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1964/30



HELICOPTER OPERATIONS, WESTERN HIGHLANDS. NEW GUINEA.

by

F.E. Dekker

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## SUMMARY

During October, 1963, the Bureau of Mineral Resources field party in New Guinea used a helicopter to assist in the regional mapping of the Lagaip Subdistrict in the Western Highlands. The helicopter was used for positioning and supplying personnel in remote areas, and for reconnaissance traversing. A total of 50 hours was flown during the month.

The helicopter proved to be extremely useful during the survey. However, the aircraft is expensive to hire, and operations in New Guinea can usually be severely hampered by bad weather and rugged terrain.

## INTRODUCTION

Small-scale helicopter operations in New Guinea have in the past been limited due to the lack of an aircraft capable of operating at altitudes above 6000 feet. Bell Helicopters, Ltd. have now produced a light aircraft, the 47G3B1, which performs well at altitudes up to 15000 feet above sea level.

Regional geological mapping in the Lagaip Subdistrict of the Western Highlands, New Guinea, was carried out during October, 1963 with the assistance of a Bell 47G3B1 helicopter. The aircraft was chartered from Helicopter Utilities, Ltd, Bankstown Airport, New South Wales.

The aircrew consisted of Captain John Arthurson and Engineer Clive Harris. Geologists engaged in the operation were Messrs. J.E. Thompson, D.J. Belford, R.G. Horne, F.E. Dekker (Party leader) and I.G. Faulks.

A total of 50 hours 2 minutes was flown over 18 flying days. In addition, 13 hours 38 minutes of idling time were logged.

## SPECIFICATIONS OF HELICOPTER

The Bell 47G3B1 is a light helicopter powered by a 260 horse-power supercharged engine, and is capable of seating three people including the pilot. Additional freight can be carried on trays mounted on either side of the cabin. The undercarriage consists of two skids, although floats can be fitted for operations near lakes, rivers and the sea. Much of the area mapped was boggy, and small plywood boards about one foot square were fitted to the rear ends of the skids to prevent the aircraft from sinking and thus fouling the tail rotor.

## Operational specifications:

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 gallons per hour approximately  
 Payload: 700 lbs disposable off 7,500 feet (including fuel, excluding pilot).  
 Fuel weight : 7.2 lbs per gallon.

Although the aircraft has such a high operational ceiling, the supercharger, which makes this possible, is driven by the exhaust, and the engine can thus not be switched off at altitudes above 8000 feet. An additional five minutes of idling time is required after landing before the engine can be switched off. On take-off, the aircraft lifts about 10 feet off the ground and only starts climbing after sufficient forward velocity has been attained. At low altitudes, the performance is much better, and the aircraft is capable of a considerable straight vertical lift, but it is likely to strain the engine. With increasing altitude, the payload of the aircraft decreases considerably.

A 20 foot long one inch thick rope, knotted at foot intervals, is carried, and an active passenger can easily climb up and down this while the helicopter is hovering. In addition, a  $\frac{1}{4}$  inch thick nylon rope fitted with a friction device can be used for lowering personnel from heights as high as 200 feet. The helicopter carries no winch, so that once a person was lowered to the ground a landing area would have to be cut before he could be picked up again. Fortunately, no acrobatics of this nature had to be performed during the operation.

Department of Civil Aviation regulations require at least two aircraft of similar operational ability to be present in the same general area. During the operation, another G3 helicopter was being used near Kerema, about 200 miles to the south-east.

#### NATURE OF TERRAIN

The area traversed lies almost wholly in the Lagaip Subdistrict of the Western Highlands. The country ranges in elevation from 1000 feet to 14,000 feet, is mostly over 6000 feet and is extremely rugged in places. Rain and moss-forest cover a large part of the area; patches of kunai grass are common and make good landing spots. Village "courtyards" and native gardens, when not surrounded by trees, are suitable for landing the aircraft.

