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DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

RECORDS:

1968/25

PROGRAMMING HELICOPTER OPERATIONS IN NEW GUINEA - SEPIK PARTY 1967

by

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SUMMARY

A Bell 47G3B1 helicopter was used by the Sepik Party for 9 weeks during the 1967 field season in the inaccessible unpopulated mountains south of the Sepik Valley in New Guinea. Landing sites were very sparse and new methods of working with helicopters had to be evolved during the season.

INTRODUCTION

Until the introduction of the Bell 47G3B1 with its excellent high-altidude performance, small helicopters were of limited use for regional mapping in New Guinea because they could not perform usefully above about 5000 feet. The Bureau was one of the first organizations to use the new machine when in 1963 the Western Highlands were mapped (Dekker 1964), and again in 1965 when they were used in Bougainville. During these surveys the pilots flying the helicopters were lacking in New Guinea experience and the full capabilities of the machines were not realized, especially during the mapping of bush-covered areas where landing sites are generally sparse.

Davies was the first to make full use of the capabilities of the new helicopter during mapping of the Papuan Ultramafic Belt in 1966, and as a result of his experience, both the Papuan Ultramafic and Sepik Parties used helicopters as the main means of access during the 1967 field season. A great number of the landings done in 1966 and 1967 would have previously been regarded as impossible, but only highly skilled pilots with a great deal of New Guinea experience are capable of making these landings.

The Bureau has been lucky to have the services of two of the best pilots in New Guinea: Captain J. Arthurson, and Mr. B. Evans of Helicopter Transport Pty Ltd.

SPECIFICATIONS OF THE HELICOPTER

The machine used by the Sepik Party was a Bell 47G3B1 which is a light machine powered by a 260 horsepower supercharged engine, and capable of seating two people in addition to the pilot. Freight is carried on racks on either side above the undercarriage which consists of two skids; floats can be fitted for landings on water and swamp, but these reduce the speed and payload so were only attached for a short period during the Sepik Survey.

Absolute ceiling:	21,000 feet
Operational ceiling:	15,000 feet
Cruising speed:	60 knots
Fuel:	100-130 octane aviation spirit
Tank capacity:	47 gallons
Fuel consumption:	14 to 16 gallons per hour
Loading:	Lifts a total of 1000 pounds up to 7500 feet (includes pilot and fuel). Decreases with increasing altitude.
Fuel weight:	7.2 pounds per gallon

Although the aircraft has a high operational ceiling, the supercharger which makes this possible is driven by the exhaust, and the engine cannot therefore be restarted after switching off at altitudes above 8000 feet.

Range:

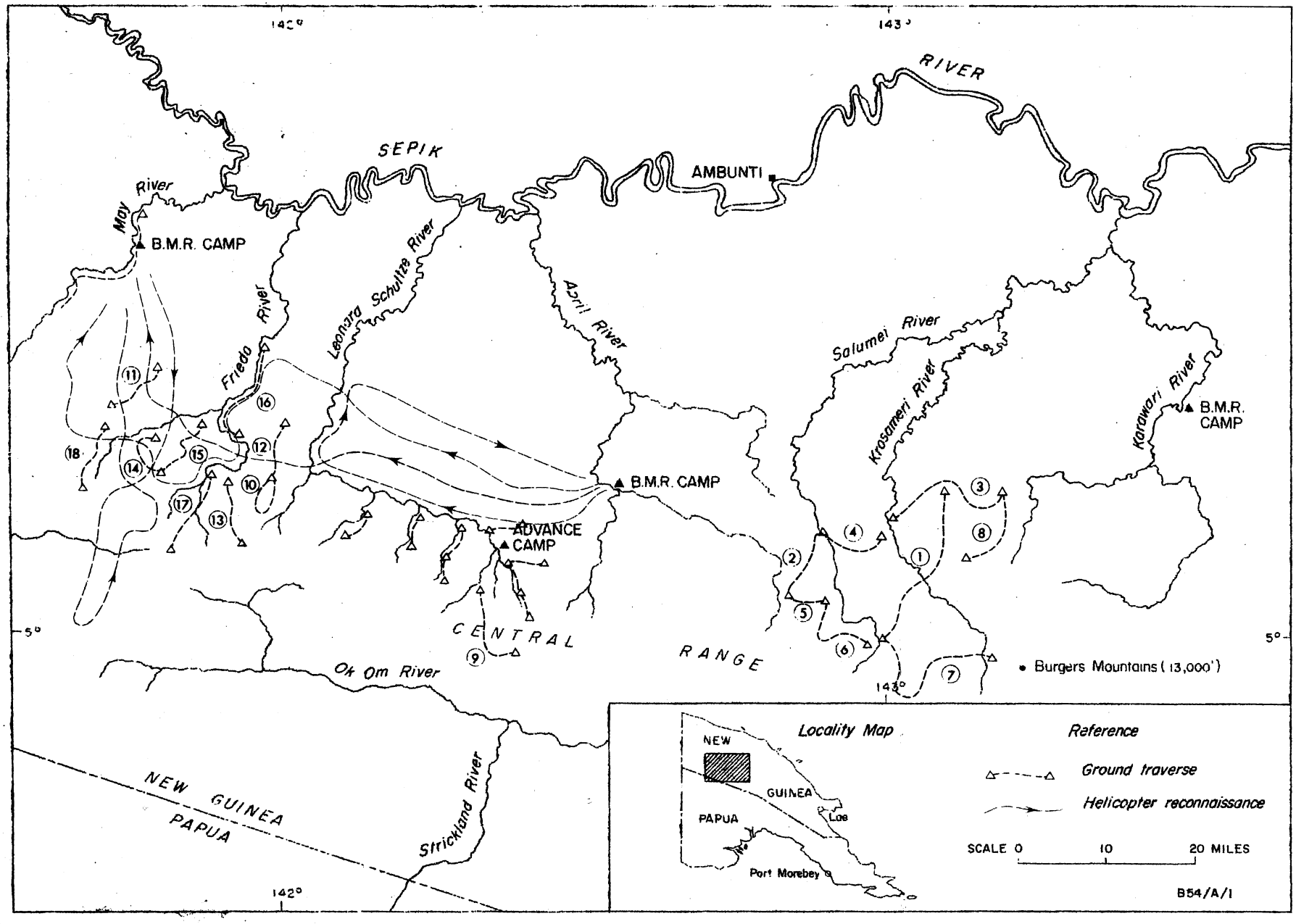
The fully-laden helicopter can fly for about 2½ hours or about 150 miles. If extra range is needed it is normally possible to reduce the cargo and carry two 4-gallon jerrycans, thus increasing the range to about 180 miles.

