICOPTER THINNINGS EXTRACTION

(a methods and data trial)

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INTRODUCTION.

The subject covered is a trial (August 1978) to extract radiata thinnings at Waimihia State Forest (Taupo). Equipment and manpower for the felling and wood preparation were supplied by the Forest Service and the helicopter for extraction by Lakeland Aviation.

This paper comments on the extraction phase of the logging cycle.

The authors involvement was as controller/timekeeper for a work study team providing data collection services.

OBJECTIVE

The objective was to ascertain the operability of the equipment and the techniques related to helicopter logging and to gather data to assess the feasibility of logging with larger helicopters.

STAND DATA

Species	P.radiata.
SPH before thinning	950
SPH after thinning	304
Average stem removed	0.15m3
Stand DBHOB	21.7cm
Stand Height	17m
Topography	Flat
Undergrowth	Nil

EQUIPMENT

Hughes 500 helicopter	365kg payload
	280KmPH max
	335 kilowatt
Main rope	18metres link chain
	1360kg breaking strain
	electro/manual release at both ends
Strops	13 polypropylene 1820kg breaking strain
	spliced eye one end,either steel ring or
	spliced eye at the other
Crew	pilot
	breakerout (pilot by trade)
	bushman
	skiddy

INITIAL PHASE

Landing layout,road construction,and the felling/trimming operations were all completed prior to the helicopter arrival. This work had been done as if for a skidder extraction system with no special considerations for helicopters.

WORK METHOD

The helicopter travelled to the bush with the main chain rope dangling below. Once located above breakerout it hovered until the breakout could reach the chain. Helicopt then hovered above tree height.

Prestropped logs were hooked on to main chain,breakerout signalled with a handwave, and the helicopter then took a straight line to the landing. Dependent on line of sight at the landing either the load (a) would touch the ground and be dragged to the drop point or (b) be manouvered until the load was suspended over the drop point and then lowered and released.

Once released the strops would be left on the skids and the helicopter return to the bush.

When convenient the strops from previous loads would be attached to the chain and returned to the bush.

This format was repeated over three haul distances - 800,1100.2400 metres.

DATA.

Table 1.

Haul Dist	ELEMENT TIME PER HAUL (Decimal Minutes)							
	Haul Empty	Lower	Breakout	Raise	Re-adjust	Haul Loaded	Drop	Pick up Strops
800	0.648	0.152	0.071	0.302	0.050	0.659	0.174	0.008
1100	0.731	0.164	0.103	0.275	0.154	0.829	0.296	0.036
2400	1.029	0.209	0.086	0.336	0.100	1.443	0.198	0.026
Average time for static elements		0.173	0.088	0.301	0.104		0.227	0.024

Table 2.

Haul Dist	Number Hauls	Number Pieces Total	Average Piece m3	Pieces per Haul	m3 per Haul	Average Cycle Time	m3 Haul as % Helicopter Maximum (.32m3)
800m	15	22	.15	1.47	0.22	2.06	69%
1100m	18	23	.18	1.28	0.23	2.59	72%
2400m	14	24	.13	1.60	0.21	3.49	66%

Description of elements is contained in Appendix 1.

Distribution of elements by percent in Appendix 2.

DISCUSSION.

Helicopter logging is often regarded as the perfect answer to eliminating the shortcomings of so called "conventional systems" eg haulers, skidders. It still requires the basic loggers skills plus a few specialist ones. In this trial some obvious deficiences in the skills needed were evident.

PAYLOAD.

An average load of .22m3 represents only 69% of the available load capacity. (maximum load carried was .34m3 or 104%). Minimum was .12m3 or 38%)). Inexperience in estimating log weights,poor log preparation in the bush, poor communications between the pilot and breakerout,and too many spectators all contributed to the low weights.

TRAVEL TIME.

The fastest is not necessarily the best applies equally to helicopters as to other logging machines. Although capable of 280 KmPH the operation speed was nearer 80-100 KmPH. Any faster than this resulted in overshooting. Travel time could have been improved through the use of aids to mark the bush and landing points.

EQUIPMENT

(a) The helicopter provided no holdups or delays.

(b) Strops showed little sign of wear but were never really tested to breaking point.