The wide Lagaip Valley runs roughly northwest through the middle of the area. In its upper reaches, it is heavily populated, but in the northwest, the river flows through a deep gorge, and hillsides are too steep for settlement. When not in flood, the river has large gravel bars on which a helicopter can land with ease.

A large undulating highland south-west of Laiagam has an average elevation of about 9000 feet. The valleys are grassland which is always boggy due to the high rainfall. No people live here, although there are poorly defined hunting tracks in both the grassland and the dense moss-forest covering the hills.

The Burgers Mountains of the Central Range lie about 20 miles north of Laiagam and rise to almost 14,000 feet above sea-level. Here small patches of Alpine grass can be used as landing pads. Air currents in this area make flying hazardous, and the rapid change to the rarified atmosphere at this altitude makes physical labour extremely arduous.

#### WEATHER

The climate of the area is affected by both the southeast and northwest monsoon. There is no marked dry or wet season although weather is usually fine during October and November. The Lagaip Valley was filled with mist every morning and we seldom took off before 8 a.m. Cloud on the mountains and highlands cleared at about 9 a.m., and reappeared between noon and 2 p.m. Most of the flying was done during this clear period. Heavy rain and thunderstorms during the afternoon were a daily feature.

#### METHOD OF OPERATION

Laiagam, the administrative centre of the Lagaip Subdistrict, at 7400 feet above sea level, was used as a base of operations. The light aircraft strip was capable of accommodating De Havilland Otter aircraft and aviation spirit for the helicopter was positioned there by several charter trips from Mount Hagen. A light-vehicle motor road connects Laiagam with Mount Hagen. The Native Affairs Officer made a small European-style house available to the party for use as a base camp.

Camping equipment for field teams consisted of normal traverse gear used in New Guinea. We borrowed three portable A510 transceivers from the Army; when used with a dipole aerial they gave a range of over 100 miles. Reception on the frequency used - 6815 kcs - was good during the middle of the day, but bad before 9 a.m. and after 4 p.m. Ground to air communication was poor. The party had a large supply of emergency Army rations, some of which were always carried on the helicopter. The area is covered by good quality vertical air photographs, and these were used throughout for planning, navigating and field mapping.

The helicopter was used for various operations, An analysis is given in Appendix II.

Because of its manoeuvrability and versatility, the helicopter is an ideal reconnaissance aircraft. The large bubble cabin gives excellent visibility, and the aircraft was used for both initial reconnaissance and later mapping after some ground control had been established. Operations were at all times hindered by the weather. The aircraft carries no flying instruments and cannot fly through cloud or mist.

Heavy rain can wash grease out of the tail-rotor driveshaft-bearings, and the helicopter had to land at odd localities on several occasions when hemmed in by rainstorms.

The helicopter was mainly used to position small parties of geologists and native field assistants in remote localities. A shuttle service was employed to place and withdraw personnel and equipment on sorties which generally lasted from three days to one week. Since bad weather often made flying impossible, a certain amount of wasted time was inevitable.

The helicopter was also used to supply well-equipped ground parties which were doing more detailed mapping. A party of two geologists and thirty carriers mapped the country immediately south of Porgera Patrol Post in this way. A predetermined rendezvous of helicopter and field party was kept, and here small hand mirrors were found useful for ground to air signalling.

On fine days, long helicopter traverses were possible. A rough itinerary was planned beforehand with the aid of air photographs, and spot observations could be made over a large area. This method, however, requires good ground control and can at best give only sketchy information.

A section about 3000 feet thick was measured on the top of the Burgers Mountains. Two geologists were set down at an elevation of 12000 feet and worked at speed for about an hour while the helicopter remained idling. The altitude was not conducive to such physical exertion, and this method is not recommended for the unfit. The rapid deterioration of the weather among these mountains prevented the helicopter from retiring to nearby localities below 8000 feet, until the completion of the geological work.

