



**SPECIAL REPORT OF RESULTS
AUSTRALIAN CONTROLLED TERRITORY
SOUTHWEST PACIFIC SURVEY
PROJECT AF 60 - 13**

VOL. 1



15 JAN 1965

**1370TH PHOTO-MAPPING WING
AIR PHOTOGRAPHIC & CHARTING SERVICE (MATS)**

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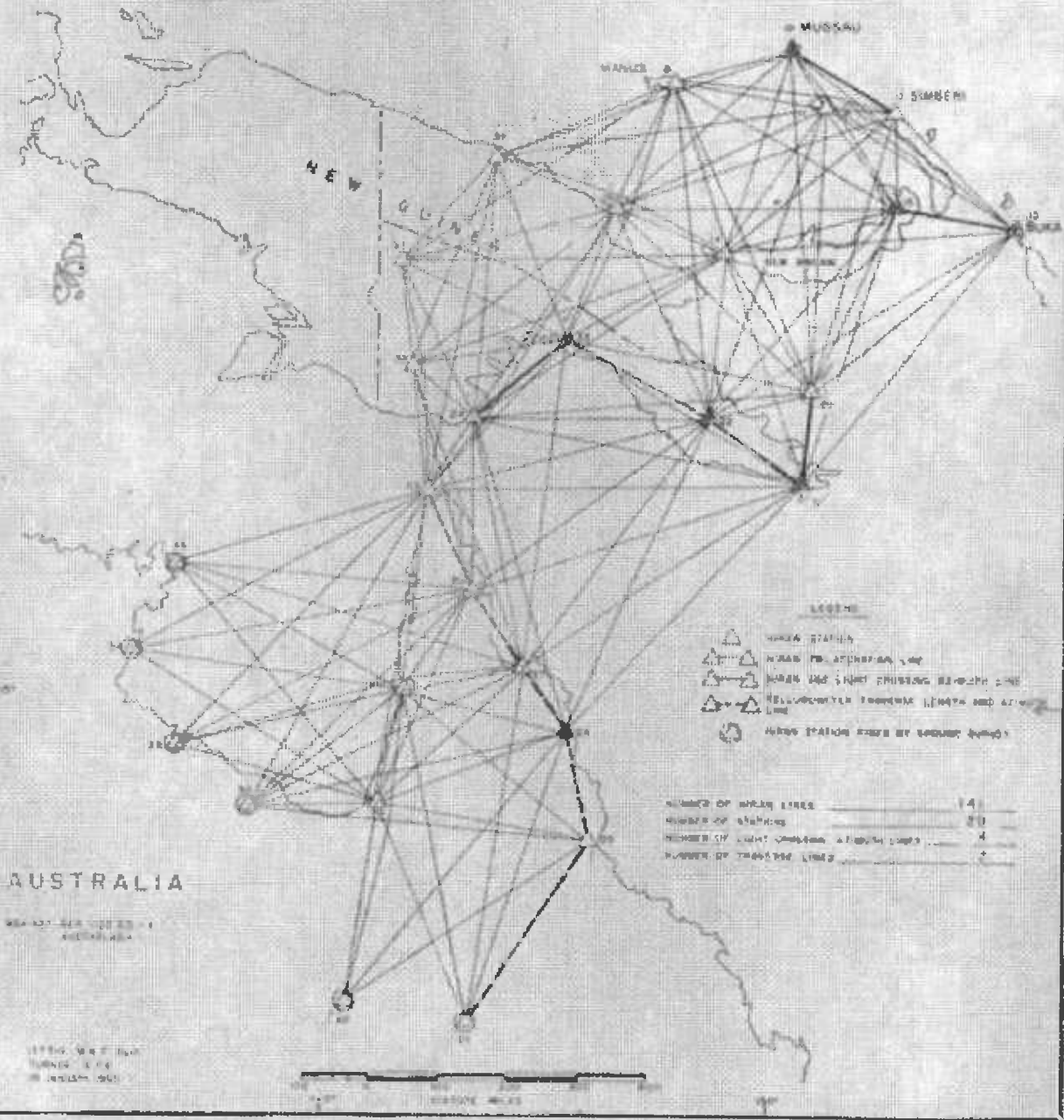
15 January 1965

VOLUME 1

Prepared By

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Albany, Georgia

SOUTHWEST PACIFIC SURVEY
 PROJECT AF 60-13
 AUSTRALIAN TERRITORY



- LEGEND
- △ WARRICK STATION
 - △-△ WARRICK TO AUSTRALIAN LINE
 - △-△ WARRICK AND LIGHT PHOSPHORIC RICHNESS LINE
 - △-△ WARRICK AND LIGHT PHOSPHORIC RICHNESS LINE AND AUSTRALIAN LINE
 - WARRICK STATION TAKEN BY GEORGE SANDS

NUMBER OF WARRICK LINES	14
NUMBER OF STATIONS	20
NUMBER OF LIGHT PHOSPHORIC RICHNESS LINES	4
NUMBER OF TRAVELING LINES	7

AUSTRALIA

WARRICK AND AUSTRALIAN LINE



FIGURE 1

1. Introduction:

The Hiran system of serial electronic surveying utilizes airborne and ground equipment to measure the lengths of lines included in networks of trilateration. The capability of the system to precisely measure long distances allows the extension of networks across water gaps and relatively inaccessible terrain. The Hiran survey in the Southwest Pacific is an example of such a network. This report covers the portion of the survey in Australian controlled territory and presents the results of the survey as well as pertinent associated data. The report is in three volumes. Volume I contains a description of the project, information on which the results are based, an analysis of the results, a list of geographic positions, and station descriptions. Volumes II and III contain station descriptions with secondary control point data also included in Volume III.

2. Description of the Survey:

a. Purpose.

The survey was accomplished to precisely connect various land masses to the primary survey system of Australia.

b. The Trilateration Net.

(1) The network consists of 141 Hiran measured distances and 29 Hiran stations. The longest line measured was 545 miles; the shortest, 84 miles, and the average line length was 346 miles. A network diagram is included as Figure 1.

(2) Six of the Hiran stations were installed on stations included in the primary survey system of Australia and supply the connection to that system. The stations are:

<u>Station</u>		<u>Location</u>
No.	Name	
32	A468	Queensland
33	U136	Northern Territory
34	RANTYIKRITY POINT U204	Northern Territory
35	MOUNT DUNDAS U214	Northern Territory
60	BISHOP CREEK A427	Queensland
61	HILLTOP A411	Queensland

(3) Two stations were installed in Australia on sites not tied to a ground survey system:

<u>Station</u>		<u>Location</u>
No.	Name	
30	NORMANTON	Queensland
31	EDWARD RIVER MISSION	Queensland

(4) Five stations were installed on an extension of the tellurometer traverse through Cape York in Australia. The stations are:

<u>Station</u>		<u>Location</u>
No.	Name	
25	MOUNT SCOTT	Prince of Wales Island Queensland
26	MOUNT TOZER BO77	Queensland
27	BO69	Queensland
28	MOUNT FIERBALD BO65	Queensland
29	BISHOP	Queensland

(5) Three Hiran stations were installed on stations included in a closed loop of tellurometer traverse in New Guinea. The stations are:

<u>Station</u>		<u>Location</u>
No.	Name	
21	SUAU	New Guinea
22	MYOLA	New Guinea
23	AIRD HILLS 1963	New Guinea

(6) Thirteen stations were installed on sites in New Guinea, the Bismarck Archipelago, and other islands. They are:

<u>Station</u>		<u>Location</u>
No.	Name	
9	LEA	Manus Island
10	NOMA	Mussau Island
11	PILIKOS	New Hanover Island
12	MORU	Simberi Island
13	TSINON	Buka Island
14	NEW TANGI	New Britain Island
15	NANDAN	New Britain Island
19	KIMIN	Karkar Island
20	NOEL	Nulei Island, Luscany Islands

No.	<u>Station</u> Name	<u>Location</u>
24	DARU	Daru Island
26	TURU	New Guinea
27	SEPIK HIRAN	New Guinea
28	SUKI	New Guinea

c. Net Orientation.

Net orientation, in addition to that supplied by the starting positions, is provided by:

(1) Long-line azimuths observed by the light-crossing technique for lines 10-12, 15-13, 20-21, and 23-24. In this procedure the line between two Hiran stations is crossed by an aircraft bearing a light which is sighted on simultaneously by observers at the terminals of the lines. Recording theodolites are used for observing the Hiran aircraft employed in the line crossing. The sightings on the light are referenced to observed astronomic azimuths. Astronomic positions are also observed at each station to permit application of the Laplace correction.

(2) Additional orientation was provided by data derived from the Australian tellurometer traverse on Cape York and in New Guinea.

d. Secondary Control Points.

(1) Eight positions were established by the secondary control point technique. This technique involves the determination of the position of a landmark or recognizable point without physical occupation by flying a low altitude clover leaf pattern of Hiran controlled photography over the unknown point. Approximately 50 photographs are taken with approximately 93% overlap while data for nadir point position determination is provided by measuring the Hiran range to each of two ground stations simultaneously with each exposure of the mapping camera. The mapping camera mount is stabilized and every possible effort is made to insure that the aircraft is flying straight and level and on course.

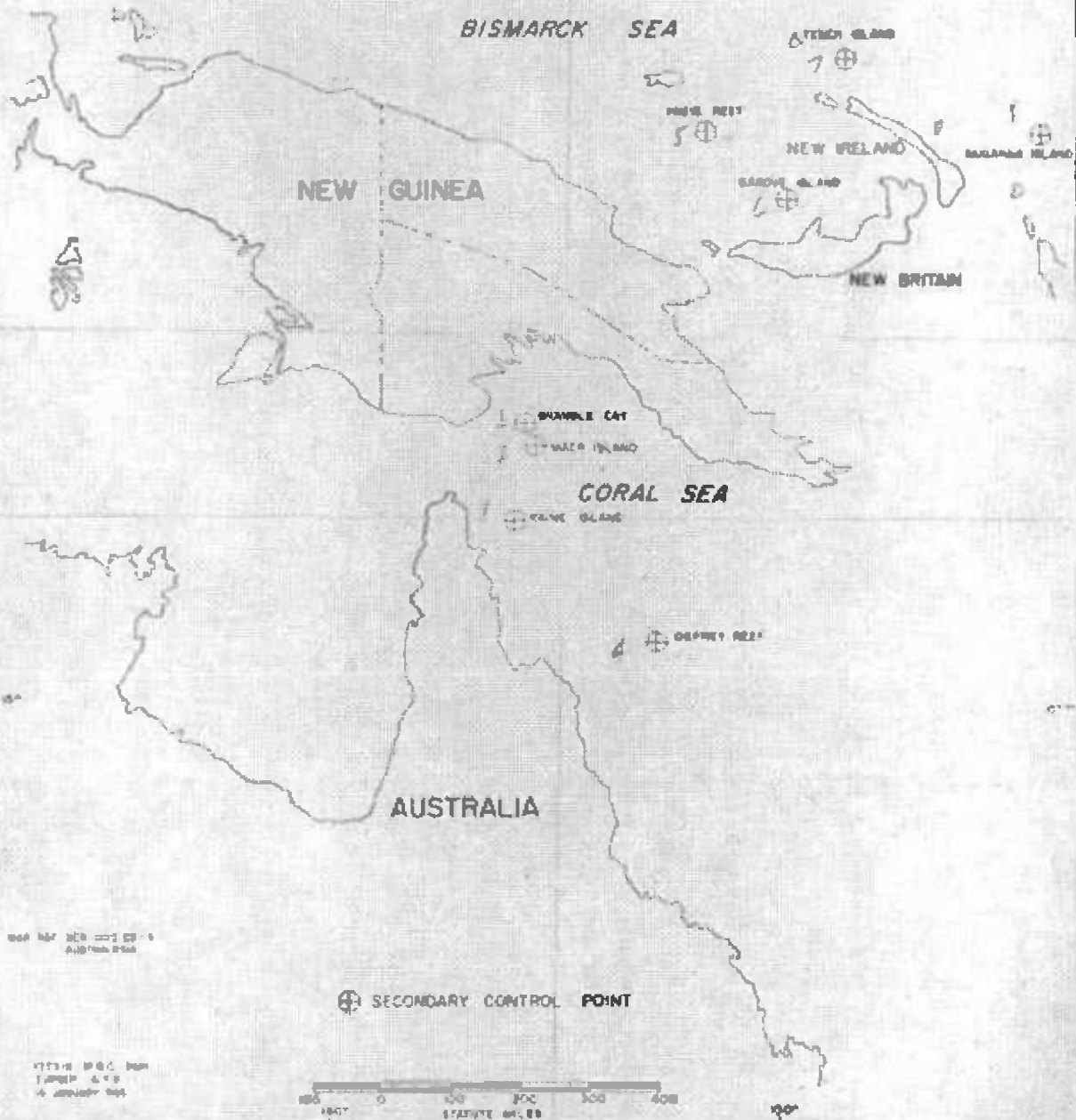
(2) Secondary control points were determined at the following locations:

KREIS REEF
 NUGARBA ISLAND, NUGURIA ISLANDS
 GAROVE ISLAND, VITU ISLANDS
 TENCH ISLAND
 KALNE ISLAND
 OSPREY REEF
 MAEE ISLAND, MURRAY ISLANDS
 BRANBLE CAY

140° 130°

SECONDARY CONTROL POINTS

PROJECT AF 60-13



(3) A diagram showing the location of the secondary control point is included as Figure 2.

e. Computations:

(1) A value of 299,792.5 km. per second for the propagation velocity of radio waves in a vacuum was used in the reduction of Hiran distance.

(2) Hiran distances are recorded in statute miles which are based on the American Survey Foot which equals $\frac{1200}{3937}$ international meter. All statute mile values listed in this report were derived using the above relationship.

(3) All inverse and position computations were based on Helmert's formulas. The inverse computation includes a five-time iteration to maintain accuracy for long lines.

(4) All azimuths noted in this report are measured from south in accordance with standard United States geodetic practice.

3. Support.

a. The United States Army and Navy participated with the Air Force in the accomplishment of the survey. The Army observed and reduced astronomic positions and conventional and light-crossing azimuths and established the elevations of certain stations. The Navy also made astronomic observations and supplied logistical support.

b. Australia provided geodetic data, performed field surveys, and further supported the survey in many ways.

4. Network Adjustment.

a. Adjustment Concept:

(1) The survey network includes various Hiran stations which are identical to stations included in tellurometer traverse surveys in Australia and New Guinea. Incorporation of traverse data in the Hiran net to provide optimum results could best be accomplished with a complete knowledge of the accuracies of the various systems. While a value describing the internal accuracy of the Hiran net could be computed, the accuracies of the various tellurometer traverses were not fully known. The traverse on Cape York is not a closed loop. The traverse loop in New Guinea is over extremely rugged terrain with great differences in elevation.