For reconnaissance work where only the geologist and survival gear is carried in addition to the pilot, the endurance can be safely extended to about 4½ hours flying time. Allowance must always be made for the possibility of bad weather on the return journey, and it is prudent to keep one hour flying time in reserve at all times.

COST OF HIRE

The contract rates and condition for the hire of the helicopter are given in Appendix I. To these costs must be added the cost of the fuel which when positioned costs roughly $1-00 per gallon (approximately $15-00 per hour for fuel).

SEPIK PARTY *TRAVERSES DURING THREE-WEEK PERIOD SEPTEMBER 1967* *Fig. 1*



Arrangements for maintenance of the helicopter in the Sepik were exceptional for the helicopter was stationed at camps well removed from airstrips. The Company's flight engineer was flown to Ambunti from Lae when a service was due (every 50 hours), and the helicopter was returned to Ambunti at the Bureau's expence. An extra $6-00 per hour had therefore to be added to the operational flying costs to cover this extra flying.

For costing a programm under the present contract, a round figure of $100-00 per hour is a good guide.

NATURE OF THE TERRAIN

The area mapped by the Sepik Party is shown in Figure 1. It is one of the most remote and inaccessible regions in New Guinea and poses difficult logistics problems, as the only access from the supply centre of Ambunti is by over 100 miles of river travel up the major tributaries of the Sepik River. The work could have been done entirely by helicopter using Ambunti as base, but it would have been prohibitively expensive because the flying time would have been about doubled.

The only alternative was to set up base camps close to the mountains from which the helicopter could position traverse parties in the mountains.

Though the use of jet-boats made setting up and supplying these advanced camps a relatively simple and inexpensive operation, the nature of the terrain nevertheless posed formidable difficulties for the traverse parties. The region forms the northern fall of the Central Range, and in places is rugged in the extreme, ranging in altitude from about 150 feet at the Sepik River, to 13,000 feet along the Central Range.

Probably the most serious handicap to the mapping was the lack of population, and the consequent lack of tracks over almost the whole of the region. Even where there were people, most had never before seen white men, and though most were friendly, they were reluctant to show us their tracks.

Access into the mountains beyond the limit of jet-boat travel was therefore well-nigh impossible on foot, except at prohibitive cost, and the helicopter provided the only practicable answer. Even so there were difficulties, for most of the area is poorly endowed with landing sites, and new methods of working had to be evolved.

WEATHER

Weather conditions in New Guinea are extremely variable and generally unpredictable, but the Sepik Party in 1967 had favourable weather and flying was seldom curtailed on this account.

Early morning fog prevented flying until between 8 o'clock and 9 o'clock on several mornings, but the April Camp was normally out of the fog zone which is troublesome further out into the Sepik Plains (Helicopters are not equipped with instruments for blind flying, and the pilot must always maintain visual contact with the ground).