#### ECONOMICS

The hire charges for the Bell 47G3B1 consist of a basic daily rate of £94, and an additional £15 per flying hour. The latter figure may vary slightly, depending mainly on the fuel positioning costs. A total of 50 hours were flown during 31 days of hire giving a cost of :

$$\begin{aligned} & \text{£} \quad \frac{(94 \times 31) + (15 \times 50)}{50} \quad \text{per hour} \\ & = \underline{\underline{\text{£}72-5-7\text{d}}} \quad \text{per hour} \end{aligned}$$

The hire charges are such that by flying as many as 30 hours per week the cost per hour is reduced to £36.18.8. The optimum flying time per week would be 25 hours after which time the aircraft requires servicing. However weather conditions prevented flying anywhere near this number of hours per week.

The alternative to the use of the helicopter in the area mapped is the utilization of airdrops to ground parties from Cessna light aircraft. These aircraft can be chartered in Mount Hagen at a cost of £25 per hour, and could drop a payload of about 800 lbs if loaded at Mount Hagen at an elevation of 5400 feet. The ground parties would require a line of at

least 20 carriers per geologist. This method, although slower and less dependable, would be considerably cheaper.

#### CONCLUSIONS AND COMMENTS

The primary role of a helicopter employed for geological work in New Guinea should be that of positioning and supplying ground parties. In this capacity, the aircraft is an excellent tool for the mapping of remote and otherwise inaccessible areas. Parties achieve increased mobility in a country where movement is normally slow due to the ruggedness of the terrain. A factor not to be overlooked is the morale of the field staff. The ready availability of an aircraft able to transport personnel to civilization at short notice is a comforting thought when engaged in field work in New Guinea.

On the other hand, the helicopter has definite limitations for geological mapping in New Guinea. The aircraft is expensive to hire, and the weather and nature of the terrain are major obstacles to its successful operation. The weather in the Highlands of New Guinea is generally unpredictable, and although the operation should be well prepared, plans must be flexible to allow for inclement weather. In New Guinea, areas which have good landing spots for the helicopter, generally have poor outcrop. Most of the rugged country is covered by dense jungle and possible set-down places are few and far between. The inability of the aircraft to switch off above 8000 feet seriously limits operations above this altitude; visits to certain critical areas may thus, of necessity, be short.

Excellent co-operation existed at all times between the aircrew and geologists. Minor technicalities arising out of the operation were clarified by reference to copies of the contract (Appendix 1).



Figure 1: The Bell 47G3B1 helicopter taking off at Iaiagam.



Figure 2: Inaccessible terrain on the Yangi Highlands (elevation 9000 feet).

APPENDIX 1

HELICOPTER CONTRACT FOR WESTERN HIGHLANDS  
SURVEY 1963

Special Conditions

1. SCOPE: The helicopter is required for a geological survey in the Western Highlands of New Guinea. The details of the survey are set out hereunder :-
  - (a) Commencement date: 1st October, 1963.
  - (b) Commencement place: Laiagam Patrol Post, Western Highlands District.
  - (c) Approximate total number of flying hours: 40 hours with a minimum of 32 hours and a maximum of 50 hours. These figures do not include idling time.
  - (d) Approximate number of miles to be flown: 1,400 miles.
  - (e) Approximate period of survey: Minimum of four (4) weeks, maximum of six (6) weeks.
  - (f) Number of flying days per week: Normally five (5) days with a maximum of six (6) days.
  - (g) Areas to be flown: The following military one-mile areas: Burgers Mts, Yogo, Mt. Yangi.
  - (h) Completion date: See (e) above.
  - (i) Completion Place: Laiagam Patrol Post.
  - (j) Fuel and oil requirements: Helicopter Utilities Pty. Ltd., will position 20 drums 100 octane avgas and 16 gallons oil at Laiagam by 15th September, 1963.
  - (k) Bases: The survey will be conducted from a series of bases determined by the Bureau.
  - (l) Performance of Helicopter: The helicopter must be capable of a guaranteed put down of 650 lbs. and up lift of 550 lbs. at an altitude of 12,000 feet.
2. PRICE BASIS: The contract rates are variable only in so far as pilot salaries may be increased by the Federation of Air Pilots and as insurance rates may be increased by the Underwriters.
3. In the event that the charterer reduces the period of charter to less than 80% of the estimated period of work and that reasonable time to obtain alternative work is not given, payment will be made for utilization of the helicopter at the overall rate of the complete charter for the minimum of 80% of the estimated hours of 50 No.
4. In the event that the helicopter is damaged beyond the scope of local repair, Helicopter Utilities Pty. Ltd., accepts responsibility for salvage to a suitable airstrip or port.
5. Payment of the minimum set charge for each 14 days to be made on each 14th day from the commencement of the charter and payment of the remainder within seven days rendering each claim after receiving certified proforma Airborne Surveys - Flight Return.