(2) A series of adjustments were performed to aid in the evaluation of the various types of data. The solutions involved the inclusion and omission of the light-crossing azimuth and traverse data in different combinations to determine the compatibility of the information. This approach is useful primarily to reveal major inconsistencies and the computed results gave no reason to believe that such inconsistencies were present in the traverse data or light-crossing azimuths. For example, the azimuths determined from the closed loop traverse in New Guinea were apparently in agreement with light-crossing azimuths on adjoining lines.

(3) The traverse data were included in the adjustment as weighted observations. A weight of five was assigned to the azimuth equations and a weight of three to the length equations. While the weights were assigned somewhat arbitrarily, they were based on known general accuracy values for the Hixan and light-crossing data and on subjective estimates for the accuracy of the traverse information. In any case, the distribution of errors is considered logical.

(4) The light-crossing azimuths were considered as fixed information based on experience with this type of data and on known accuracy criteria for the azimuth determinations. The final value for each light-crossing azimuth is determined from 12 crossings. These data are furnished by the U.S. Army Map Service and it is understood that the uncertainty in the final value cannot exceed a probable error of ± 1 second. Ordinarily the probable error is somewhat less than this figure.

b. Geodetic Datum:

The network was adjusted on the Central Australian Datum which uses the "165" Ellipsoid as the figure of reference. The dimensions of the ellipsoid are:

$$a = 6,378,165 \text{ m.}$$

$$c = 1/299.3$$

c. Conditions Used:

(1) Positions held (Central Australian Datum):

<u>STATION</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>
32	17° 24' 27.334 S	138° 15' 00.055 E
33	16° 11' 34.437 S	136° 47' 46.012 E
34	14° 11' 31.269 S	135° 54' 01.494 E
35	12° 13' 09.009 S	136° 51' 46.165 E
60	20° 47' 25.096 S	140° 42' 16.755 E
61	20° 54' 51.884 S	143° 22' 54.340 E

(2) Azimuth conditions: Listed below are azimuths which were used as conditions and the astronomic positions to which they correspond. The azimuths were determined by the light-crossing technique:

<u>STATION</u>	<u>ASTRONOMIC POSITION</u>	<u>AZIMUTH TO STATION NUMBER</u>	
10	Lat 001° 25' 46.69 S Long 149° 37' 48.34 E	296° 27' 16.96	12
15	Lat 004° 23' 52.72 S Long 151° 43' 01.08 E	286° 47' 38.45	13
20	Lat 008° 33' 54.36 S Long 150° 16' 47.25 E	001° 30' 39.67	21
23	Lat 007° 26' 55.55 S Long 144° 21' 10.57 E	034° 50' 51.13	24

c. Observed Data:

(1) Traverse data used as observations:

(a) Data derived from computations between appropriate pairs of the following listed positions were used to form observation equations:

<u>STATION</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>
21	10° 34' 09.369 S	150° 13' 33.906 E
22	09° 07' 52.663 S	147° 48' 54.246 E
23	07° 26' 56.268 S	144° 21' 21.135 E
25	10° 39' 17.106 S	142° 12' 43.470 E
26	12° 45' 12.947 S	143° 12' 33.295 E
27	14° 23' 40.188 S	144° 15' 20.888 E
28	15° 19' 14.790 S	145° 04' 53.835 E
29	18° 28' 37.425 S	146° 07' 17.635 E
61	20° 54' 51.884 S	143° 22' 54.340 E

(b) The following azimuths computed from the above positions were used in the formation of observation equations which were assigned a weight of five. Corrections in statute miles and equivalent in seconds resulting from the adjustment are also shown:

<u>LINE</u>	<u>AZIMUTH</u>	<u>CORRECTION (STATUTE MILE X 10⁴)</u>	<u>CORRECTION (SECONDS)</u>
21-22	120°48'44.4712	-13	-1.4
23-22	296°15'56.6007	-20	-1.6
25-26	335°00'31.8192	+14	+1.8
26-27	328°09'36.7036	+ 6	+0.9
27-28	319°10'28.2260	- 8	-2.0
28-29	342°32'58.7388	+ 4	+0.4
29-61	046°20'21.0138	+ 3	+0.3

(c) The following lengths computed from the above positions were used in the formation of observation equations which were assigned a weight of three. Corrections resulting from the adjustment are also shown:

<u>LINE</u>	<u>LENGTH (STATUTE MILE)</u>	<u>CORRECTION (STATUTE MILE X 10⁴)</u>
21-22	191.7546	-17
23-22	263.5002	0
25-26	159.2969	-11
26-27	132.9596	+29
27-28	84.2938	-12
28-29	227.7006	+ 3
29-61	244.8712	+13

(2) Observed Hiran data and corrections:

<u>LINE</u>	<u>OBSERVED HIRAN (STATUTE MILES)</u>	<u>CORRECTION (STATUTE MILES X 10⁴)</u>
9-10	177.7038	-17
11	220.5656	-30
12	335.8899	+30
14	254.3532	-45
15	349.4904	- 7
19	190.9564	+53
20	488.9990	+72
22	480.4954	-44
23	411.1716	-11
36	281.8280	+16
37	448.2956	-48
10-11	93.0476	-29
12	183.3476	-30
13	430.7950	+35
14	302.4536	-46
15	249.5295	+46
19	336.6684	+22
20	492.0892	-41
36	459.2313	- 7
11-12	115.8066	-26
13	345.5219	-19
14	249.3910	-27
15	156.8300	+ 2
19	332.9240	-48
20	410.5682	0
22	481.5520	+16
36	487.3078	+56
12-13	253.5219	-75
14	324.7900	- 3

<u>LINE</u>	<u>OBSERVED HIRAN (STATUTE MILES)</u>	<u>CORRECTION (STATUTE MILES X 10⁴)</u>
12-15	123,8630	+80
19	439,4388	-22
20	425,3479	+31
13-14	426,1457	+48
15	209,7300	+21
20	372,1407	+ 2
21	470,9364	+34
22	534,5859	-41
14-15	244,3474	- 9
19	179,7607	+56
20	237,9334	-10
21	360,0098	-59
22	241,9816	+12
23	303,7028	-23
24	427,1224	-44
36	375,3289	- 7
14-37	483,8710	+23
38	486,7652	-15
15-19	396,0294	-23
20	302,7060	+22
21	436,0554	+26
22	421,1518	+26
19-20	398,3642	+25
22	330,9719	-47
23	220,5691	- 6
24	357,9202	- 5
25	484,9438	+57
36	195,5646	-16
37	317,8888	+ 6
38	372,9276	-11
20-21	137,7864	+57
22	172,8818	+51
23	412,9546	-56
24	484,9262	+43
21-22	191,7568	-80
23	454,7474	+16
24	489,2182	+29
25	544,9392	+15
26	498,5158	+44
27	481,3618	-59
28	476,3706	-22
22-23	263,5035	-33
24	314,8974	+11
25	395,9250	+13
26	399,7753	+ 7
27	434,6906	-27

<u>LINE</u>	<u>OBSERVED HIRAN (STATUTE MILES)</u>	<u>CORRECTION (STATUTE MILES X 10⁴)</u>
22-28	463.8379	-41
23-24	137.5983	+33
25	264.5479	- 9
27	477.4424	- 5
36	272.3818	-29
37	257.9655	0
38	165.0271	- 6
24-25	127.0292	+11
26	251.7693	+ 4
27	371.4584	-50
28	446.6360	+63
36	376.3144	+12
37	297.9974	-46
38	123.9586	+29
25-26	159.2908	+49
30	488.6842	+ 1
31	294.5805	- 2
32	534.9380	-24
33	526.9282	+33
34	490.8050	+16
35	376.3045	-18
36	489.9163	+ 1
37	382.3366	+14
38	182.0713	-20
26-30	366.9912	0
31	182.1770	+68
32	460.5140	-16
33	490.3108	-14
34	501.5460	+20
35	430.2248	+69
38	338.6690	+64
27-28	84.2902	+24
30	308.7884	-62
31	179.8890	-54
32	450.0770	+37
33	512.9115	+43
35	519.6693	-18
38	468.6506	-33
61	452.0696	+10
28-29	227.7016	- 7
30	310.6078	-21
31	233.0743	-29
32	475.6416	-45
60	473.6306	0
61	400.6023	-17

<u>LINE</u>	<u>OBSERVED HIRAN (STATUTE MILES)</u>	<u>CORRECTION (STATUTE MILES X 10⁴)</u>
29-30	335.6703	+ 2
31	386.6466	- 2
32	523.3146	- 6
60	387.2015	-11
61	244.8730	- 4
30-31	194.2194	- 8
32	188.1045	-84
33	301.8099	-36
34	420.0793	+33
35	469.5804	+49
60	215.5476	-21
61	268.3530	- 5
31-32	282.5680	-13
33	333.5269	+19
34	386.0459	-34
35	369.1568	+ 7
60	409.5213	-13
61	429.5556	+74
35-37	171.4330	+37
38	324.4833	+16
37-38	200.4829	+28

e. Adjusted Results:

A list of geographic positions resulting from the adjustment is contained in this volume. Also listed are lengths and azimuths computed between the adjusted positions.

5. Analysis:

a. Accuracy of Observed Data.

(1) A value of $\pm .00262$ statute miles for the probable error of a single observation was determined from the adjustment solution. This value, of course, was affected by the inclusion of weighted observations derived from the traverse data.

(2) The ratio of the probable error of a single observation to the average line length of 346 miles gives a probable error expressed in proportional parts of 1/131,000.

(3) The largest correction applied to a Hiran measurement was $-.0084$ miles and the average without regard to sign was $.00274$ miles. The largest correction applied to a traverse length was $+.0029$ miles, and the average without regard to sign was $.0013$ miles. The largest correction applied to the traverse data azimuth was $-.0019$ miles and the average, $.0010$ miles.

(4) A solution of an adjustment containing only Hiran data, restrained only by the fixed positions in Australia, gives a value of ± 0.00259 miles for the probable error of a single Hiran observation. This value may be used when a knowledge of Hiran accuracy is required.

b. Accuracy of Adjusted Positions.

Probable errors of latitude and longitude and the resultant of these errors for all positions are given below. The probable errors shown are with reference to the starting positions in Australia. A comparison with an assumed expected accuracy of a first-order triangulation system of $1/20,000 \sqrt{M}$ is also shown. In this case M is distance from starting position expressed in statute miles.

FIXED POSITIONS TO	M STATUTE MILES	PE LATITUDE	PE LONGITUDE	PE RESULTANT	PE RESULTANT M	$\frac{1}{20000 \sqrt{M}}$
9	1290	.00202	.00294	.00357	1/361,000	1/218,000
10	1410	.00243	.00301	.00387	1/364,000	1/224,000
11	1380	.00247	.00294	.00384	1/359,000	1/223,000
12	1420	.00246	.00299	.00387	1/367,000	1/225,000
13	1440	.00264	.00254	.00366	1/393,000	1/226,000
14	1110	.00205	.00229	.00307	1/367,000	1/207,000
15	1320	.00263	.00262	.00371	1/356,000	1/219,000
19	1090	.00186	.00244	.00307	1/355,000	1/206,000
20	1060	.00227	.00166	.00281	1/377,000	1/204,000
21	970	.00195	.00164	.00255	1/380,000	1/198,000
22	910	.00168	.00171	.00240	1/379,000	1/194,000
23	880	.00148	.00174	.00228	1/386,000	1/192,000
24	710	.00143	.00188	.00236	1/301,000	1/178,000
25	680	.00127	.00127	.00180	1/333,000	1/169,000
26	450	.00127	.00106	.00165	1/273,000	1/153,000
27	480	.00117	.00096	.00151	1/318,000	1/157,000
28	450	.00109	.00097	.00146	1/308,000	1/153,000
29	390	.00100	.00085	.00131	1/296,000	1/146,000
30	210	.00116	.00117	.00165	1/127,000	1/119,000
31	310	.00120	.00111	.00163	1/190,000	1/135,000
36	1090	.00175	.00275	.00328	1/324,000	1/206,000
37	900	.00190	.00254	.00317	1/284,000	1/193,000
38	740	.00164	.00219	.00274	1/270,000	1/181,000

6. Secondary Control Points.

a. The coordinates of secondary control points are determined by adjustments using the variation of coordinates method. The form of the observation equation is essentially that used for Hiran triangulation. The point adjusted is a selected landmark. The observed Hiran distances are used in the computation of the coordinates of the nadir

points of the photographs. No attempt is made to rectify the photographs and the nadir points are considered to be identical with the principal points. Distances measured on the photographs from the principal points to the selected secondary control point are the observed distances in the adjustment.

b. The solution described above is necessarily approximate because of non-rectification of the photography. Errors in measured distances may be due to non-verticality of the photographs, relief, scale, measuring error, horizon distance error, etc. However, the effect of types of such systematic errors as scale are minimized by the adjustment process and, of course, it is expected that random errors of any type, within a flight line or between flight lines, will also be minimized. Measurements are made with a micro-rule on film positives.

c. The adjusted geographic position and the probable error of position for each secondary control point established are given in Volume III. This probable error reflects only the magnitude of random errors from any source and certain types of systematic errors. While the magnitude of the probable error for several of the secondary control points furnished is somewhat larger than that usually obtained by this procedure, they are considered to be of some value and can be improved considerably by rectifying the associated photography. The geographic positions are referenced to the ground station positions listed herein and are therefore referenced to the Central Australian Datum.

d. Geographic positions for the nadir point of each photograph taken and the photography itself are also being furnished to the Australian government under separate cover.

7. Astronomic Positions.

The following is a list of all available astronomic positions.

<u>STATION</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>
9	002°09'57.30 S	147°09'59.36 E
10	001°25'46.69 S	149°37'48.34 E
11	002°35'16.93 S	150°19'49.95 E
12	002°36'59.26 S	152°00'30.66 E
13	005°15'22.55 S	154°34'08.80 E
15	004°23'52.72 S	151°43'01.08 E
19	004°41'13.20 S	145°58'35.26 E
20	008°33'54.36 S	150°14'47.25 E
21	010°34'19.37 S	150°13'37.40 E
22	009°07'51.47 S	147°48'46.20 E
23	007°26'55.55 S	144°21'10.57 E
24	009°05'20.88 S	143°12'24.11 E
25	010°39'15.83 S	142°12'43.38 E
35	012°13'09.31 S	136°51'48.92 E
36	003°37'03.02 S	143°20'40.18 E

The following Hiren ground station descriptions, sketches and identification photography are contained in the remainder of this volume:

<u>NUMBER</u>	<u>NAME</u>
9	LEA
10	NOMA
11	PILIKOS
12	MORU
13	TSINON
14	NEW TANGI
15	NANDAN
19	KUMUN
20	NOEL
21	SUAD
22	MYOLA

HIRAN STATION DESCRIPTION

NAME AND NUMBER: LEA (9) LOCATION: Manus Island
Bismarck Archipelago
Territory of Papua
and New Guinea

DATE ESTABLISHED: September 1962

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 02° 10' S
Longitude: 147° 10' E

ELEVATION: 777 feet (Barometric Leveling, USAF)

DESCRIPTION: Station LEA is located in the southeastern part of Manus Island, approximately 2 miles NE of the coastal village of Nohang and approximately 2 miles north of the western tip of Sanders Island, a small offshore island. It is situated in a cleared area on a ridgetop which can readily be seen from the sea. The station is marked by an APCS Survey Control Station disk, stamped "LEA 1962", set in a 12 by 14 inch concrete monument projecting about 2 inches above the ground surface. The subsurface mark is a disk of the same description set in concrete, 2.7 feet below the surface mark. (A first order astronomic position was established by the U.S. Navy Oceanographic Office coincident with the Hiran station.)