It is an almost invariable rule that thunderstorms build up in the afternoon and prevent flying high in the mountains, and any landing sites likely to be shut out by such weather must be visited in the morning. Fortunately, landing sites in the larger river valleys, even well into the mountains, generally remain open until late in the afternoon.

RADIO COMMUNICATIONS

No radio communication was possible between base camp and the helicopter during the 1967 field season, and while this was not a great handicap, a reliable system of communication would be a help to the organization of the program.

Helicopter Transport Pty Ltd, applied for the allocation of a frequency for Company communications which could also have been used between base camp and the helicopter, but were refused because available frequencies in New Guinea are very crowded.

A frequency of 6815 K/c has been approved for intercommunication between Bureau field parties in New Guinea, and it is hoped that the helicopter can be equipped with this frequency.

FIELD METHOD

It was thought early in the season that much of the mapping could be done by day trips from the helicopter or by making spot observations wherever the helicopter could land, but we soon found that only a small part of the area could be mapped in this way because the geology is so complex and photo-interpretation almost worthless.

However, spot observations made during the initial reconnaissance of an area were an essential prelude to the later mapping and were used to delineate critical areas for traversing. Availability of landing sites and some idea of the terrain could be gained during these reconnaissances.

Only by traversing streams and examining all the available outcrops can the critical rock relationships be deciphered, but even where this can be done by day trips from the helicopter, a minimum of several hours walk is generally required. In some cases the helicopter can wait for the geologist to do this walk, but usually it is required elsewhere and must return later for the pick up.

Another factor militating against day traverses is that each geologist must be accompanied by one native carrier on these trips both to cut tracks and carry survival equipment, and also as a safety precaution in case of accident. Under these circumstances, to position and return each geologist for a day traverse required at least two hours flying, and the geological returns were generally not commensurate with the cost.

ORGANIZATION OF TRAVERSE PARTIES

One of the most economical, and geologically most productive, methods used was to position a geologist and his carrier line for traverses of 3 to 8 days' duration.

Previous geological parties in New Guinea used a minimum of 14 carriers per geologist, but as the helicopter can carry only 2 passengers and some gear, the cost of positioning such a party by helicopter is obsiously prohibitive. With the light-weight equipment evolved by Bureau parties over the last few years, it has proved possible to cut the number of carriers down to five per geologist for traverses of more than four days and to three per geologist for less than four days.

Thus a party can be positioned in the field by three return trips in the case of the larger party, and two return trips for the smaller. The same number of trips is required to return the party to base at the end of the traverse.

This method allowed some obvious economies not possible using day traverses:

(1) In some cases the carriers were kept in the field and were taken over by a new geologist who continued the traverse: only one return trip of the helicopter was therefore needed to position the geologist. Such an arrangement is rather hard on the carriers and was only done where the distances away from base warranted it.

(2) The most economical method which was used wherever possible was to position one party on the outward flights, and repatriate another party on the return flights. To utilize the helicopter fully by this method requires a large number of traverse parties operating, and is one of the main reasons for requiring at least four traverse geologists in the party.

In suitable areas a temporary camp accommodating the traverse geologists and the helicopter pilot can be established in a central location and the mapping done by means of day traverses. Only one area in the South Sepik region proved to have sufficient day trips available within a short distance to enable this method to be used.

BASE CAMP ORGANIZATION

The cost of the helicopter overshadows the other costs of the expedition, so it is imperative that the amount of flying be kept to the absolute minimum. I believe that this is possible only if the Party Leader confines his work to that of co-ordinator, whose main function is to gather the results of the traverses and use them to programme the later helicopter work. The time spent in this way during the Sepik Survey, though totalling many hours per day, resulted in the saving of many hours flying time.

The Party Leader is then able to take advantage of any periods suitable for reconnaissance flights.

On these occasions there was nobody left at base camp conversant with the operation, and a record of the parties movements had to be kept in camp. The lines of traverse of all the party members and any possible alternatives were plotted on a photo-mosaic kept permanently in the office, alongside a timetable on which all the parties schedules were plotted.

Early in the season the helicopter pilot was also given a copy of the photomosaic with all the traverse lines plotted, but as he became familiar with the area, he found perusal each morning of the copy kept in the office was sufficient. It must be emphassized however that Mr. Arthurson is an exceptional pilot and navigator, and most other pilots would need explicit instructions every day.

As an example of the type of operation carried out by the Sepik Party in 1967, I have shown below the operations chart used for part of the season (Table 1). Figure shows the traverses done during that period.

(Note: The Base Camp shown on the April River is shown at the wrong stream junction and should be 10 miles farther downstream).