## A T T A C H M E N T "B"

### 1. COMMENCEMENT OF HIRE:

The hiring period shall be deemed to have commenced upon the helicopter being declared "available for flying" by the Bureau'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, the helicopter is not available before 6.30 a.m. the Bureau reserves the right to refuse to declare 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.

It is likely that clouds will close in over most of the area to be mapped between 10.30 a.m. and 12.00 noon. It is therefore particularly important that the aircraft be ready to fly by 6.30 a.m. every flying day.

The helicopter must be available for hire within one day of 1st October, 1963. The availability of the aircraft on the nominated day is extremely important as the Bureau has to arrange for field officers to be in the area on the date nominated.

### 2. CERTIFICATION:

Helicopter Utilities Pty.Ltd., shall be required to provide the aircraft at the commencement of the hire airworthy and properly so certified, properly manned and equipped in accordance with the standard configuration for this type of aircraft, taking into account the altitude, ruggedness, and remoteness of the terrain within which the aircraft will be operating, and shall so maintain the aircraft for the period of the hire subject as hereinafter provided.

### 3. ORDERS AND DIRECTIONS:

The pilot and engineer operating and maintaining the aircraft shall be, and remain at all times the servants of Helicopter Utilities Pty.Ltd., but shall carry out the orders and directions of the hire for the purpose of the hire and which shall not require the contravention of any law or any order or regulation made under the law of the Territory of Papua and New Guinea, provided that the pilot shall have the right at all times, having regard to the safety of the aircraft and to passengers, to decide the composition, weights or stowage of any cargo to be carried in the aircraft, the suitability of weather conditions for flying, and the altitude and speeds of flight, and the locality of any landing.

### 4. TIME OUT:

In each period of 14 days there will be an allowable unserviceability of four (4) days without penalty, calculated in periods of single days. The above allowable period of four (4) days for unserviceability is to include time required for normal service maintenance and routine component changes.

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

The remaining two days per 14 days period shall be credited against any other servicing requirements. Such credit shall not be carried over from one 14 day period to another.

5. PENALTY:

Where the aircraft is unavailable for flying in excess of four (4) days per fourteen (14) days due to repairable mechanical failure of the helicopter or repairable damage due to accident, Helicopter Utilities Pty.Ltd., will use its best endeavours to expedite the necessary repairs in order to proceed with the hirer's requirements, but shall not be liable for any loss or damage to the hirer arising out of the unavailability but Helicopter Utilities Pty.Ltd., 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 four (4) days per fourteen (14) days, provided that no such allowance shall be made in respect of any fourteen (14) day period where the utilisation of the helicopter by the hirer is equal to or exceeds 20 flying hours.

(a) Unserviceability will be based on one (1) day period.

(b) The fourteen (14) day period shall commence from the day the helicopter is declared "available for flying" by the field party leader.

(c) "Availability for flying" means the aircraft (including a pilot) is ready in all respect 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 otherwise. A period of unserviceability shall cease upon certification by the party leader that the machine is "available for flying".

6. DAILY INSPECTION:

In planning the operations, time will be allowed for daily inspections to be performed before first and after last flights.

7. AIRCRAFT LOGS:

Helicopter Utilities Pty.Ltd., must maintain a log, a copy of which shall be made available to the hirer if desired.