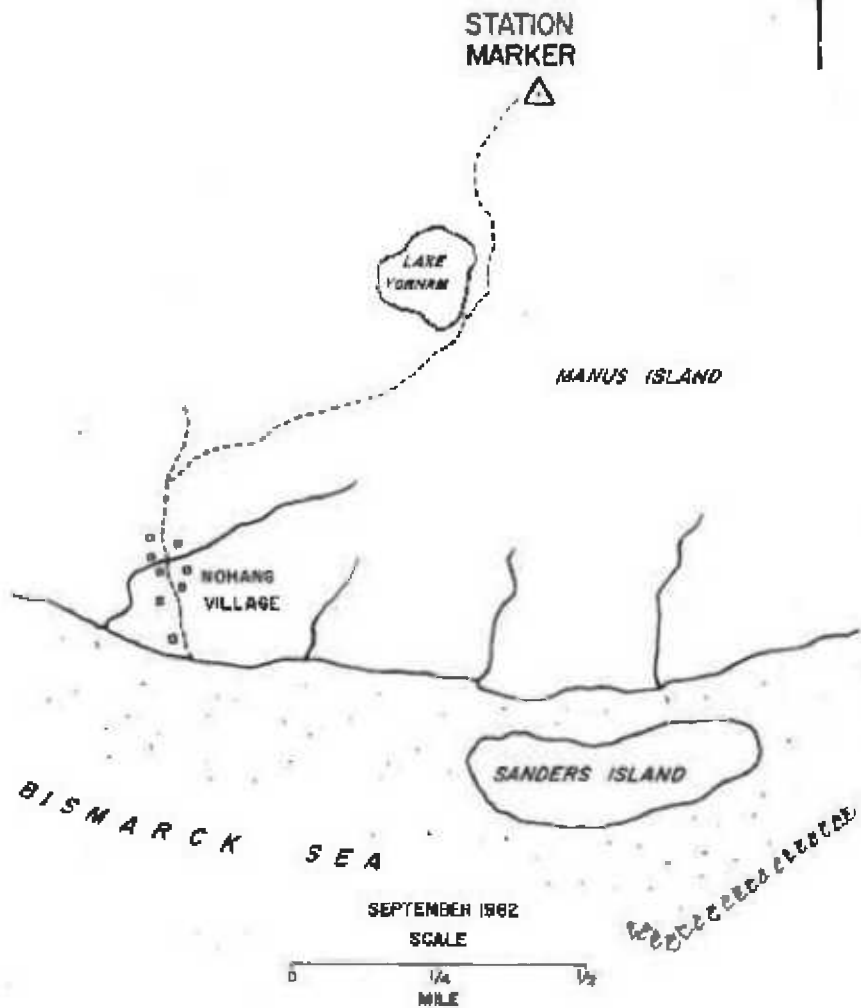
REFERENCES: Reference marks are APCS reference mark disks stamped "RM 1", "RM 2", and "RM 3", respectively, set in masses of concrete about 8 inches in diameter. The azimuth mark is located on the highest point of the hill due east of the station; it is marked by the center of the outlet of a yellow aluminum compressed gas cylinder, set in a concrete pad which is inscribed "NAN-1962-USNHO." The azimuth mark is at astronomic azimuth (from south) of 262° 52' 30"±20 from RM 2.

<u>OBJECT</u>	<u>DISTANCE (FEET)</u>	<u>AZIMUTH FROM NORTH (MAGNETIC)</u>
RM 1	44.62	40° 45'
RM 2	66.81	89° 35'
RM 3	42.35	297° 11'

ROUTE DESCRIPTION: The best means of access is by ship-based helicopter. An alternate method is by foot-trail from Nohang village. The village is reached by small boat or native canoe from a sea-going vessel, which must remain outside the coral reef. From the village the trail follows a ridgeline to the northeast, goes around the east side of Lake Yornam, crosses a small creek, and thence leads up the side of the ridge on which the station is located. The station is on the easternmost high point of the ridge. A native guide should be obtained at Nohang village before attempting this trail. Walking time from the village to the station is approximately 1 1/2 hours.

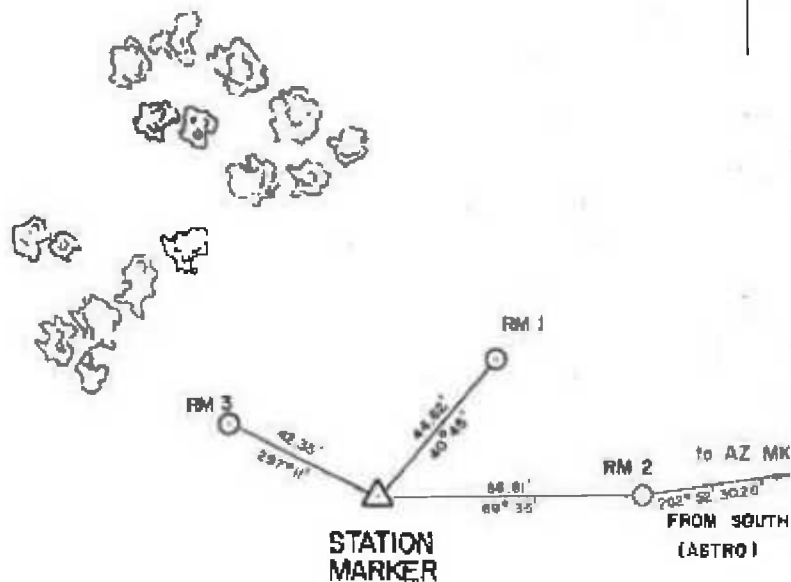
AREA SKETCH

LEA (9)

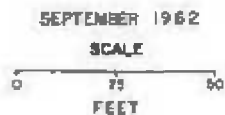


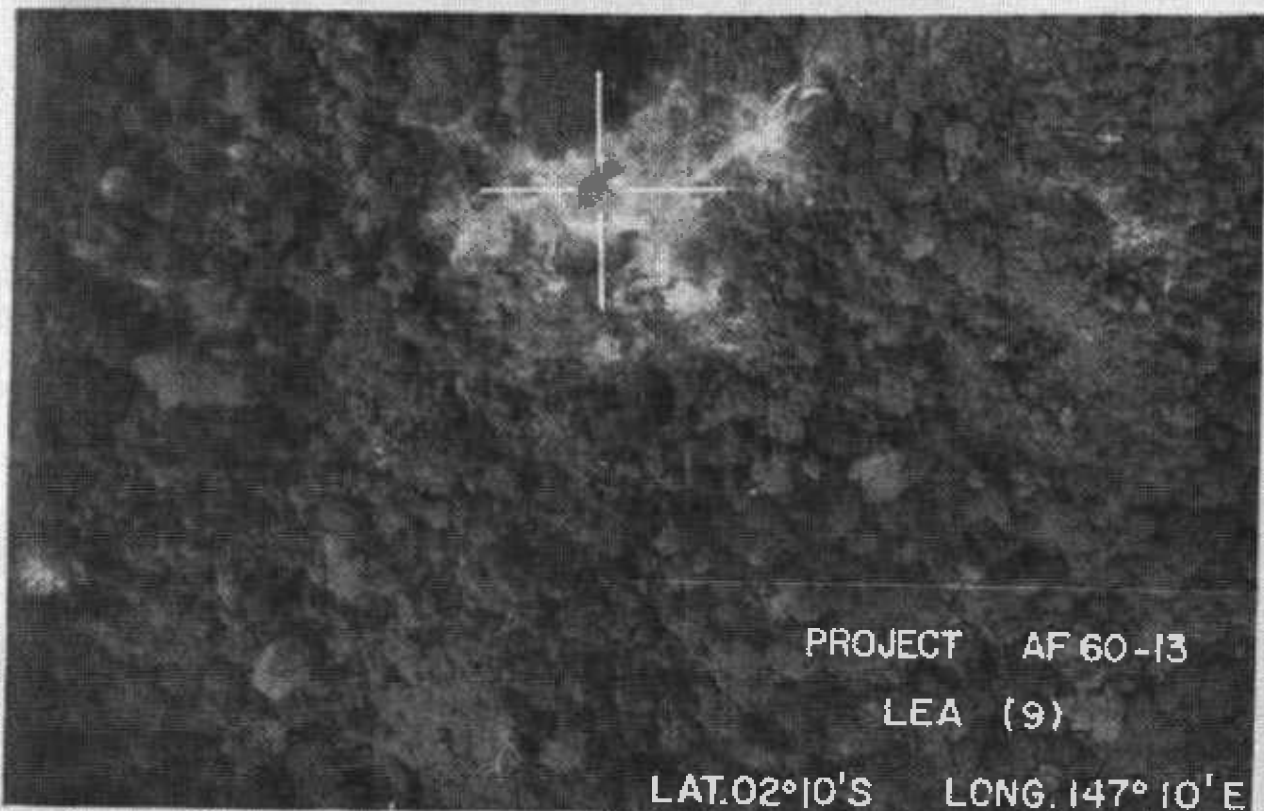
STATION SKETCH

LEA (9)



AZIMUTHS FROM NORTH (MAGNETIC) EXCEPT AS NOTED





PROJECT AF 60-13

LEA (9)

LAT. 02° 10' S LONG. 147° 10' E



PROJECT AF 60-13

LEA (9)

LAT 02° 10' S LONG 147° 10' E



PROJECT AF 60-13

LEA (9)

LAT 02°10'S LONG 147°10'E



PROJECT AF 60-13
LEA (9)

LAT 02° 10' S LONG 147° 10' E



PROJECT AF 60-13

LEA (9)

LAT. 02° 10' S LONG. 147° 10' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: NOMA (10) LOCATION: Mussau Island
Bismarck Archipelago
Territory of Papua
and New Guinea

DATE ESTABLISHED: August 1962

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 01° 26' S
Longitude: 149° 38' E

ELEVATION: 2124.9 feet (Trigonometric Leveling, AMS)

DESCRIPTION: Station NOMA is located on Ungsonoma Mountain, which is in the approximate center of Mussau Island and the highest point on the island. It is in an area approximately 150 feet by 50 feet on the mountain top which was cleared of jungle vegetation. The station is marked by a USAF Geodetic Survey Hiran Station disk stamped "NOMA 1962", set in a concrete monument, roughly circular, about 9 inches in diameter and projecting about one inch above the ground surface. The subsurface mark is a disk of the same description set in solid coral, 2.6 feet below the surface mark.

REFERENCES: Reference Mark No. 1 is a U.S. Army Corps of Engineers disk stamped "NOMA SODANO LIGHT, AMS, 1962", centered within a tribrach set in top of a concrete pier 14 inches square and four feet high. This position was occupied for Sodano light-crossing observations by AMSFE. Reference Marks No. 2 and No. 3 are APCS reference mark disks stamped "RM 2" and "RM 3" respectively, set in concrete monuments about 8 inches in diameter, projecting about 2 inches above the ground surface. The azimuth mark is a U.S. Army Corps of Engineers disk stamped "NOMA SODANO AZ MK, AMS, 1962", set in a concrete monument 6 inches in diameter, projecting 3 inches above the ground surface.

<u>OBJECT</u>	<u>DISTANCE (METERS)</u>	<u>AZIMUTH FROM SOUTH (ASTRONOMIC)</u>
RM 1	12.055	221° 31' 45"
RM 2	9.737	05° 57' 39"
RM 3	7.781	77° 36' 34"
AZ MK	104.6	288° 20' 20"

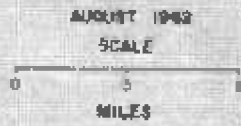
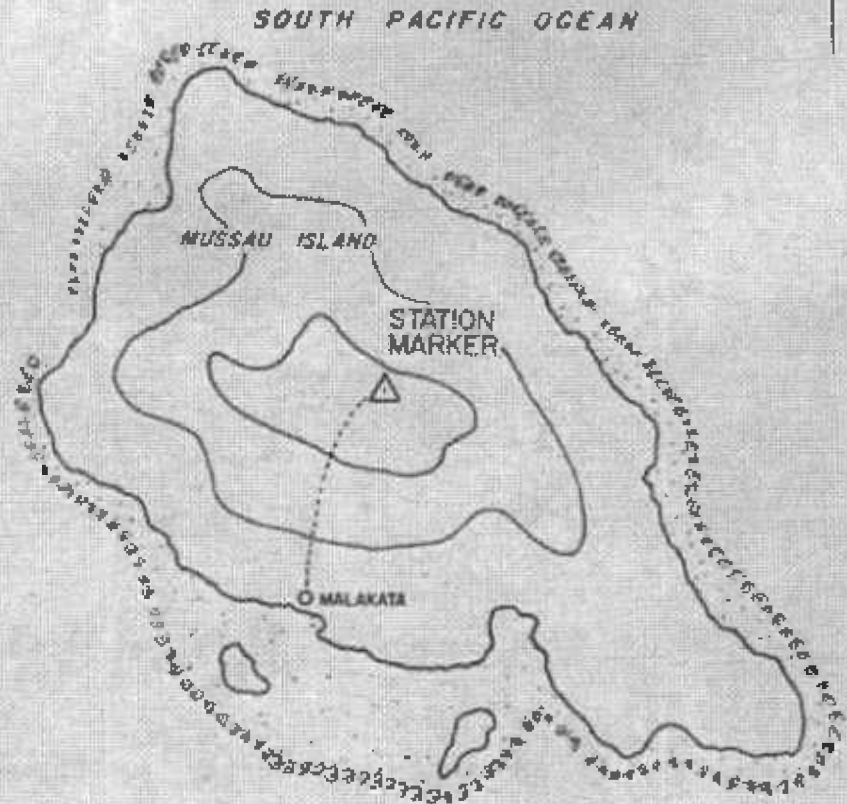
REMARKS: RM 3 was occupied for astronomical observations by an AMSFE Astro party and is identified in field records as NOMA ASTRO AMSFE 1962.