TABLE 1

TRAVERSES MADE DURING A THREE WEEK PERIOD - SEPTEMBER 1967

DATE	HELICOPTER HOURS FLOWN hrs-mins	DOW	SMIT	RYBURN	BAIN	PAGE	MACNAB	FIELD ASSISTANT
SEPTEMBER MONDAY 4	5 - 55		0800 Drop Bisorio	0800 Drop Salumei R.				
TUESDAY 5	5 - 53				0800 Drop Krosameri River	1000 Drop Salumei R.		
WEDNESDAY 6	5 - 00	Reconnaissance Frieda and May Rivers	(1)	(2)				
THURSDAY 7	3 - 39	Reconnaissance Leonard Schultze River			(3)	(4)		
FRIDAY 8	3 - 45					1400 Pick up Krosameri River		
SATURDAY 9	2 - 46			1400 Pick up native village				1400 Drop native village
SUNDAY 10	3 - 41				1600 Pick up Yokopos Ck.			(5)
MONDAY 11	4 - 34		0730 Pick up Wulifa R.			1200 Drop Salumei R.	0730 Drop Wulifa R.	1200 Pick up Salumei R.
TUESDAY 12	2 - 43			0800 Drop near Yokopos Ck.				
WEDNESDAY 13	4 - 08	1400 Drop Gufug Camp.	1600 Drop Gufug Camp.	(8)	1600 Drop Gufug Camp.	(6)	(7)	1400 Drop Gufug Camp.
THURSDAY 14	6 - 38	Day Traverse	Day Traverse	1400 Pick up Yokopos Ck	Day Traverse.			
FRIDAY 15	4 - 24	Day Traverse	Day Traverse	1000 Drop Gufug Camp.	Day Traverse			
SATURDAY 16	9 - 11		Day Traverse 1600 Return April Camp.	Day Traverse 1600 Return April Camp.	Day Traverse 1700 Return April Camp.	1200 Pick up Salumei R.		1700 Return April Camp
SUNDAY 17	5 - 11						0730 Pick up Kasagari	
MONDAY 18	1 - 54				0800 Drop Leonard Schultze R.			
TUESDAY 19	8 - 16		0730 Drop Frieda R.		(9)	0930 Drop Frieda R.		
WEDNESDAY 20	9 - 18	Frieda River Reconnaissance 1600 Transfer to May River	(10)	0800 Drop Frieda R.		(11)	1200 Drop Frieda R.	
THURSDAY 21	BASE 3 - 27	CAMP Reconnaissance Niar. River	0800 Transfer to Porphyry Ck.	TRANSFERRED (12)	TO	MAY	RIVER (13)	
FRIDAY 22	9 - 14		(14)		1400 Pick up Return May R.	0900 Pick up Return May R.		
SATURDAY 23	4 - 26	Jet boat Mapping lower May River		0800 Pick up Return May R.		0900 Jet boat Frieda R	0800 Transfer Porphyry Ck	
SUNDAY 24	1 - 48				0800 Drop Wabia	(16)	(15)	
MONDAY 25	3 - 06		0730 Pick up Return to May R.	0730 Drop	(17)	Return to May Camp		
TUESDAY 26	3 - 48	Jet boat Reconnaissance Upper May R.		(18)			0900 Pick up Return to May R	
WEDNESDAY 27	2 - 51			1600 Pick up Porphyry Ck		1600 Drop Porphyry Ck		

Time spent compiling geology at base camp.

Helicopter drops one party, picks up another.

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The area mapped in early September was about one and a half hours flying time from base camp so it was imperative to use the outward trips of the helicopter to drop a party and the return trips to retrieve another party in the same area.

Between 13th and 16th September half of the party was mapping by day trips from a flying camp near Gufug Creek.

During this early part of the month a field assistant was used to keep a line of carriers in the Salumei area until Page became available for traverse on 11th September. This manoeuver saved one return trip of the helicopter which in this case represented about 3 hours flying time. That this flying would have cost approximately $300-00 shows the magnitude of the savings that can be made.

The large amount of flying time done between 19th and 22nd September was occasioned by the shift of the party base camp from the April River to the May River Patrol Post. The traverse parties were dropped in areas about half-way from the April Camp, and picked up at the end of the traverses and taken to May River.

Plotting of results, labelling of samples, filling out sample cards, and preparing for the following traverse took a minimum of one and a half days hard work in base camp, and it can be seen that the six geologists were fully occupied in order to keep the helicopter fully utilized. Most other areas in New Guinea are probably less demanding on the experienced geologists time, but most areas would need a minimum of four experienced geologists during the helicopter operations.

ARRANGEMENTS FOR SET-DOWN AND PICK-UP OF PARTIES

Landing sites were almost entirely restricted to gravel beaches in the larger tributaries: earlier it was thought that native gardens would provide many landing areas, but in fact almost all proved unsuitable either because they were steeply sloping, or else obstructed by stumps. With experience it became possible to predict landing sites from the air photographs with about 90 percent certainly; unfortunately it was quite common to find suitable spots in the lower reaches inundated by rivers swollen by overnight rain.