8. INDEMNIFICATION:

The hirer shall indemnify Helicopter Utilities Pty.Ltd. against all claims actions and demands whatsoever by any servant or agent for the death of or injury to any such servant or agent arising out of the operation of the aircraft. The hirer shall not pledge the aircraft or the credit of Helicopter Utilities Pty.Ltd., for any purpose.

9. ASSIGNATION:

During the period of the contract the helicopter shall be used only by the Bureau. The benefit of the hire shall not be assigned to any other person either by the Bureau or by Helicopter Utilities Pty.Ltd., nor any sub-contract entered into by Helicopter Utilities Pty.Ltd., during the period of the contract.

10. LANDING PERIODS:

The helicopter will be used to supply two ground teams, and to transport geologists from these two teams, and from Laiagam Patrol Post, to localities up to 12,000 feet above sea level within the areas to be mapped.

On supply runs, the helicopter pilot will be expected to fly, in some cases alone, to pre-determined localities, and unload the aircraft into supply dumps. The helicopter will be used to carry a geologist, native assistant and camping gear to specified localities, and to pick them up at a later date, at the same or different locality. This may be the same afternoon, or up to three days later.

Because of the weather conditions prevailing in the area, it is anticipated that the helicopter will be unable to return to Laiagam most afternoons, and the pilot will therefore be expected to camp with the traverse parties. Bad weather may force the helicopter to land at remote localities for an overnight stop. The pilot must therefore carry with him, camping gear and food for seven days.

11. NAVIGATION AND SEATING ARRANGEMENTS:

a) The pilot will be required to co-operate with the geologist in navigating by airphotos and photo-mosaic maps. The photos will have marked on them the exact position at which the geologist wishes to be landed. Landing and identification problems will determine the actual site of the landings. At times the pilot will be required to fly and navigate alone.

b) Seating arrangements must be such as to permit a geologist to sit alongside the pilot to enable them both to navigate from the same airphoto, and must be such as to accommodate two persons in addition to the pilot.

12. RADIO COMMUNICATION:

The helicopter must be equipped with a radio transceiver fitted for communication with the Department of Civil Aviation station appropriate to the area. In addition the transceiver must be able to transmit and receive on a frequency to be determined by the hirer. Helicopter Utilities Pty.Ltd., must guarantee to maintain the transceiver in first class order at all times.

13. FLIGHT PLANS:

A plan, either on photo-mosaics or on aerial photographs, showing the projected route of each flight will be held at the point of commencement of flight until such time as it is known that the flight has been successfully completed.

14. FUEL AND OIL:

Helicopter Utilities Pty.Ltd., will be required to:-

- (i) Ensure that the total fuel and oil requirements for 50 hours flying be delivered, to Laiagam Patrol Post on or before 15th September, 1963.
- (ii) Stock fuel dumps at Porgera and the traverse camps, by helicopter, at Bureau expense.
- (iii) Make arrangements, at Helicopter Utilities Pty.Ltd., cost for the disposal of empty fuel drums.

15. CAMP SITES:

The survey will be conducted from Laiagam Patrol Post and a number of traverse camps in the area to be mapped.

16. BUREAU PERSONNEL:

The two ground teams will each consist of two geologists supported by native carriers. In addition, there will be one, or possibly two, geologists at Laiagam. Some visiting geologists may be present during part of the survey.

17. ACCOMMODATION AND CAMPING EQUIPMENT:

During the helicopter survey, Bureau personnel will camp at Laiagam and successive operating bases, accommodation will be available in the Bureau camps for helicopter crew personnel. The flight engineer, as well as the pilot will be expected to camp part of the time with the ground parties.

All camping equipment will be provided by the Bureau. Crew members will be required to live under the same conditions as Bureau personnel.

18. MESSING ARRANGEMENTS:

Bureau personnel receive fixed camping allowance, and each contribute about £6 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 a rate of about £6 per week per person.

Should the helicopter personnel require any special food in addition to that provided, it may be purchased and transported at their own cost, unless sufficient notice is given of such special requirements as to enable the incorporation of the items in the party supplies.