ROUTE DESCRIPTION: The station is best reached by ship-based helicopter. However, the site is in the clouds most of the time. An alternate method is by a foot trail cut through the tropical rain forest, from the coastal village of Malakata, on the southwest

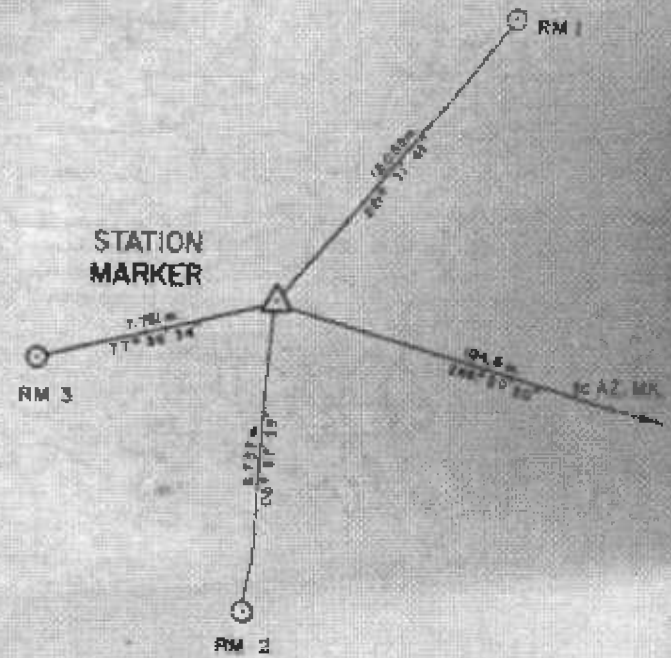
NOMA (10)

coast of the island. The island can be reached by chartered boat from Kavieng, New Ireland, but sea going vessels must remain outside the coral reef surrounding the island and native canoes used to go from ship to shore. A native guide should be obtained in the village before attempting the trail, which is obscure and goes up near-vertical slopes. Walking time from the village to the station is 6 to 8 hours.

AREA SKETCH
NOMA (10)

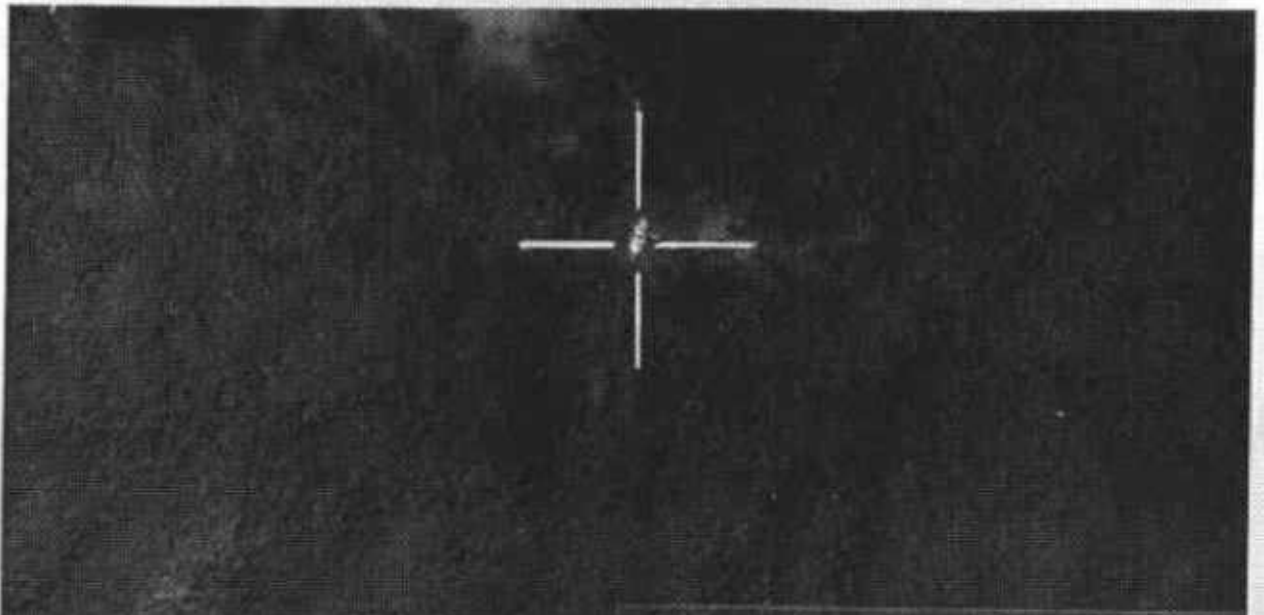


STATION SKETCH
NOMA (10)

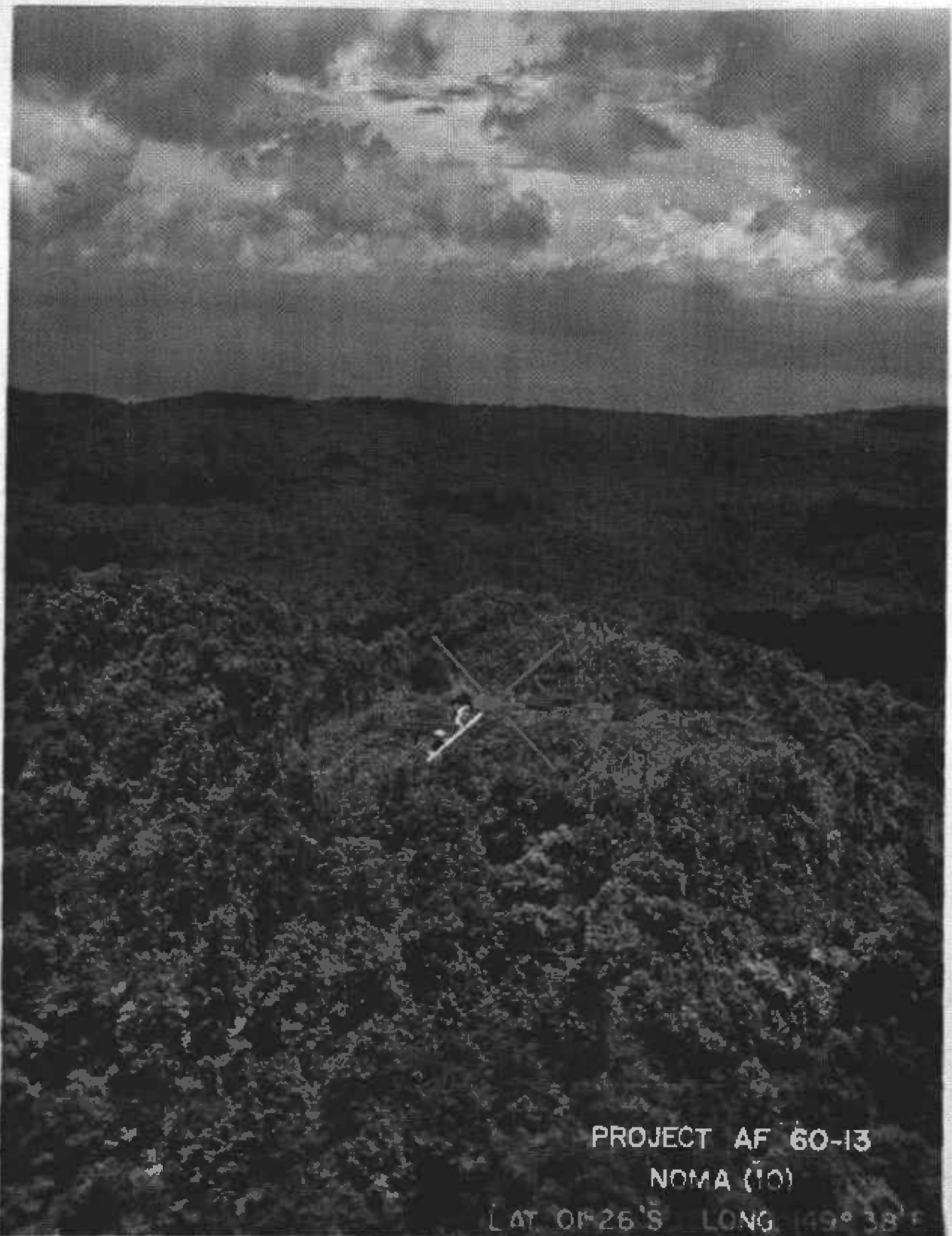


AZIMUTHS FROM SOUTH (ASTRONOMICAL)



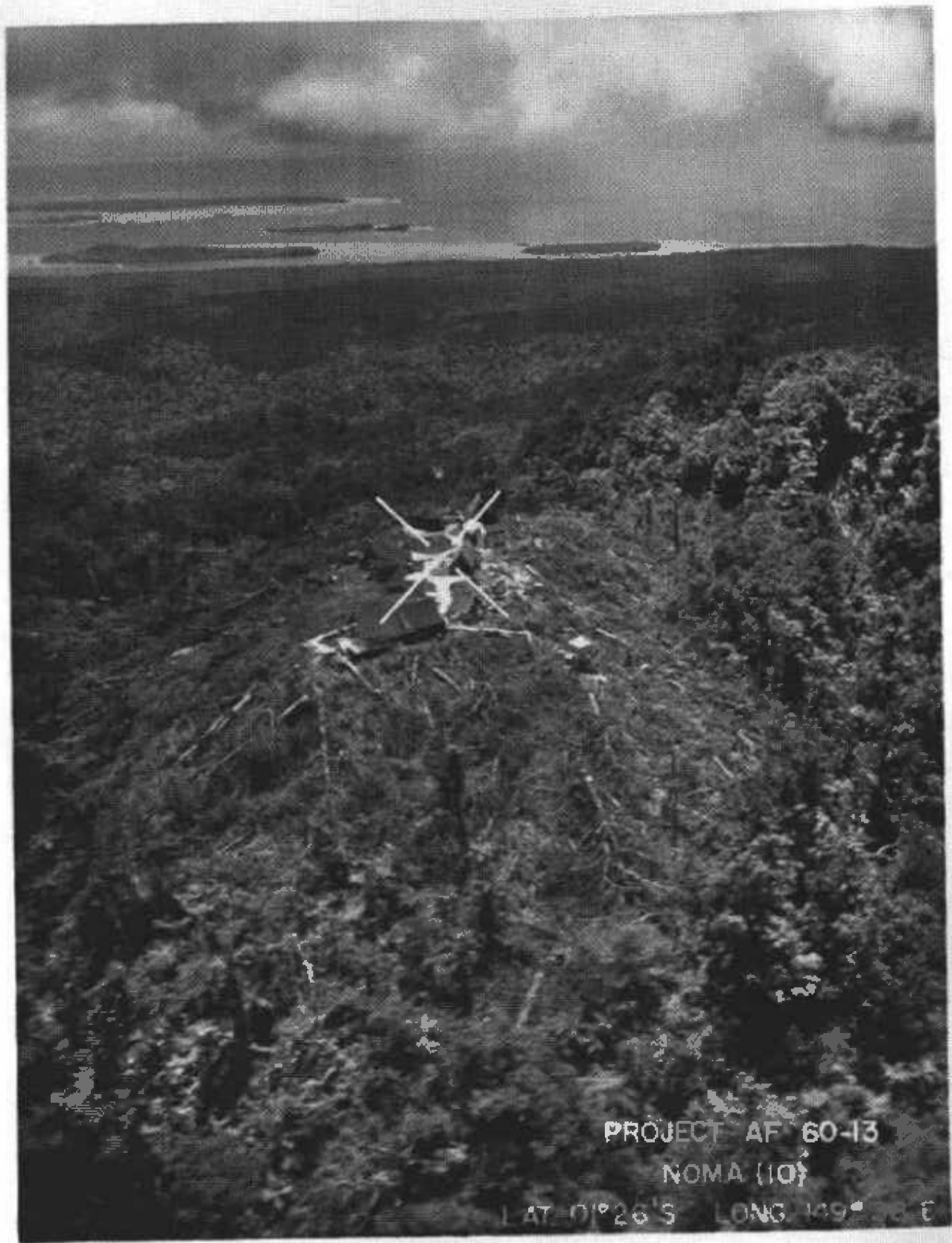


PROJECT AF 60-13
NOMA (10)
LAT. 0°26'S LONG. 149°38'E



PROJECT AF 60-13
NOMA (10)

LAT. 01°26'S LONG. 149°38'E



PROJECT AF 60-13

NOMA (10)

LAT 01°26' S LONG 149° 38' E



PROJECT AF 60-13

NOMA (10)

LAT. 01°26' S LONG. 149°38' E



PROJECT AF 60-13

NOMA (10)

LAT 0°26' S. LONG 149° 38' E.

HIRAN STATION DESCRIPTION

NAME AND NUMBER: PILIKOS (11) LOCATION: New Hanover Island
 Bismarck Archipelago
 Territory of Papua and
 New Guinea

DATE ESTABLISHED: August 1962

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 02° 35' S
 Longitude: 150° 20' E

ELEVATION: 1822 feet (Barometric Leveling, USAF)

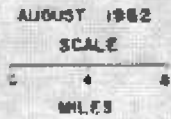
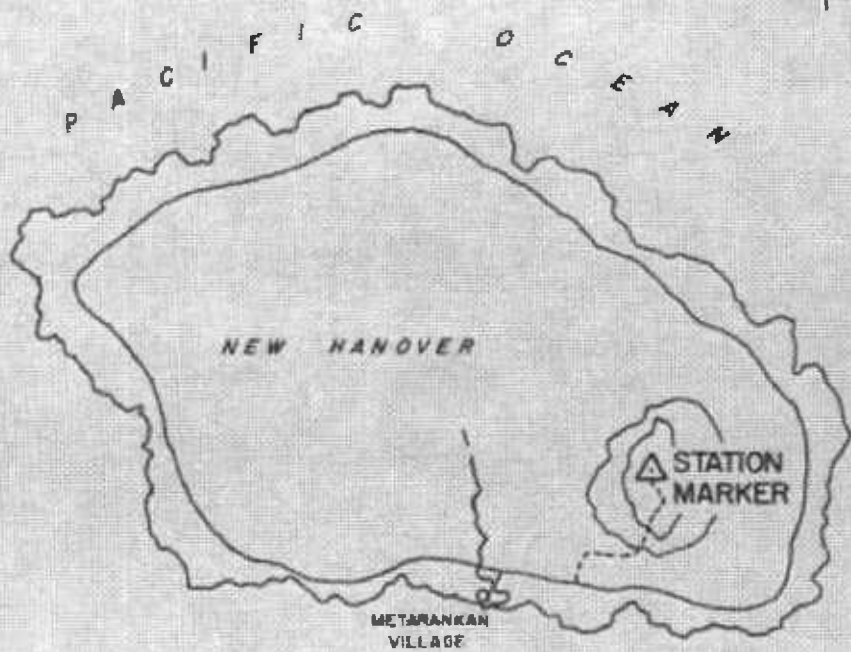
DESCRIPTION: Station PILIKOS is located on a mountain top in the south-eastern part of New Hanover (Lavongai) Island. (It is probably the mountain named Batwunk on the AMS 1:500,000 map). The mountain is in the form of a ridge running approximately north-south, and the station is on the highest point on the ridge. There is no nearby feature by which to identify the station more precisely, but the site is well known to natives in the village of Meteranken. The station is marked by an APCS Survey Control Station disk, stamped "PILIKOS 1962", set in a roughly circular concrete monument, about 10 inches in diameter and flush with the ground surface. The sub-surface mark is a disk of the same description set in concrete, 2.6 feet below the surface mark.