With landing sites so few and far between it was seldom practicable for a traverse party to end up at a natrual landing site, so a clearing usually had to be made. Fortunately the carriers were capable of clearing these without supervision (the thought of walking out was always a great incentive), leaving the geologist free to do a day trip on the last day.

Experience showed that by far the best site for a landing pad cut from virgin bush was a sharp ridge above the river, where a slot 100 feet wide can easily be constructed by felling trees down the slope. A platform such as shown in Figure 2 was generally necessary and is easily constructed.

Five carriers could construct a landing pad in virgin bush in 4 to 5 hours using 2 axes and 3 bush knives.

SIGNALLING THE HELICOPTER

In bush a smoky fire was sufficient to guide the helicopter to the landing pad, even if the party was several miles away from the agreed spot. In populated country fires in native gardens can cause confusion, and other methods of attracting the pilot's attention may be required.

A small heliograph is ideal in sunny conditions, and small smoke flares should be carried in case of cloudy conditions.

Some difficulty was experienced by the pilot in spotting a geologist and carrier after a day trip because it was seldom possible to predict the exact pick-up spot along a stream. In practice the pilot generally had to search at least a mile of river for the party. As there is often not time to light a fire or cut a clearing in the bush, bright red or yellow parkhas which are readily seen against the river boulders and dark bush should be worn at pick-up time.

SURVIVAL EQUIPMENT

The possibility that the helicopter would fail to meet the rendevous either due to bad weather or the non-serviceability of the helicopter, always loomed large to the man in the field. It is essential that the geologist be equipped to spend the night in reasonable comfort at the pick-up spot, and that he stays in that locality until picked up. Fortunately, the Sepik Party had good weather for most of the season, and only once was a geologist not picked up within an hour of the arranged time. In this case, bad weather prevented flying late in the afternoon, but as he was at the end of several days traverse the extra night out was no hardship.

On single day trips the geologist was accompanied by one carrier, and had the following survival equipment:

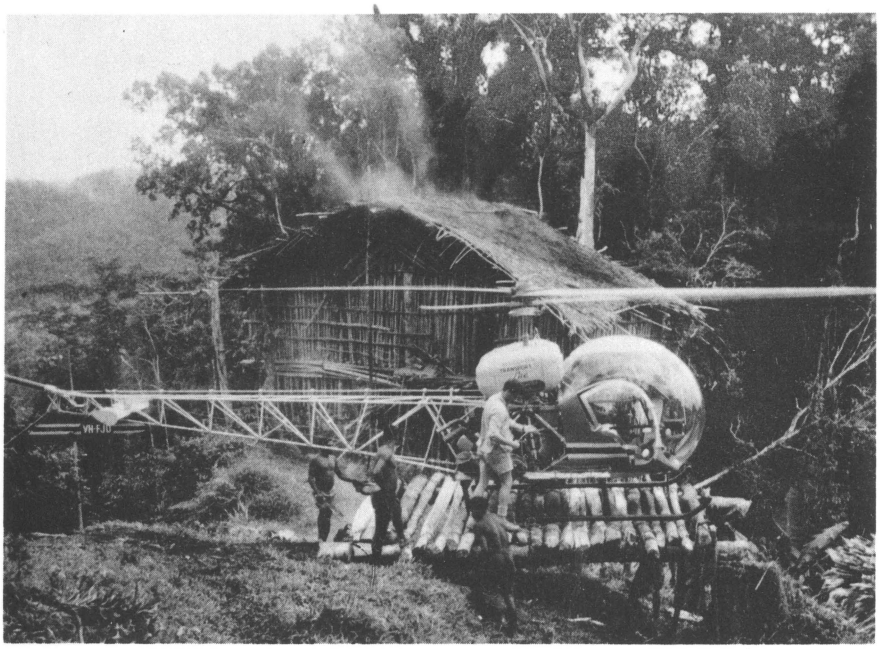

Figure 2:

Helicopter pad constructed near a native hamlet in the headwaters of the Salumei River. The Sepik Party made the first contact with these natives in 1967.

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(1) a light tent fly

(2) Mosquito net

(3) light plastic ground sheet
(not always carried but desireable)

(4) food and cooking equipment for two meals
(including matches)

Above about 4000 feet a sleeping bag or blanket was generally included in the gear.

No special equipment was needed for the traverse parties, but food for at least one extra day was always carried: as the party carried a shotgun as in most areas, they could, if necessary, live off the land.

The helicopter at all times carried the following survival equipment which was not standard with the helicopter and was supplied by the Bureau

(1) Axe

(2) Light bright-coloured (preferably yellow) tent fly

(3) Plastic ground sheet and mosquito net.