The Bureau party is not provided with a cook, either on traverse, or at Laiagam Patrol Post, and the helicopter personnel will be expected to share the camp chores. Subject to operational commitments, the helicopter crew personnel will be expected to prepare all personal effects, bedrolls, stretchers, and tents ready to be transported, and set up their own bed etc., at the new camp site.

19. RIGHT TO REFUSE PASSENGERS OR CARGO:

Helicopter Utilities Pty.Ltd., shall have the right to refuse to carry any passengers or cargo which might endanger the safety of the aircraft.

20. CURTAILMENT OF SORTIE:

If during the course of a sortie it becomes apparent that insufficient daylight remains to complete it the pilot shall consult with the geologist on 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.

21. SEARCH AND RESCUE:

Helicopter Utilities Pty.Ltd., will be responsible for initiating action for search and rescue should it be necessary. Costs involved to be shared as follows :-

Search and Rescue Personnel: pro rata to the number of personnel of each party.

Salvage and Recovery of Helicopter: responsibility to be Helicopter Utilities Pty.Ltd.

22. BREACH OF TERMS:

In the event of a breach of the terms hereof by the hirer, Helicopter Utilities Pty.Ltd., may give written notice specifying such breach to the hirer and unless such breach is remedied within seven days after receipt of such notice by the hirer, Helicopter Utilities Pty.Ltd., shall be entitled to terminate the hire forthwith. The hirer shall have the right to terminate the contract on 7 days notice in writing if Helicopter Utilities Pty.Ltd., fail to abide by any of the conditions hereof.

23. ACTION OR PROCEEDINGS:

Any action and other proceedings against Helicopter Utilities Pty.Ltd., shall be brought in the State of Victoria and the hire shall be governed by and construed according to the law of such State.

24. TERMINATION:

Five days notice is required if the hirer desires to terminate the contract during the period of the survey within two (2) weeks of the commencement of the hire.

25. CONCLUSION:

When the survey is nearing completion the party leader will keep the pilot informed and will notify the pilot, as an agent of Helicopter Utilities Pty.Ltd., two (2) days in advance of the date on which the contract will conclude. This could be any time after the minimum period of four (4) weeks has expired, irrespective of the actual hours of flying.