REFERENCES: Reference marks are APCS reference mark disks, stamped "RM 1 1962", "RM 2 1962", and "RM 3 1962", respectively, set in concrete monuments about 8 inches in diameter and flush with the ground surface.

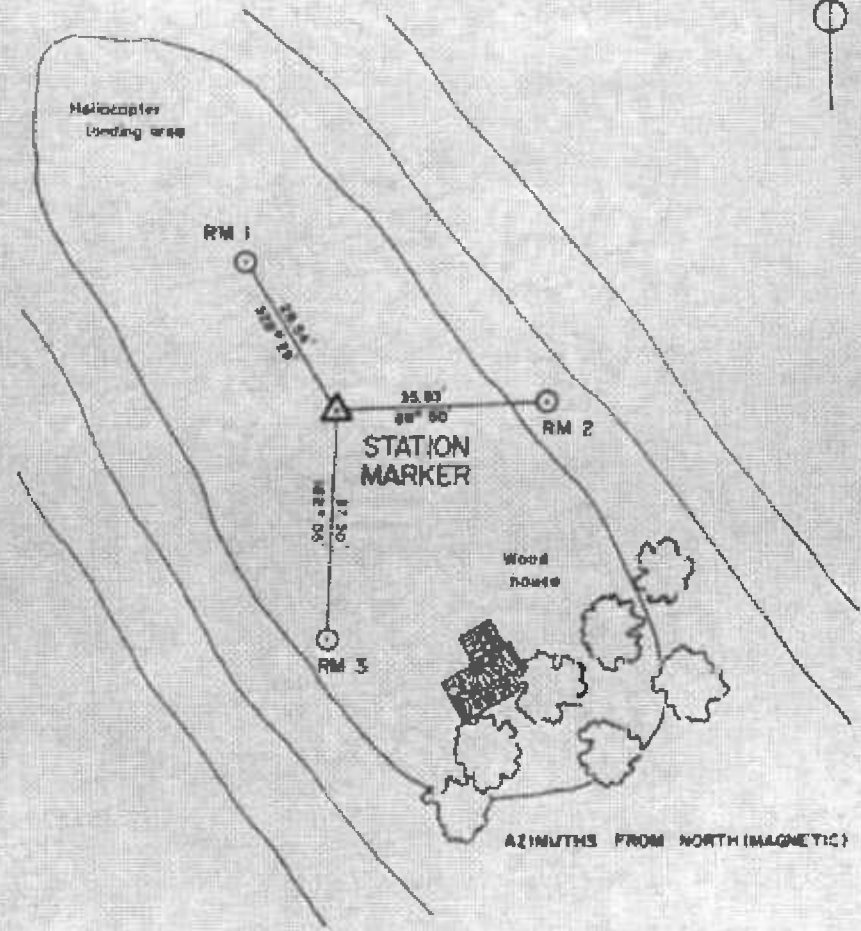
<u>OBJECT</u>	<u>DISTANCE (FEET)</u>	<u>AZIMUTH FROM NORTH (MAGNETIC)</u>
RM 1	28.54	328° 29'
RM 2	35.83	88° 50'
RM 3	37.30	182° 05'

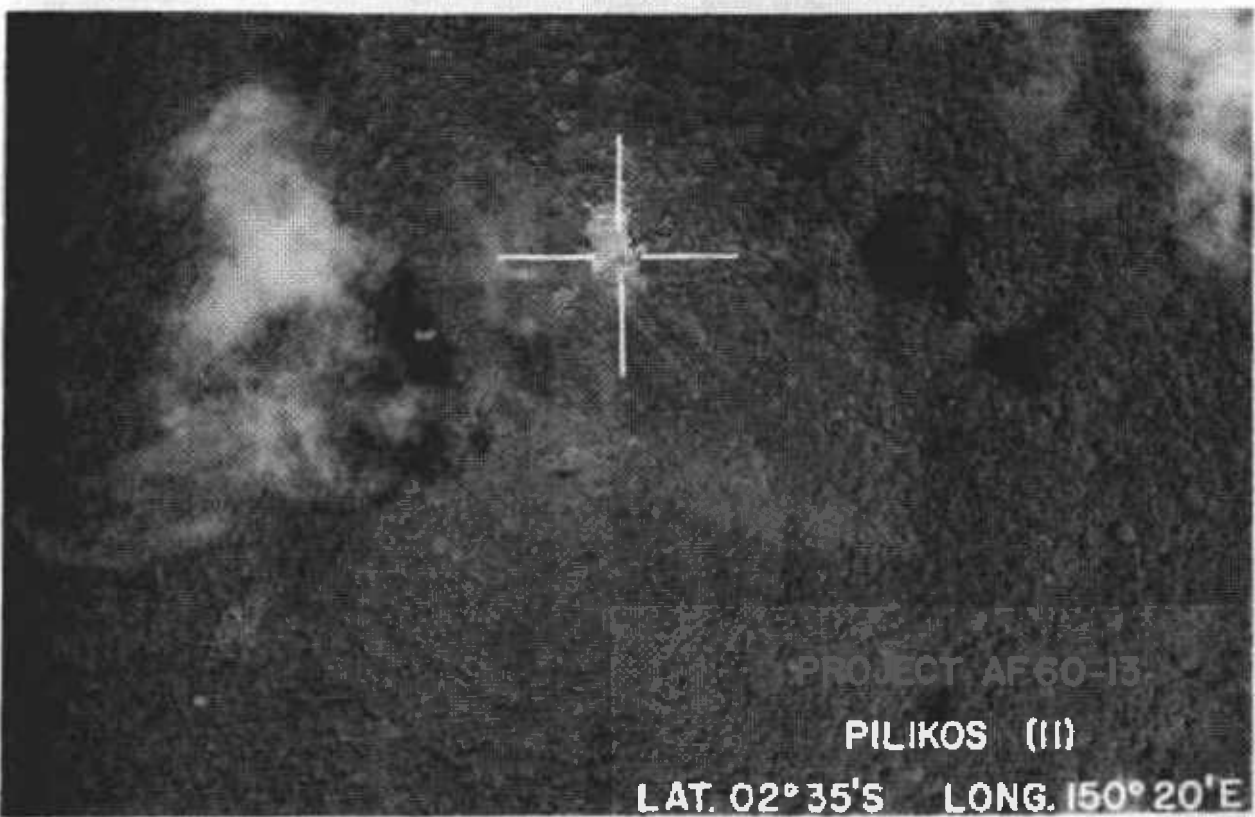
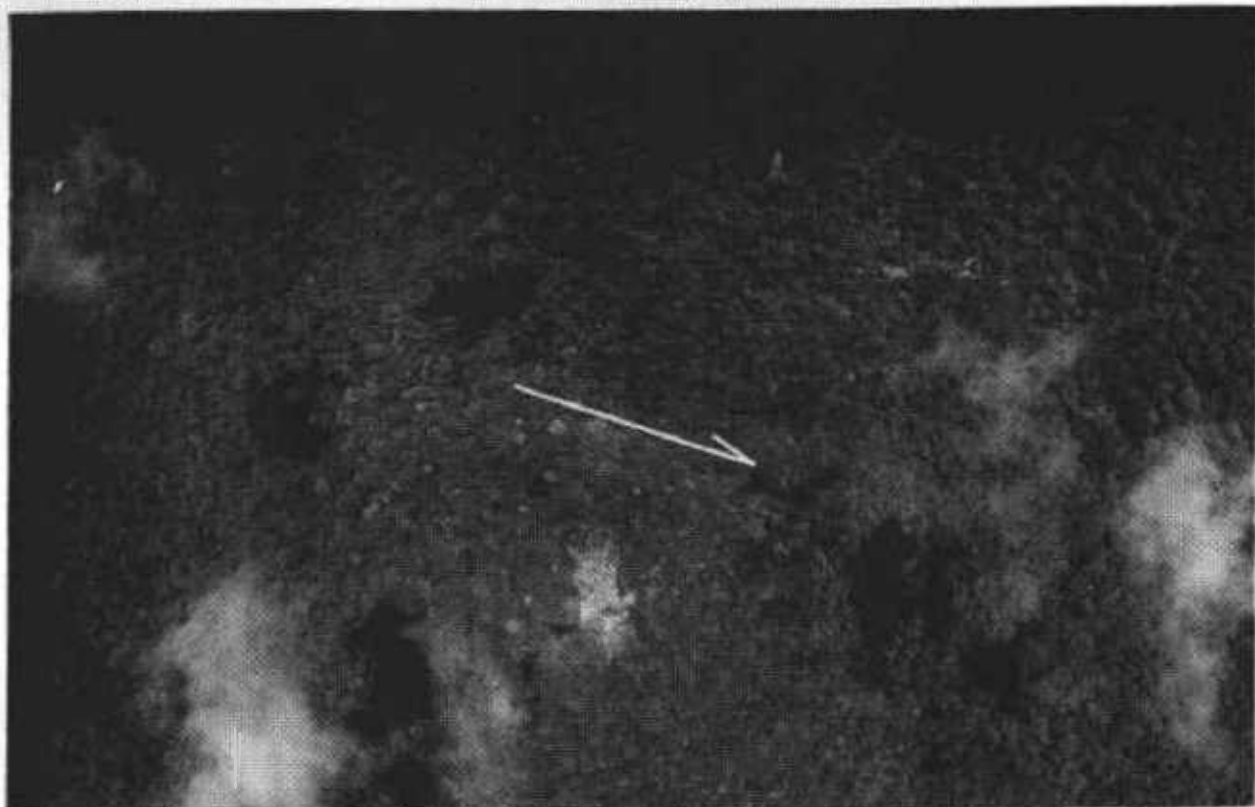
ROUTE DESCRIPTION: The best means of access is by ship-based helicopter. The site is in a cleared area on the ridgetop which can best be seen from the air from the east or west. An alternate method is by rough foot trail from the village of Meteranken (Matarakin) on the south coast of the island. The island can be reached by chartered boat from Kevicng, New Ireland. It is necessary to obtain a guide in Meteranken before attempting to reach the station site on foot. Guides can be furnished by a native named Pilikos. The trail goes through heavy rain forest and is extremely steep in many places. Walking time from the village to the station is approximately 4 to 5 hours.

AREA SKETCH PILIKOS (II)



STATION SKETCH PILIKOS (II)

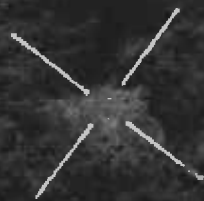




PROJECT AF60-13

PILIKOS (II)

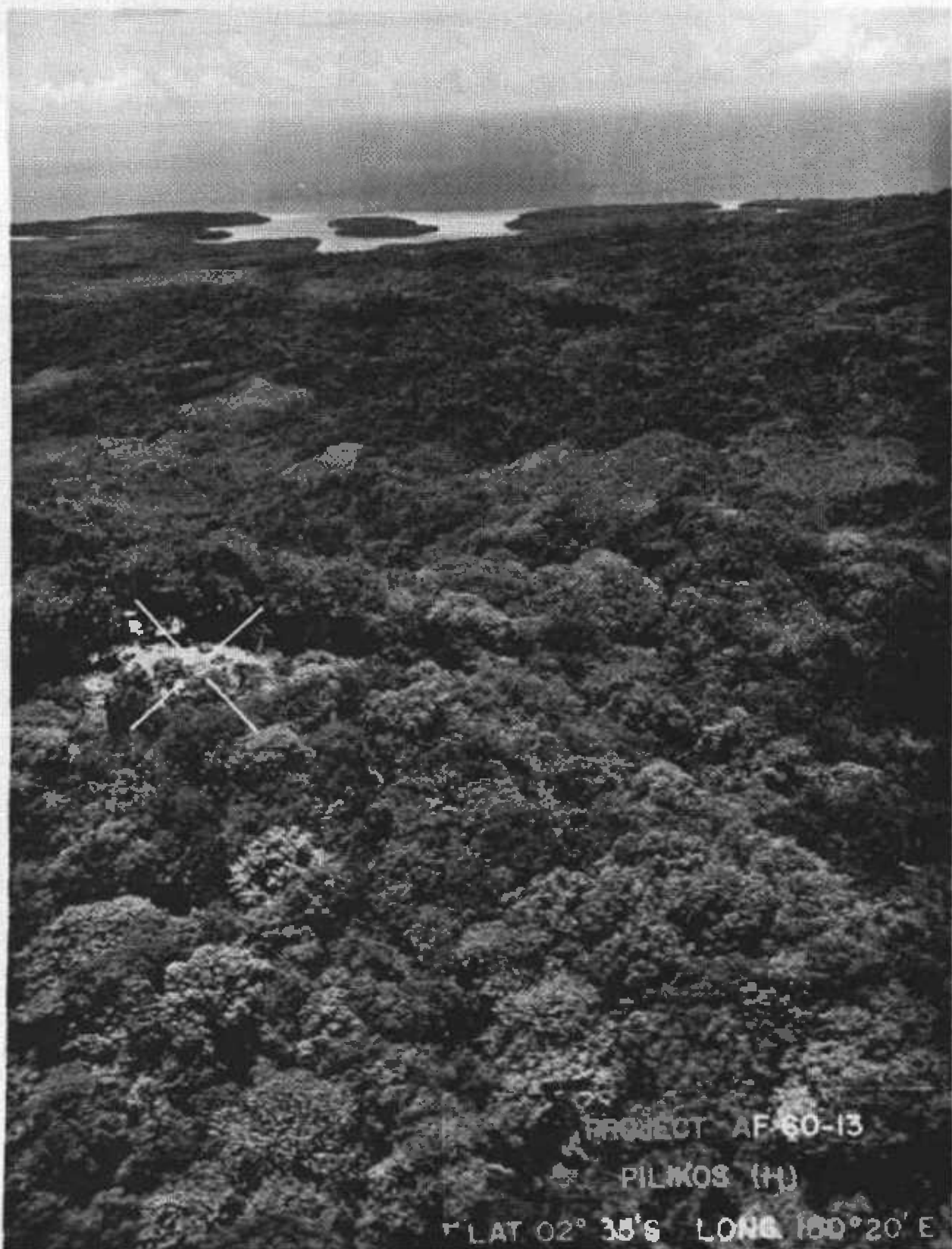
LAT. 02° 35'S LONG. 150° 20'E



PROJECT AF60-13

PILIKOS (II)

LAT. 02° 35'S LONG. 150° 20'E



PROJECT AF 60-13

FILMOS (H)

LAT 02° 35' S LONG 100° 20' E



PROJECT AREA 013

PILIKOS (II)

LAT. 02° 35' S LONG 150° 20' E



PROJECT AF 60-13

PILIKOS (17)

LAT. 02° 35' S LONG. 160° 20' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: MORU (12) LOCATION: Simberi Island
Bismarck Archipelago
Territory of Papua and
New Guinea

DATE ESTABLISHED: July 1962

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 02° 37' S
Longitude: 152° 00' E

ELEVATION: 939 feet (Trigonometric Leveling, AMSFE, from 4th Order
Australian Bench Mark)

DESCRIPTION: Station MORU is located on the highest point of a mountain locally known as Moru, in the northeastern part of Simberi Island, of the Tabar Group, north of New Ireland. The top of the hill is a flat, elongated area approximately 150 feet by 75 feet, which was cleared for helicopter access. The station is marked by a USAF Geodetic Survey Hiran Station disk, stamped "MORU 1962", set in a roughly circular mass of concrete about 8 inches in diameter, flush with the ground surface. The subsurface mark is a disk of the same description set in concrete, 2 feet below the surface mark.