(4) Emergency food and cooking gear

APPENDIX I

HELICOPTER FLYING TIME

Date		Flying time Hours	Mins.	
August	20.	4	50	Positioning Lae to Ambunti
	21.	4	01	Start contract. To April Camp
	22.	2	22	
	23.	5	42	
	24.	4	07	
	25.	NIL		
	26.	4	19	Less 40 minutes return journey to Ambunti by Company
	27.	4	49	
		25	20	(24 - 40)
	28.	1	53	
	29.	5	20	
	30.	6	12	
	31.	3	35	
September	1.		39	To Ambunti 50 hourly service
	2.	1	14	
	3.	3	02	
		21	55	
	4.	5	55	
	5.	5	53	
	6.	5	00	
	7.	3	39	
	8.	3	45	
	9.	2	46	
	10.	3	41	
		30	39	
	11.	4	34	
	12.	2	43	To Ambunti Service
	13.	4	08	
	14.	6	38	
	15.	4	24	
	16.	9	11	
	17.	5	11	
		36	49	

September	18.	1	54	
	19.	8	16	
	20.	9	18	
	21.	3	27	
	22.	9	14	
	23.	4	26	
	24.	1	48	
		38	23	
	25.	3	06	To Ambunti Service
	26.	3	48	
	27.	2	51	
	28.	5	41	
	29.	1	39	
	30.	5	34	
October	1.	2	30	To Ambunti
		25	09	
	2.	1	32	
	3.	2	03	
	4.	7	30	
	5.	6	12	
	6.	6	20	To Ambunti Service
	7.	2	33	
	8.	8	23	
		34	33	
	9.	3	25	
	10.	4	43	
	11.	5	00	
	12.	4	32	To Mount Hagen
	13.	NIL		
	14.	NIL		
	15.	4	29	To Tabibuga
		22	09	
	16.	4	56	
	17.	6	07	
	18.	5	55	
	19.	4	12	
	20.	4	16	
	21.	8	04	
		33	30	
	23.	-	40	To Hagen end contract.

APPENDIX II

SCHEDULE OF CONTRACT RATES AND CONDITIONS FOR THE HIRE OF HELICOPTER USED BY THE SEPIK PARTY 1967

CONTRACT PERIOD: 1st June, 1967 to 31st January, 1969

ESTIMATED REQUIREMENTS: The quantities shown are estimated requirements only. Although every endeavour has been made to form accurate estimates the Commonwealth does not bind itself to take these quantities but reserves the right to order greater or lesser quantities than those stated according to the requirements of the Ordering Officer during the period of the Contract.

2. Type of Helicopters - Bell 47G3B-1.

3. Price Schedule

(a) Positioning Charge The rate per hour for positioning of helicopter, which shall include fuel and other charges, and to commence from Lae to area of operation and returning to Lae at the completion of the charter.

$40.00 per hour

NOTE: No positioning charge shall be applied where area of operation is Lae.

(b) STANDING CHARGE: per day or part thereof to charters where twenty-five (25) flying hours or less are required in any seven (7) day period.

$180.00 per day

(c) Flying Rate: per hour to charters where twentyfive (25) flying hours or less are required in any seven (7) day period and shall be exclusive of fuel and oil costs.

$25.00 per hour

(d) Overall Flying Rate per flying hour to be applied to all charters where more than twenty five (25) hours flying are required in any seven (7) day period and shall be exclusive of fuel and oil costs.

$80.00 per hour

(e) Idling Time Rate per hour (if applicable) exclusive of oil and fuel costs.
Prices are firm for the duration of the contract.

$80.00 per hour

NOTE: The Bureau of Mineral Resources, Department of National Development and Department of the Army will be responsible for the arrangements for positioning of fuel and oil in the areas of operation, as required for any charter under this contract.

4. PERIOD OF CONTRACT: The Period of the contract shall be from 1st June, 1967 to 31st January, 1969.

5. SERVICE: The service shall be executed to the entire satisfaction of the Officer Commanding the exercise or his representative, in accordance with the attached General Conditions of Contract.

6. ACCOUNTS: The contractor will forward his accounts for payment direct to the Ordering Officer together with any relevant documents.

GENERAL CONDITIONS OF CONTRACT FOR HIRE OF HELICOPTERS

1. SCOPE: This contract provides for the charter of Bell 47G3B1 helicopters on a period contract basis for the Departments of the Army and National Development for use in the Territory of Papua and New Guinea. Orders for such charters will be placed for work as required, and at the rates set out on page 1 hereof.

2. ESTIMATED REQUIREMENT: The estimated requirements set out below are furnished as a guide only. Although every endeavour has been made to form accurate estimates, the Commonwealth does not bind itself to adhere to these times, but reserves the right to order greater or lesser periods than those stated, according to the requirements of both the Departments of the Army and National Development, during the period of the contract.