(c) Manpower. The pilot required several short rests. The constant low level operation with multitudes of movement changes plus the safety of the ground crews (and spectators) all combined to leave him physically and mentally exhausted. It is probable that a full scale commercial operation would require more than one pilot per machine.

(d) Communications. Direct radio link from ground to air at both bush and landings is essential. The use of hand signals as used in this trial was dangerous in terms of misunderstandings and tiring as the pilot was forced to lean out the door to observe all activities.

(e) Clothing. 1. Bright clothing, easily seen from the air, were worn by the breakerout. Others at the trial wore traditional forestry clothing. It was most apparent that the bright gear was safer.

2. Goggles for ground crew are necessary. In the bush pine needles,branches,dust, are all tossed around in the downdraught. On the landing dust is the main problem.

3. Boots, helmets, earmuffs are considered as standard items.

ELEMENTS.

Drop The variation in drop time for the 1100metre haul highlights the importance of skid location. This landing required more manouvering before dropping because of surrounding trees and roads.

Re adjust This was a direct result of inexperience. Premeasurement in the bush, a better knowledge of weight to length, a high standard of trimming, an exoerienc breakerout, would eliminate this element.

DAMAGE.

No damage to final crop trees occurred using the helicopter for extraction. An unknown quantity is whether the tree tips during the spring flush would be snapped by the downdraught.

PRODUCTION AND COSTS.

Table 3.

	EXTRACTION PHASE ONLY.					
	HELICOPTER			SKIDDER		
Distance	800	1100	2400	800	1100	2400
Annual m3	12800	11400	8200	15700	12000	5900
DOLLARS m3	39.75	44.63	62.05	2.99	3.91	7.97

Costs as 1/6/81.

The above table assumes for the helicopter that there is no re-adjust element, that average haul is the maximum of .32m3, and no allowances. For the skidder (current logging method used in this topographical site) a 51-75 Kw machine, average haul 2.15m3, and no allowances. 75% availability is assumed for both systems. Refer appendix 3. From the above data it appears that helicopter thinning of radiata under these condition would be an economic disaster. However the trial did achieve its objectives in that the equipment was proven to be practical, the techniques viable (subject to alterations outlined above), and it pinpointed the importance of log preparation, experience, and planning, whilst highlighting the speed of operations.

APPENDIX 1.

DESCRIPTION OF ELEMENTS.

Haul loaded. Travel from bush to landing after logs have cleared the tops of crop trees.

Drop. Haul of logs is released onto the landing.

Haul empty. Travel from landing until above the breakerout.

Lower. Once positioned above breakerout helicopter is lowered until breakerout catches the end of the mainline.

Breakout. Prestropped logs are hooked onto the mainline.