REFERENCES: Reference Marks No. 1 and No. 2 are USAF Geodetic Survey reference mark disks, stamped "RM 1 1962" and "RM 2 1962" respectively, set in irregular masses of concrete about 8 inches in diameter, flush with the ground surface. Reference Mark No. 3 is a U.S. Army Corps of Engineers survey disk, stamped "MORU SODANO LIGHT ARMY MAP SERVICE", centered within a tribrach set in the top of a concrete pier about one foot square and 4 feet high. (This point was used for astronomic position observations by USNCO, and for astronomic azimuth and light crossing observations by AMSFE.) The azimuth mark is a U.S. Army Corps of Engineers bench mark disk, stamped "MIKE 9", set in concrete flush with the ground surface, on the highest hill on the island, about a mile SSW of the Hiran station. (This bench mark was also stamped "HIRAN 1962". Care should be taken not to identify this mark as the Hiran station). A fourth order elevation of 957 feet above local MSL was established for Mike 9 by the Royal Australian Survey Corps (1957).

<u>OBJECT</u>	<u>DISTANCE (METERS)</u>	<u>AZIMUTH FROM SOUTH (ASTRONOMIC)</u>
RM 1	8,183	201° 46' 30"
RM 2	13,668	275° 54' 39"
RM 3	11,948	58° 34' 25"
AZ MK (MIKE 9)	1837.3	23° 0' 30"

ROUTE DESCRIPTION: The best means of access is by ship-based helicopter. The station can also be reached by foot trail from the coastal village of Napekur. Simberi Island can be reached by chartered boat from Kavieng, New Ireland. A guide should be hired in Napekur

MORU (12)

before attempting to reach the station on foot. From the village a fairly well defined trail follows the coast eastward for about a 30 minutes' walk. An obscure track then cuts inland, crosses a saddle in a ridge, drops to a creek, and then follows a knife ridge to the top of Moru. The trail goes through dense tropical rain forest and is almost vertical in places. Walking time from Napekur village to the station is approximately two hours.

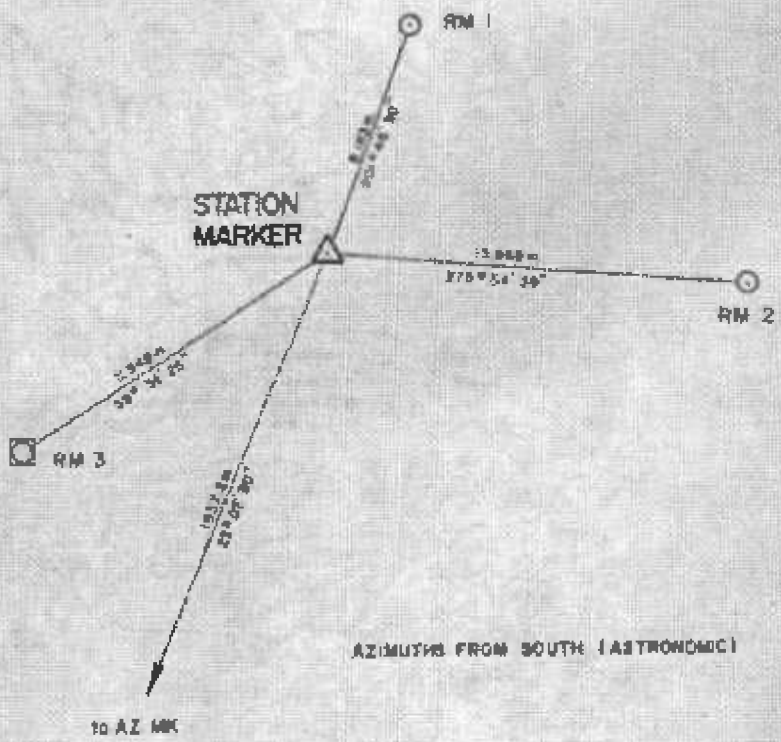
AREA SKETCH MORU (12)



PACIFIC OCEAN

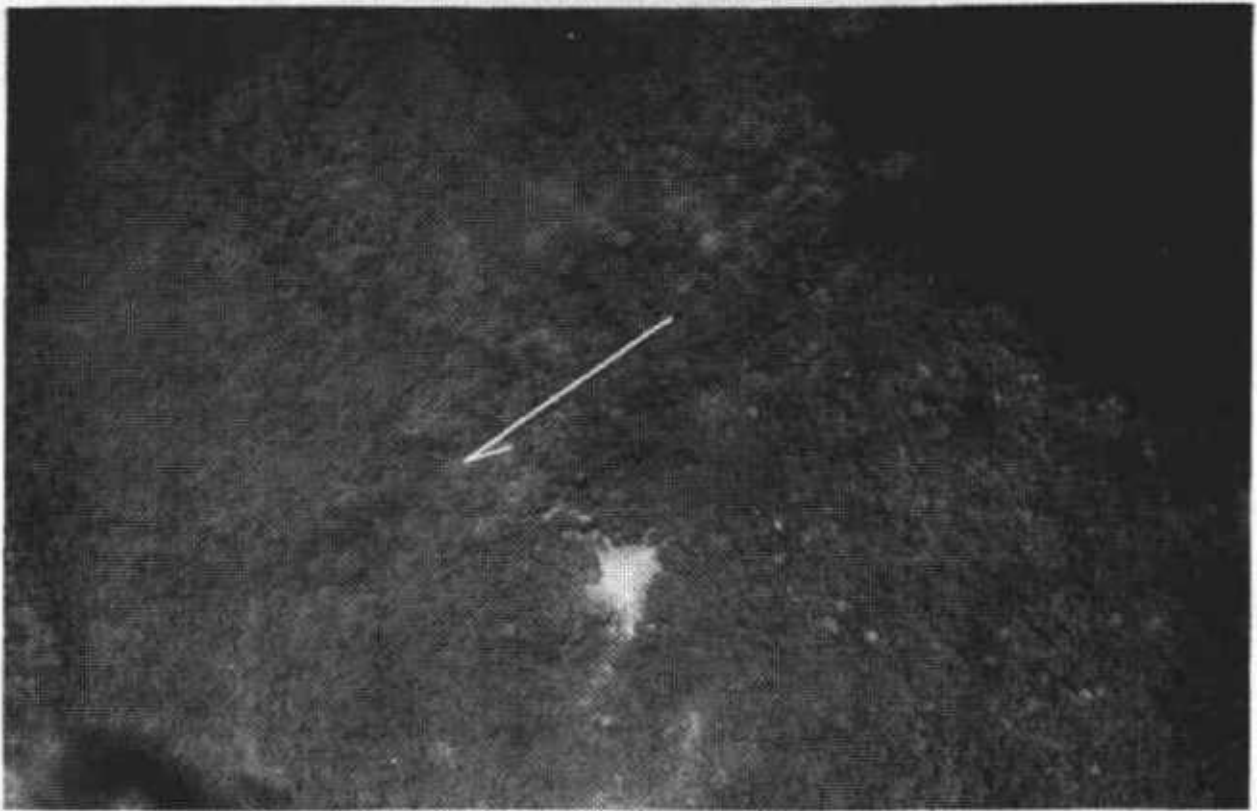


STATION SKETCH MORU (12)



AZIMUTHS FROM SOUTH (ASTRONOMIC)





PROJECT AF 60-13
MORU (12)
LAT. 02° 37' S LONG. 152° 00' E



PROJECT AF 60-13
MORU (12)
LAT. 02° 37' S LONG 152° 00' E



PROJECT AF 60-13
MORU (12)

LAT. 02° 37' S LONG. 152° 00' E



PROJECT AF 60-13
MORU (12)

LAT. 02° 37' S LONG 152° 00' E



PROJECT AF 60-13

MORU (12)

LAT. 02° 37' S LONG. 152° 00' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: TSINON (13) LOCATION: Buks Island
 Solomon Islands
 Territory of Papua and
 New Guinea

DATE ESTABLISHED: October 1962

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 05° 15' S
 Longitude: 154° 34' E

ELEVATION: 1259 feet (Barometric Leveling, USAF)

DESCRIPTION: Station TSINON is located on the highest point of Tainon mountain, in the west-central part of Buks Island. It is approximately 1 3/4 miles SE of the coastal village of Bei. An area on the mountain top was cleared of the dense jungle growth. The station is marked by an APCS Survey Control Station disk, stamped "TSINON 1962", set in a roughly circular concrete monument 8 inches in diameter, projecting about two inches above the ground surface. The subsurface mark is a disk of the same description set in concrete, 2 feet below the surface mark.

REFERENCES: Reference Marks No. 1 and No. 2 are APCS reference mark disks, stamped "RM 1 1962" and "RM 2 1962", respectively set in concrete monuments 8 inches in diameter, projecting 2 inches above the ground surface. Reference Mark No. 3 is a U.S. Army Corps of Engineers survey disk, marked with a triangle, centered in a tribrach set in the top of a concrete pier approximately one foot square and 4 feet high. (This point was used for light-crossing azimuth observations by AMSFE and is identified in their records as "TSINON SODANO LIGHT AMS 1962"). The azimuth mark is a U.S. Army Corps of Engineers survey disk, stamped "TSINON SODANO AZ MK 1962 ARMY MAP SERVICE" set in an 8 by 12 inch concrete monument, 2 inches below the ground surface, in the new Bei village. It is 42.8 feet NW of the NE corner, and 38.7 feet NW of the NW corner of the metal-roofed council house.

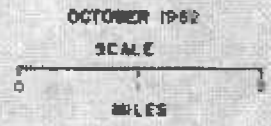
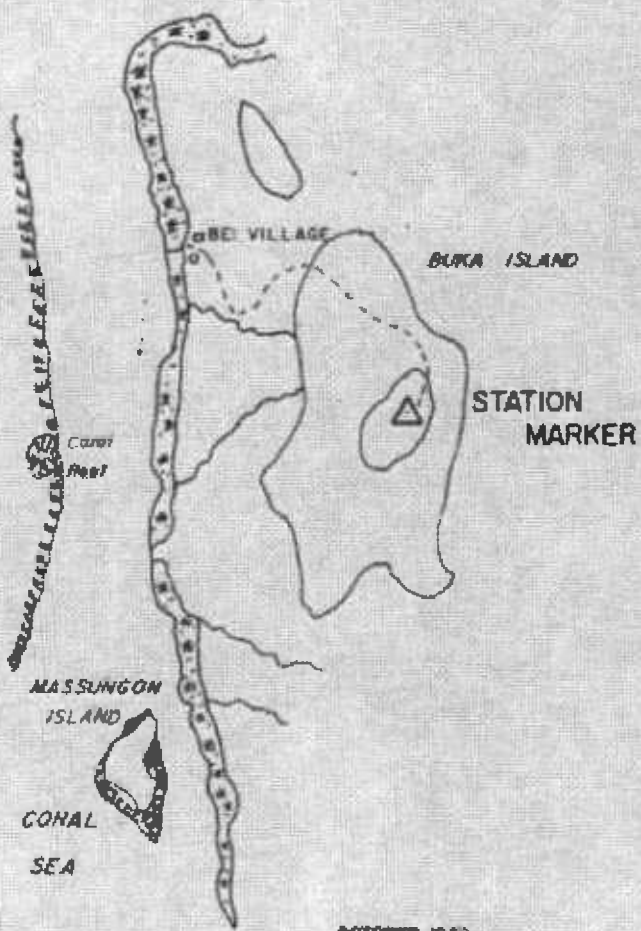
<u>OBJECT</u>	<u>DISTANCE (METERS)</u>	<u>AZIMUTH FROM SOUTH (ASTRONOMIC)</u>
RM 1	9.719	304° 44' 50"
RM 2	9.398	63° 19' 03"
RM 3	5.844	179° 43' 18"

Measured from RM 3:

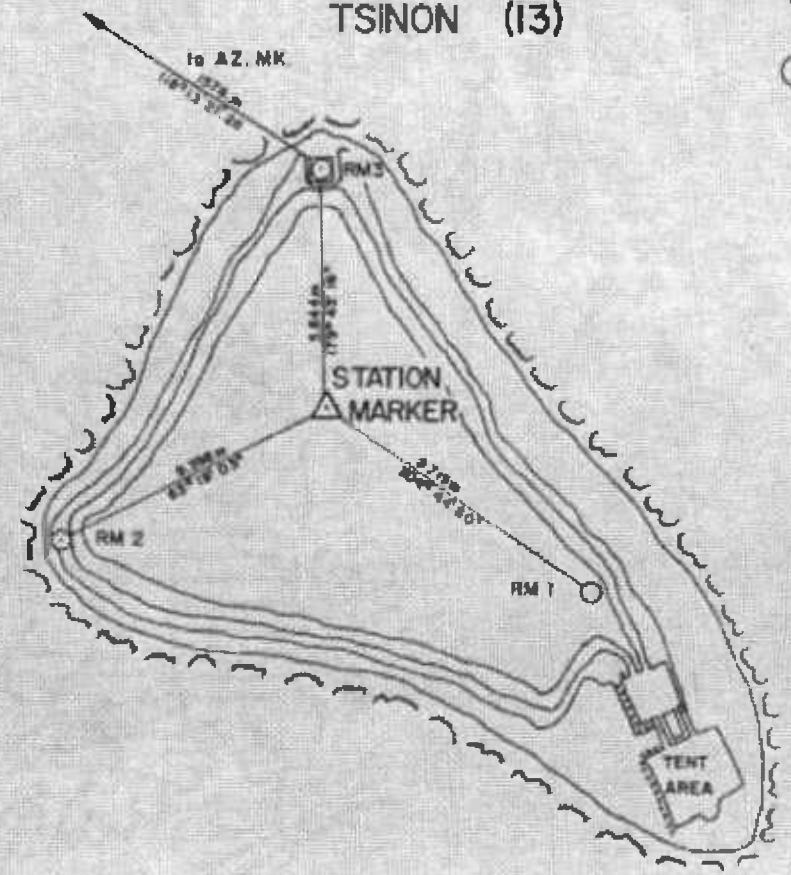
AZ MK	1578.	118° 13' 21.26
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ROUTE DESCRIPTION: The station can best be reached by helicopter. It can also be reached on foot by an obscure and difficult jungle trail from the village of Bei to the top of Mt. Tainon. A guide should be obtained in the village if this method is attempted. Walking time is approximately two hours.