Department of the Army - 500 hours.

Department of National Development - 900 hours.

The above flying hours may be taken under several Charters during the period hire from 1st June, 1967, to 31st January, 1969.

A tentative schedule of anticipated requirements for the first six months is given for the guidance of the contractor, and shall be subject to confirmation by the Department of the Army and Department of National Development before proceeding with the charter.

(a) Department of National Development

(i) 26th June, 1967 - 7th July, 1967 - Kui - Popondetta.
(ii) 14th August, 1967 - 16th October, 1967 - Sepik (Ambunti - Mt. Hagen)
(iii) 1st October, 1967 - 31st October, 1967 - Safia (S.E. of Popondetta)

(b) Department of the Army
8th July, 1967 - 22nd July, 1967 - Lae Area.

3. LANDING PERIODS: Landing periods will vary in time. The charterer will co-operate with the contractor and advise him at the time of ordering the approximate amount of time he will require on the ground. As a normal day's operation may involve only three (3) to four (4) hours' flying, the contractor shall make provision for the shutting off of engines during stops for any longer than five (5) minutes. (Flying time shall be based on individual engine start to engine off).

4. NAVIGATION AND SEATING ARRANGEMENTS:

(a) The pilot will be required to co-operate with the charterer's representative in navigating by means of air photos and air photo mosaic maps. The photos will have marked on them the exact position at which the charterer wishes to be set down and picked up. Landing and identification problems will determine the actual site of the landing. At times the pilot will be required to fly and navigate alone.

(b) Seating arrangements must be such as to permit the charterer's representative to sit alongside the pilot to enable them to navigate from the same air photo, and must be such as to accommodate two (2) persons in addition to the pilot.

5. RADIO COMMUNICATION: The helicopters must be equipped with a radio transceiver fitted for communication with the Department of Civil Aviation station for the area. The contractor will be required to maintain the transeiver in first class order at all times. Radio communication may be required between the helicopter and the field party, therefore provision of this facility should be made. The relevant radio frequency will be notified to the contractor at the time of ordering.

6. CONCENTRATED USE OF HELICOPTER: It may be necessary in exceptional circumstances (and by mutual agreement between the Ordering Officer and the contractor to utilise one (1) helicopter for periods in excess of the hours laid down by Department of Civil Aviation in respect of aircraft crews (viz. 8 hours per day, 30 hours per week and 100 hours per month) which would thereby require the use of two (2) crews to carry out the charter.

In such instance, the price shall be on the all inclusive rate, per flying hour.

7. FLIGHT PLANS: A plan, either on photo-mosaics or on air photos, showing the projected route of each flight will be held at the appropriate base camp, until such time as it is known that the flight has been successfully completed.

8. ACCOMMODATION AND CAMPING EQUIPMENT: During the helicopter survey Commonwealth personnel may camp at the successive operating bases, and accommodation will be available in the camps for the helicopter crew. All messing and camping equipment will be provided by the Commonwealth. Crew members will be required to live under the same conditions as the Commonwealth personnel.

9. MESSING ARRANGEMENTS: Commonwealth personnel receive fixed camping allowances, and each contributes a set amount per week to a party mess account. Bulk purchases of food for the party are made from this account.

The helicopter crew will be required to contribute to this mess account at the relevant rate per week per person.

10. PREPARATION OF PERSONAL EFFECTS AND MOVEMENT PROCEDURE: Subject to operation commitments, members of the helicopter crew will be expected to prepare all personal effects, bed-rolls, stretchers and tents ready to load on to trucks when camp is to be moved, and set up their own bed, etc. at the new camp site.

To permit full utilisation of the helicopter during the operation, all helicopter personnel other than the pilot will be required to travel by Commonwealth or other vehicles between operating bases, if so requested by the party leader.

11. COMMENCEMENT OF HIRE: The hiring period shall be deemed to have commenced on the helicopter being declared "available for flying" by the Commonwealth's field party leader even though the helicopter is not required for flying on the day declared available or on subsequent days. Payment for the hire of the helicopter will be from the day it is declared "available for flying". If, on this day, a helicopter is not available before 10 a.m. the Commonwelth reserves the right to refuse to decrlare the helicopter "available for flying" provided that, in the opinion of the party leader, the late start does not allow efficient utilisation of the aircraft on that day.

All claims for payment will be based on the full period of the charter. The helicopters must be available for hire within fourteen (14) days from date of ordering. The availability of the aircraft on the nominated day is important because the Commonwealth has to arrange for field officers to be in the area on the date nominated.

12. CERTIFICATION: The contractor shall be required to provide the aircraft at the commencement of hire airworthy and properly so certified, and properly manned and equipped in accordance with the standard configuration for the type of aircraft as required by the Department of Civil Aviation, and shall so maintain the aircraft for the period of the hire subject to the conditions hereinafter provided. Provision is to be made for the aircraft to operate over the open sea when required.