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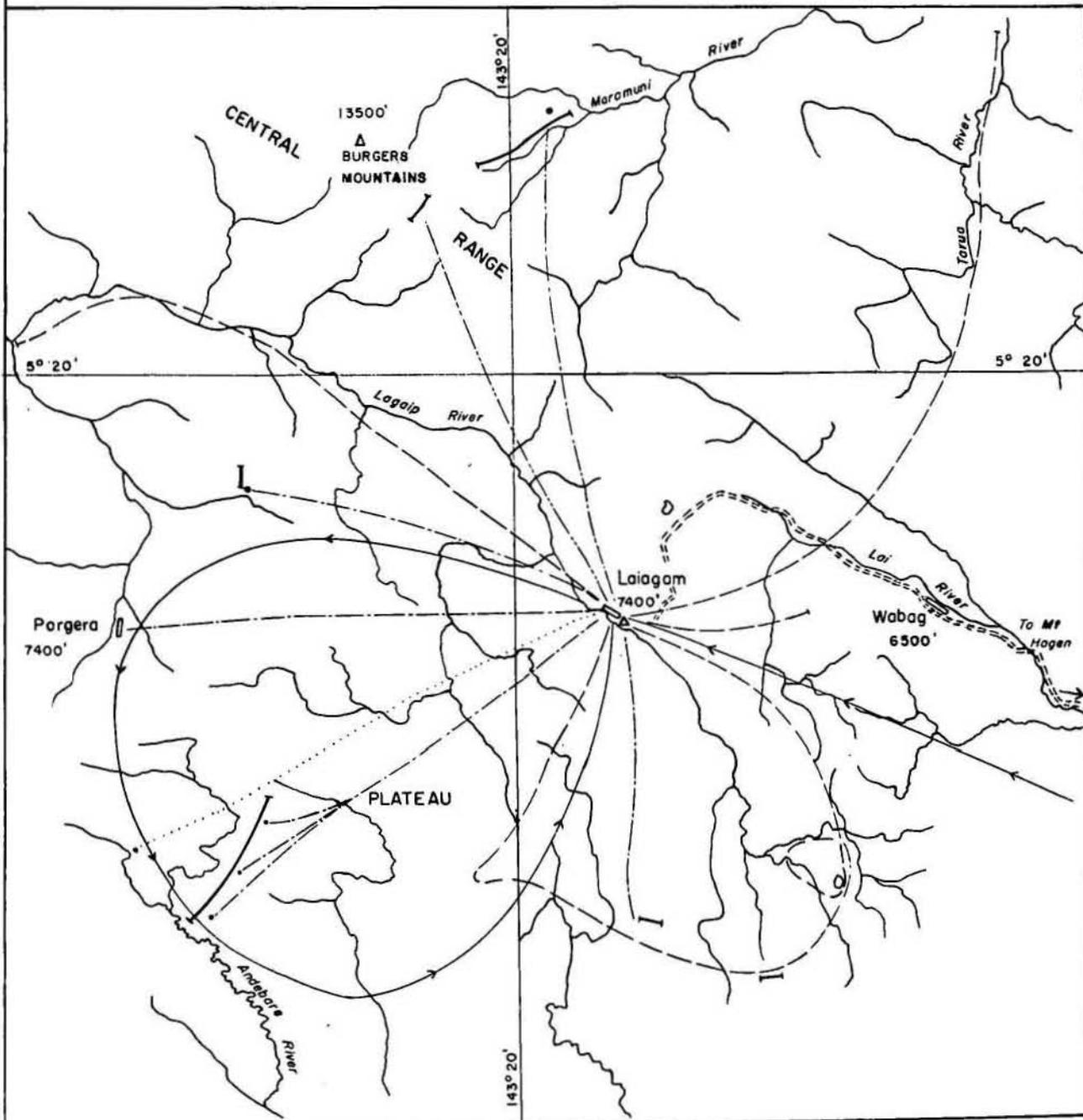
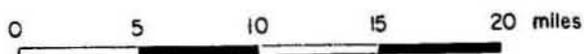
APPENDIX II

Analysis of Flying Hours.

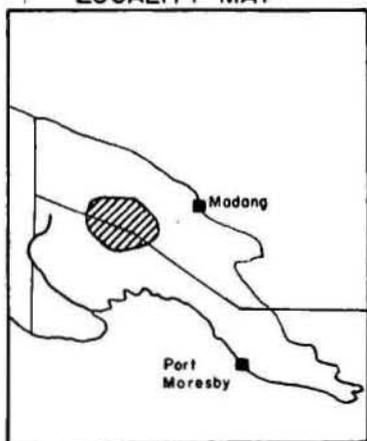
<u>Aerial Reconnaissance</u>	<u>Date</u> 2nd	<u>Hours</u> 1	<u>Minutes</u> 16
Positioning of field parties	3rd	2	26
	7th	2	24
	11th	4	25
	12th	1	53
	15th	3	44
	16th	3	13
	17th	2	27
	19th	4	32
	21st	4	46
	23rd	2	40
<hr/>			
Supply of ground parties	9th	3	11
<hr/>			
Continuous traverse	4th		50
	5th	1	42
	7th	1	10
	8th	2	4
	18th	1	16
	23rd	1	5
	26th	1	14
<hr/>			
Burgers Mountains	4th	1	20
	10th	1	22
	26th	1	2
<hr/>			
	Total	50 hours	02 minutes

# HELICOPTER OPERATIONS

NEW GUINEA 1963



LOCALITY MAP



## LEGEND

- Airstrip
- Base Camp
- Field Camp
- Road
- Measured Section
- Reconnaissance Flight
- Traverse Flight
- Positioning Flight
- Supply Flight
- Burgers Mtns. Flight