AREA SKETCH
TSINON (13)



STATION SKETCH
TSINON (13)



AZIMUTH FROM
SOUTH (ASTRONOMIC)





PROJECT AF 60-13

TSINOW (13)

34'E



PROJECT AF 60-13

TSINDM (13)

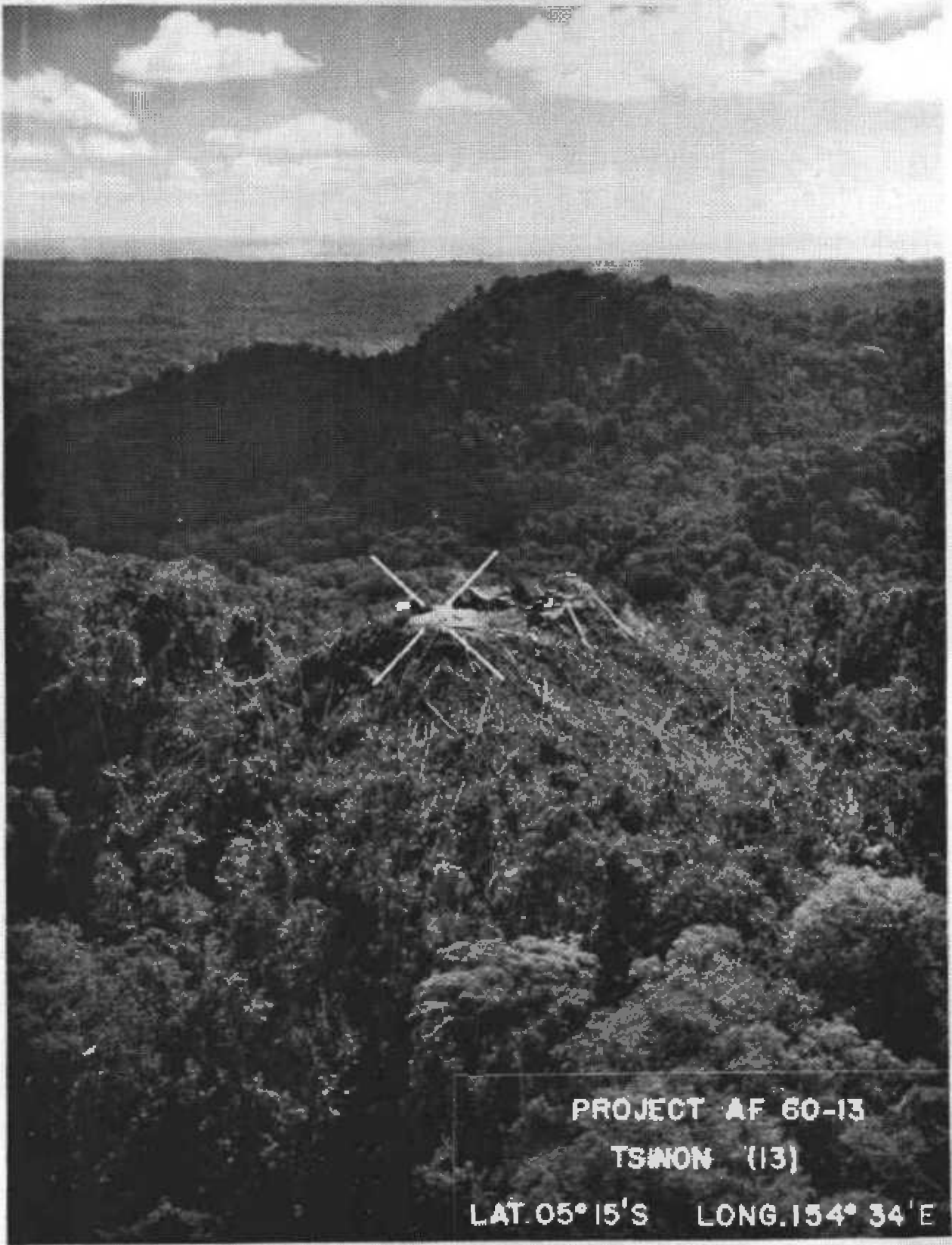
LAT. 05° 15' S LONG. 154° 34' E



PROJECT AF 60-13

TSINON (13)

LAT. 03° 15' S LONG. 154° 34' E



PROJECT AF 60-13

TSNON (13)

LAT. 05° 15' S LONG. 154° 34' E



PROJECT AF 60-13

TSINON (13)

LAT. 05° 15' S LONG. 154° 34' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: NEW TANGI (14) **LOCATION:** New Britain Island
Bismarck Archipelago
Territory of Papua and
New Guinea

DATE ESTABLISHED: December 1962

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 05° 39' S
Longitude: 148° 24' E

ELEVATION: 4858 feet (Barometric Leveling, USAF)

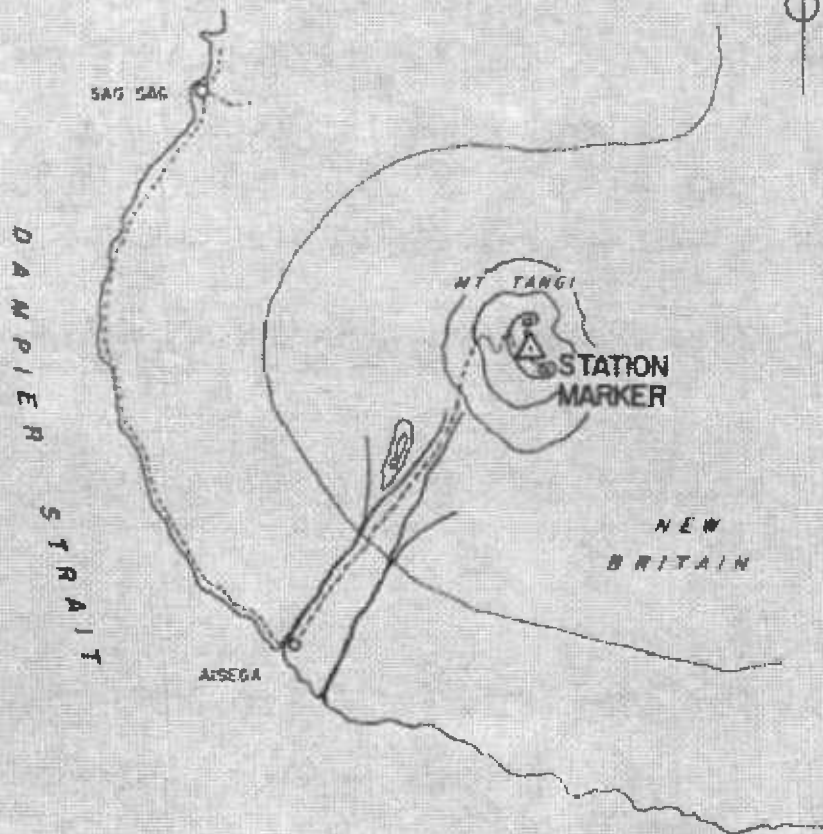
DESCRIPTION: Station NEW TANGI is located on Mount Tangi, the more southerly and lower of two prominent mountains on the western end of New Britain. It is approximately 6.3 miles NNE of Aisege village and 7 miles SE of Sag Sag village, both on the coast. Mount Tangi has three peaks, of which the easternmost and highest is the site of a fourth order station, established by the U.S. Army Engineers, designated CHARLIE 10. The Hiran station is on the third highest peak, which is covered with thick, small trees and kuni grass; it is approximately 300 feet NW of the highest point of this peak. The station is marked by an APCS Survey Control Station disk, stamped "NEW TANGI 1963", set in a concrete monument seven inches square, projecting two inches above the ground surface and surrounded by a protective mound of concrete. The subsurface mark is a disk of the same description set 36 inches below the surface mark.

REFERENCES: Reference Marks are USAF Geodetic Survey reference mark disks, stamped "NEW TANGI 1963 1", "NEW TANGI 1963 2", and "NEW TANGI 1963 3", respectively, set in triangular concrete monuments, 6 inches on a side, projecting about 3 inches above the ground surface and surrounded by protective mounds of concrete.

<u>OBJECT</u>	<u>DISTANCE (FEET)</u>	<u>AZIMUTH FROM NORTH (MAGNETIC)</u>
RM 1	17.28	37°
RM 2	18.76	167°
RM 3	13.87	313°

ROUTE DESCRIPTION: The station can best be reached by ship-based helicopter. It can also be reached on foot from the village of Aisege, on the extreme SW tip of New Britain, by an obscure and difficult trail cut through the tropical rain forest. A guide must be obtained in the village before attempting this route. Walking time is approximately six hours.

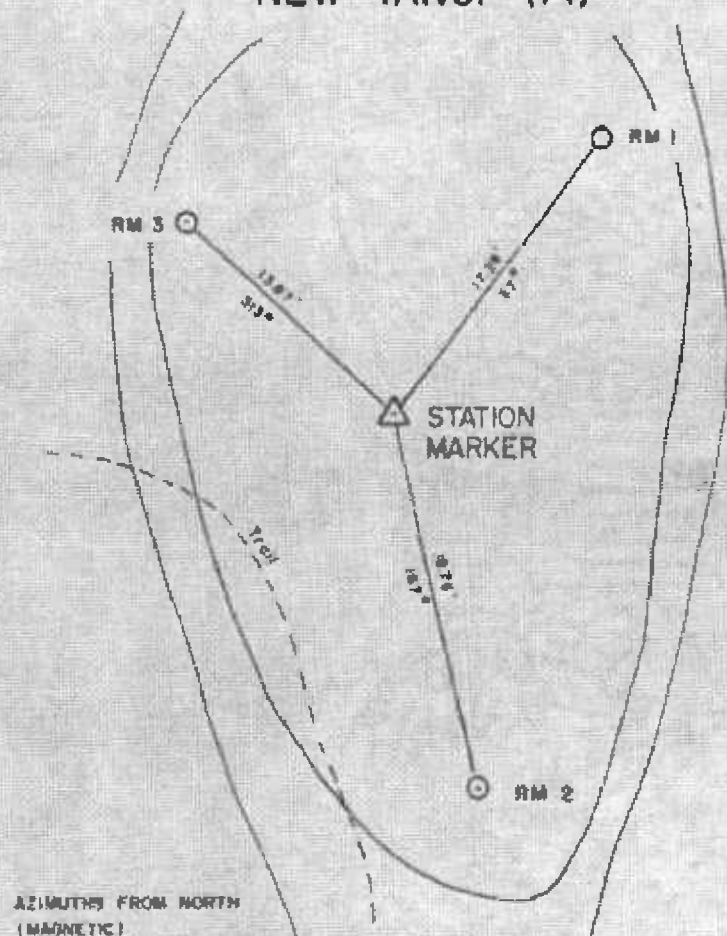
AREA SKETCH
NEW TANGI (14)



FEBRUARY 1963
SCALE

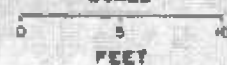


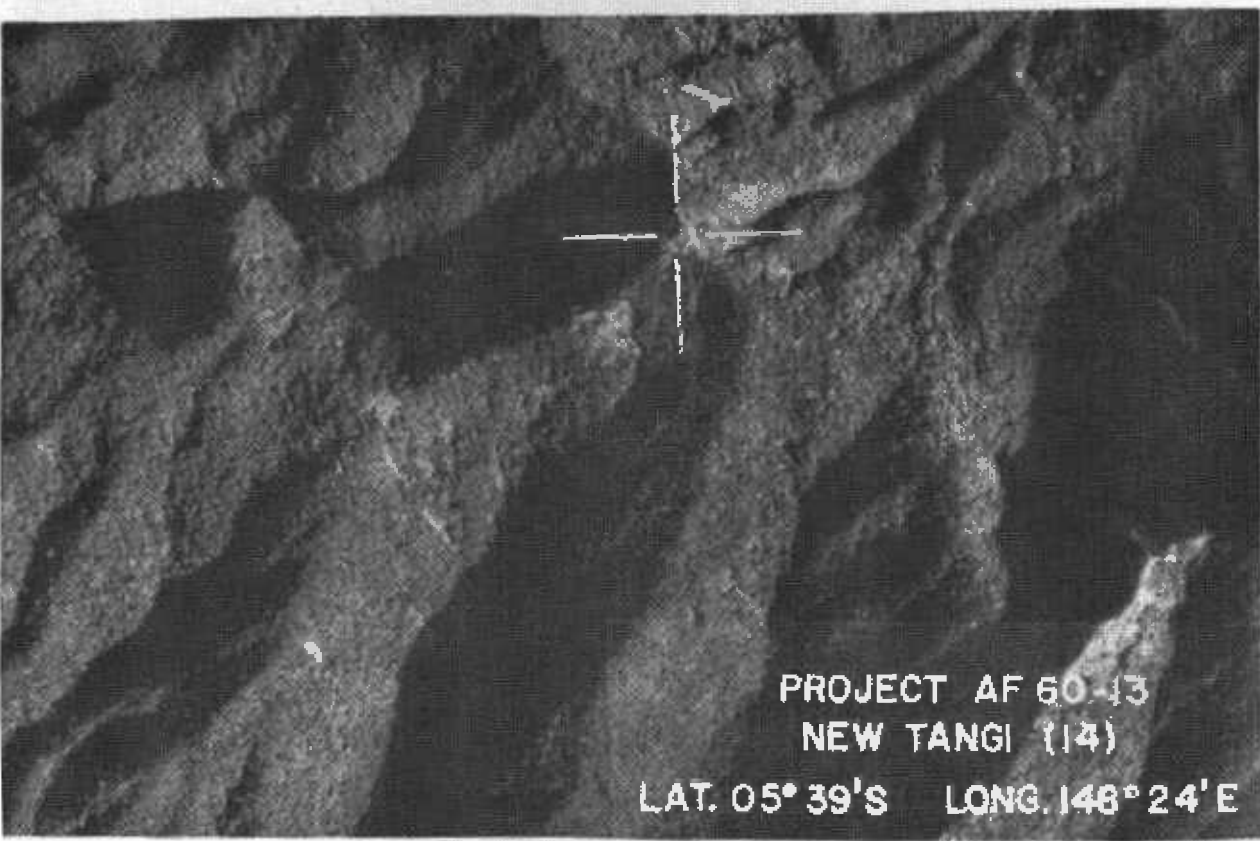
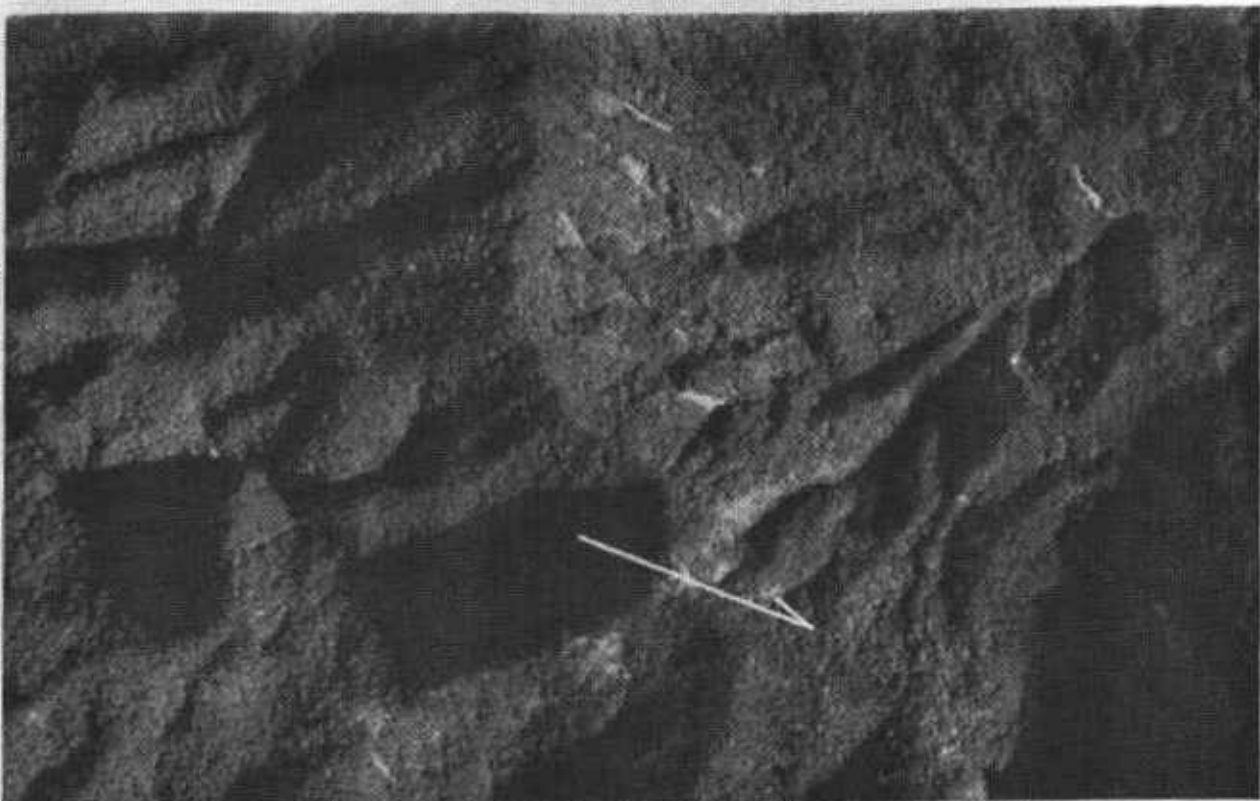
STATION SKETCH
NEW TANGI (14)