13. ORDERS AND DIRECTIONS: The pilot and engineer operating and maintaining the aircraft shall be and remain at all times the servants of the contractor, but shall carry out the orders and directions of the hirer for the purpose of the hire provided that such orders do not require the contravention of any law or any order or regulation made under the law of the Commonwealth of Australia, and provided that the pilot shall have the right, having regard to the safety of the aircraft and of the passengers, to decide the composition, weight, or stowage of any cargo the be carried in the aircraft, the suitability of weight for flying, the altitude and speeds of flight, and the locality of any landing place.

14. TIME OUT: In each seven (7) day period there will be a total allowance of two (2) days unserviceability without penalty, calculated in periods of half days. The total allowance of two (2) days for unservieability is to include time required for normal service maintenance and routine component changes.

Except in unusual circumstances there will be no flying on Sundays, and the contractor is required to undertake as much maintenance as possible on that day. The contractor must agree that when an "unusual circumstance" is declared by the party leader one other day each week will be taken in lieu of Sunday for maintenance purposes, and that the start of such day should coincide (as far as is deemed practicable by the helicopter personnel) with the cessation of flying from any one base.

The remaining one (1) day per weekly period shall be credited against any other servicing requirements.

15. LIQUIDATED DAMAGES: Where the aircraft is unavailable for flying in excess of a total of two (2) days per seven (7) day period owing to repairable mechanical failure or repairable damage due to accident, the contractor shall use his best endeavour to expedite the necessary repairs in order to proceed with the hirer's requirements. However, in respect of each day's delay so occasioned, the contractor shall make allowance to the hirer of 7/5 of the daily hire charge for each day on which the helicopter is unserviceable in excess of the total of two (2) days per seven (7) day period, provided that no such allowance shall be made in respect of any seven (7) day period where the total utilisation of the helicopter by the hirer equals or exceeds twenty (20) flying hours.

Where the contract cannot be completed within two (2) weeks owing to unserviceability of the helicopter any period of unserviceability in excess of the allowable four (4) days may be credited to the hirer, and added on to the original two (2) days.

(a) Unserviceability will be based on half-day periods.
(b) The first seven (7) day period shall commence from the day the helicopter is declared "available for flying" by the field party leader.
(c) "Available for Flying" means that the aircraft (including pilot) is ready in all respects to carry out the type of flying required by the hirer. The daily rate of hire shall commence from the date the aircraft is certified by the field party leader as "available for flying", whether the machine is required or not.

A period of unserviceability shall cease upon certification by the party leader that the machine is "available for flying".

16. DAILY INSPECTION: In planning the operation time will be allowed for daily inspection to be carried out before the first and after the last flight.

17. AIRCRAFT LOGS: The Contractor must maintain a log, a copy of which shall be made available to the hirer.

18. IDEMNITY AND INSURANCE: The Commonwealth shall not be responsible for loss or damage to the aircraft and the owner shall indemnify and deep indemnified the Commonwealth and all of its officers, employees and agents against all actions, proceedings, suits and claims or demands which may be made by any such person arising out of or in any way connected with the operation of the aircraft under this contract and the Contractor shall insure and keep himself insured against such risks.

19. ASSIGNMENT: During the period of the contract the helicopter shall be used only by the Commonwealth. The benefit of the hire shall not be assigned to any other person by either the Commonwealth or the contractor, nor any sub-contract entered into by the contractor during the period of the contract.

20. RIGHT TO REFUSE PASSENGERS OR CARGO: The contractor shall have the right ro refuse to carry any passengers or cargo which might endanger the safety of the aircraft.

21. CURTAILMENT OF SORTIE: If during the course of a sortie it becomes apparent that insufficient daylight remains to complete it, the pilot shall discuss with the Commonwealth Officer in the aircraft an alternative method of completing as much work as is practicable. If the pilot should insist on reducing the time by other than the method preferred by the geologist, he shall submit a written explanation on his return to base.

22. SEARCH AND RESCUE: The contractor shall be responsible for initiating action for search and rescue should such be necessary. Costs involved are to be shared as follows:-

Search and Rescue of Personnel: pro rata according to the number of personnel of each party, and their equipment.

Salvage and Recovery of Helicopter: responsibility to be the contractor's.

All persons on board must be equipped with suitable footwear, head gear, and water bottle in case of stranding. For flights over the sea the contractor will be required to provide and carry life-belts, an inflatable dinghy and paddles, and survival rations.

23. CONCLUSION: When the survey is nearing completion, the party leader shall keep the pilot informed and shall notify the pilot, as an agent of the contractor, two (2) days in advance, the date on which the contract will conclude.