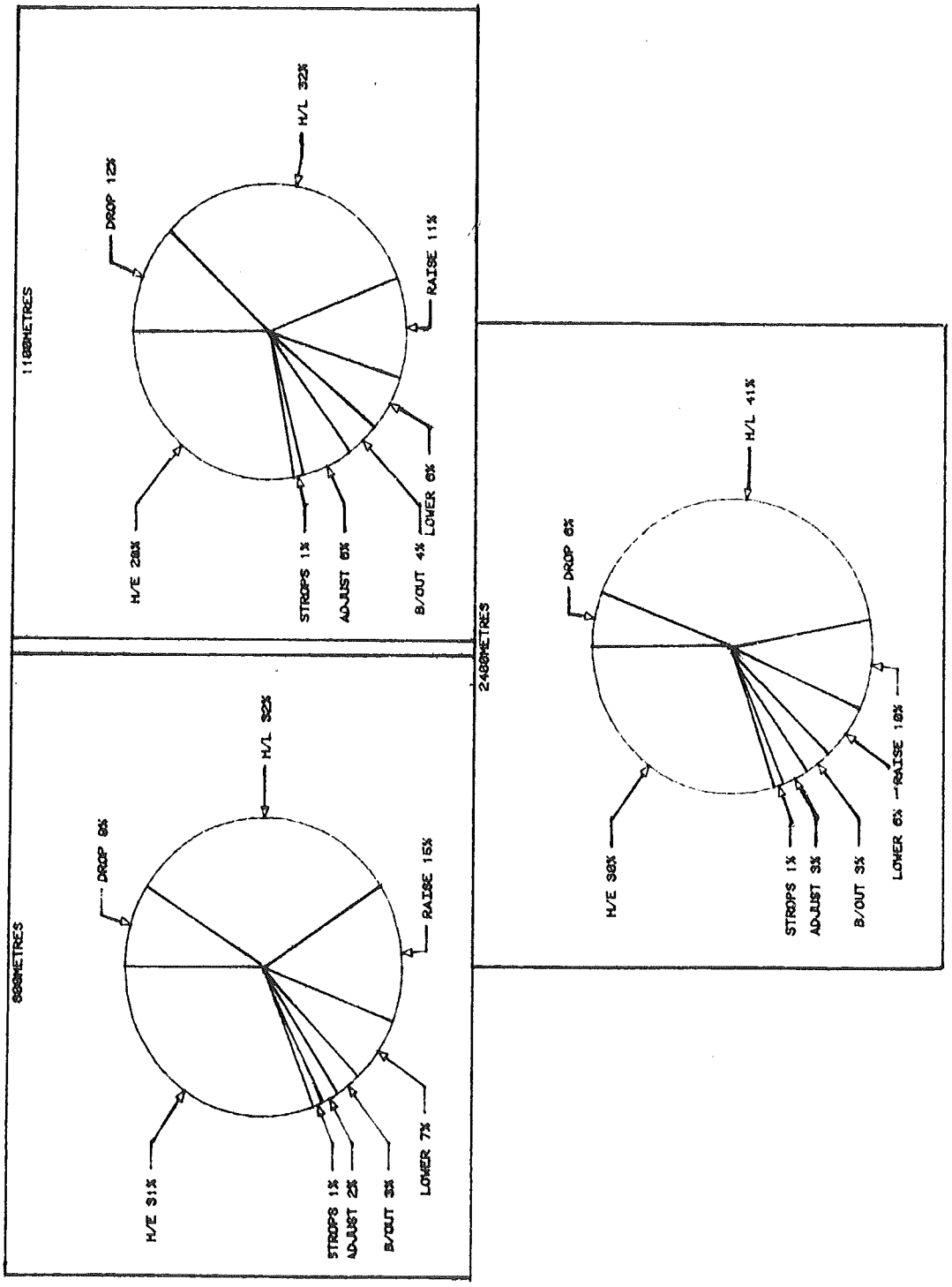
Raise. Logs are lifted until completely clear of final crop trees.

The above elements occur with each cycle. The following two elements occur intermittently.

Pick up Strops. After the drop element the strops from previous hauls may be attached to the mainline for return to the bush.

Re-adjust. During the raise element logs may be restropped or the haul aborted.

APPENDIX 2


1188METRES
DROP 12%
H/L 32%
RAISE 11%
H/E 28%
STROPS 1%
ADJUST 6%
B/OUT 4%
LOWER 6%
2488METRES
DROP 6%
H/L 41%
H/E 36%
STROPS 1%
ADJUST 3%
B/OUT 3%
LOWER 6%
RAISE 10%
888METRES
DROP 8%
H/L 32%
RAISE 15%
H/E 31%
STROPS 1%
ADJUST 2%
B/OUT 3%
LOWER 7%

APPENDIX 3.

PRODUCTION AND COSTS.

HELICOPTER.			800	1100	2400
	Haul loaded		.659	.829	1.443
	Haul empty		.648	.730	1.029
	Drop	.227			
	B/Out	.088			
	Raise	.301	= .813	.813	.813
	Lower	.173			
	Pick up strops	.024			
	TOTAL CYCLE		2.120	2.373	2.472
360*.32m3*235days/cycle =annual m3 =			12800	11400	8200
Costed at $350hr * 6hrs*235 days = annual dollars of $508775. This includes pilot plus one breakerout at $65day .					
	Dollars per m3 =		39.75	44.63	62.05

SKIDDER.			800	1100	2400
	Haul loaded		6.800	9.350	20.40
	Haul empty		6.000	8.250	18.00
	Drop	.34			
	B/Out	.97			
	Position	.41	= 2.620	2.620	2.620
	Bladework	.30			
	Skid travel	.60			
	TOTAL CYCLE.		15.42	20.22	41.02
360 *2.15m3 *235days/cycle =annual m3=			15700	12000	5900
Costed at $135day plus operator at $65 day for 235days per year =annual dollars of $47000					
	Dollars per m3 =		2.99	3.91	7.97