AZIMUTHS FROM NORTH
(MAGNETIC)

FEBRUARY 1963
SCALE





PROJECT AF 60-13
NEW TANGI (14)

LAT. 05° 39' S LONG. 148° 24' E



PROJECT AF 60-13
NEW TANGI (14)

LAT. 05° 39' S LONG. 148° 24' E



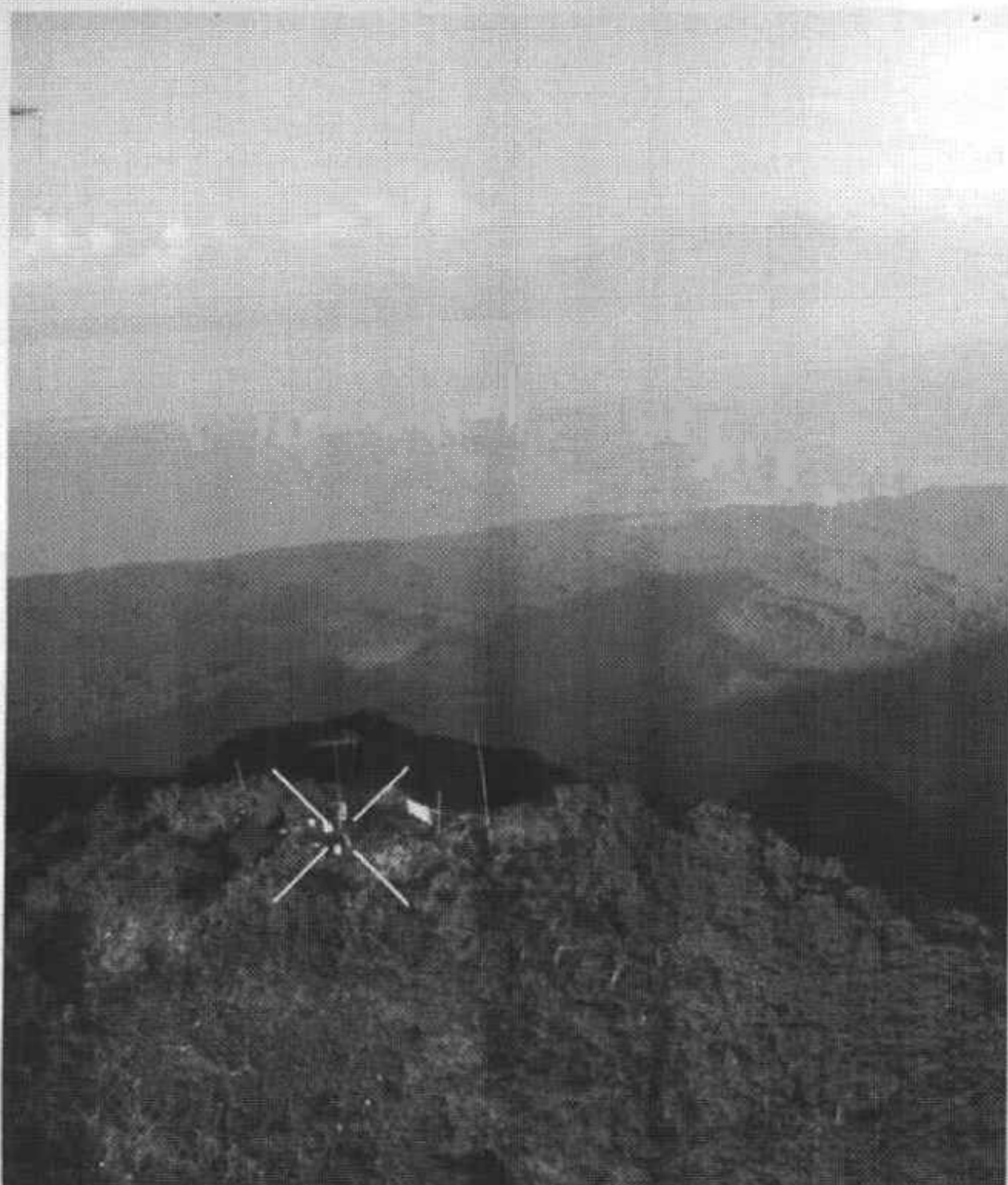
PROJECT AF 60-13
NEW TANGI (14)

LAT. 05° 39'S LONG. 148° 24'E



PROJECT AF 60-13
NEW TANGI (14)

LAT. 05° 39' S LONG. 148° 24' E



PROJECT AF 60-13
NEW TANGI (14)

LAT. 05° 39'S LONG. 148° 24'E

NIRAN STATION DESCRIPTION

NAME AND NUMBER: NANDAN (15)

LOCATION: New Britain Island
Bismarck Archipelago
Territory of Papua and
New Guinea

DATE ESTABLISHED: November 1962

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 04° 24' S
Longitude: 151° 43' E

ELEVATION: 5587 feet (Barometric Leveling, USAF)

DESCRIPTION: Station NANDAN is located in the northwest part of the Gazelle Peninsula, which is the northernmost part of the island of New Britain. It is 34 miles WSW of Rabaul and approximately 2 miles SW of the village of Komgi, on the edge of a prominent vertical escarpment. The station is marked by an APCS Survey Control Station disk, stamped "NANDAN 1962", cemented into an irregular shaped limestone outcrop which projects about an inch above the surrounding ground surface. There is no subsurface mark.

REFERENCES: Reference Mark No. 1 is an APCS azimuth mark disk, stamped "NANDAN RM 1 1962", set in a concrete monument about 9 inches in diameter, projecting about 2 inches above the ground surface. Reference Mark No. 2 is an APCS azimuth mark disk stamped "NANDAN RM 2 1962", cemented in a limestone outcrop projecting about 2 inches above the general ground level. Reference Mark No. 3 is a U.S. Army Corps of Engineers survey disk stamped "NANDAN SODANO LIGHT AMS 1962" centered in a tribrach set in the top of a concrete pier 14 inches square and 4 feet high. (This position was used for light-crossing azimuth observations by the U.S. Army). Nandan Astro Station is marked by a Corps of Engineers survey disk stamped "NANDAN ASTRO 29 ENGR 1962", set in a concrete monument 6 inches in diameter, projecting two inches above the ground surface. (This position was occupied for astronomic observations by the U.S. Army). The azimuth mark is a Corps of Engineers Survey disk stamped "NANDAN SODANO LIGHT AZ MK AMS 1962" set in a concrete monument 8 inches in diameter, flush with the ground surface.

<u>OBJECT</u>	<u>DISTANCE (METERS)</u>	<u>AZIMUTH FROM SOUTH (ASTRONOMIC)</u>
RM 1	4.845	55° 36' 14"
RM 2	2.875	118° 47' 08"
RM 3	4.180	16° 33' 14"
NANDAN ASTRO	4.604	81° 29' 37"

NANDAN (15)

<u>OBJECT</u>	<u>DISTANCE (METERS)</u>	<u>AZIMUTH FROM SOUTH (ASTRONOMIC)</u>
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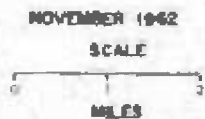
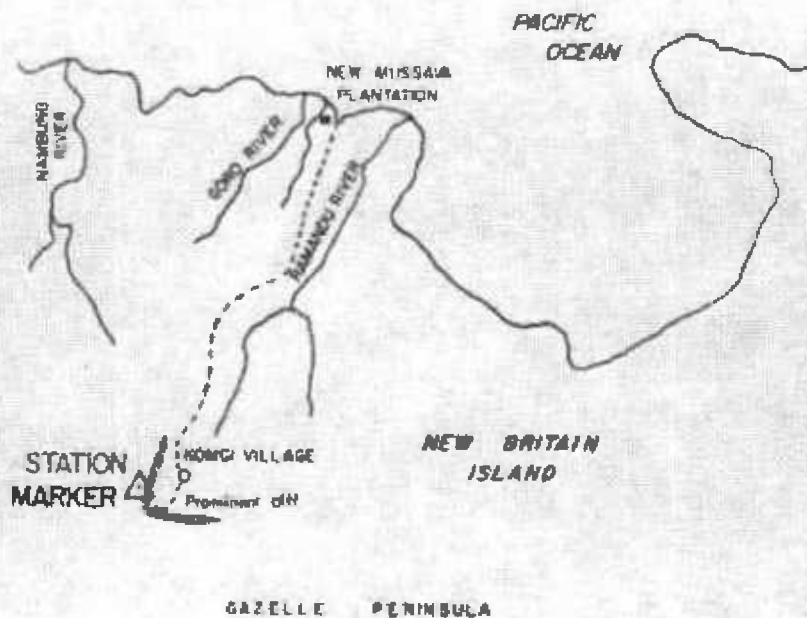
Measured from RM 3:

AZ MK	52.53	43° 11' 26.36
NANDAN ASTRO	4.683	134° 03' 27"

ROUTE DESCRIPTION: The site is best reached by helicopter. It can also be reached on foot by an obscure and difficult jungle trail from the New Mussava Plantation, which is on the north coast between the mouths of the Goro and Ramandu Rivers. The plantation has a small ship wharf for unloading cargo and personnel. A native guide should be obtained at the plantation before attempting to reach the station on foot. From the plantation the trail goes generally southward to the village of Kongi, about 8 hours walking time, and thence up to the station, about an additional 4 hours walking time.

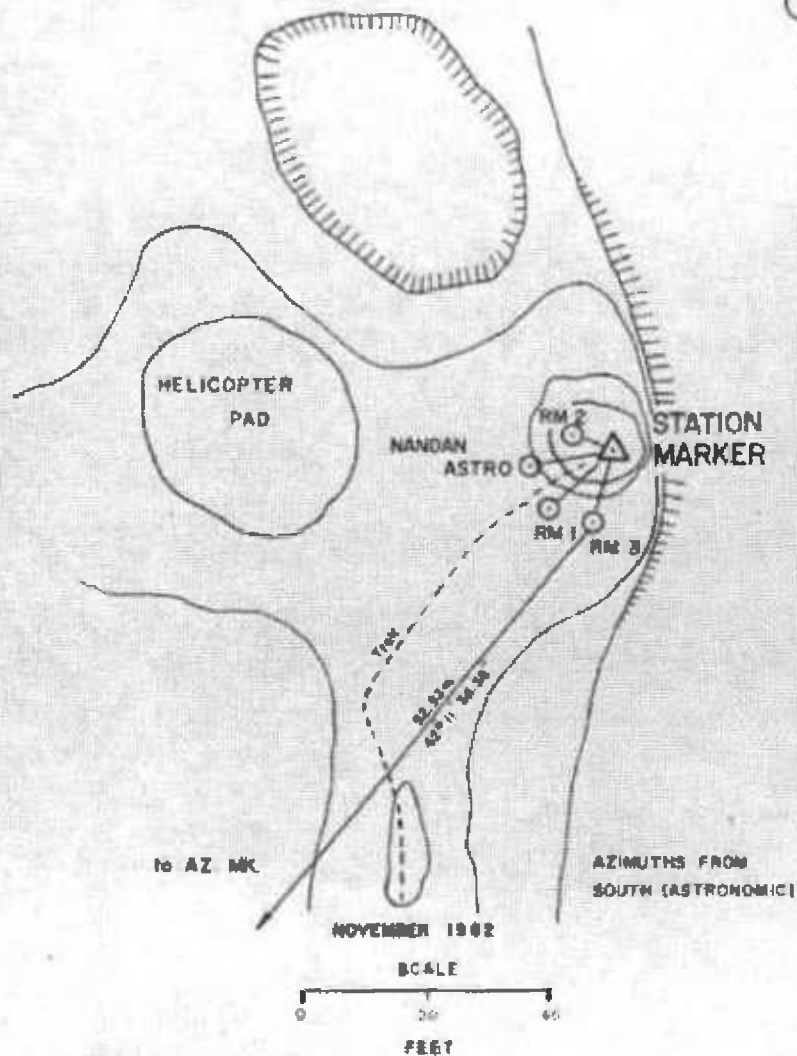
AREA SKETCH

NANDAN (15)

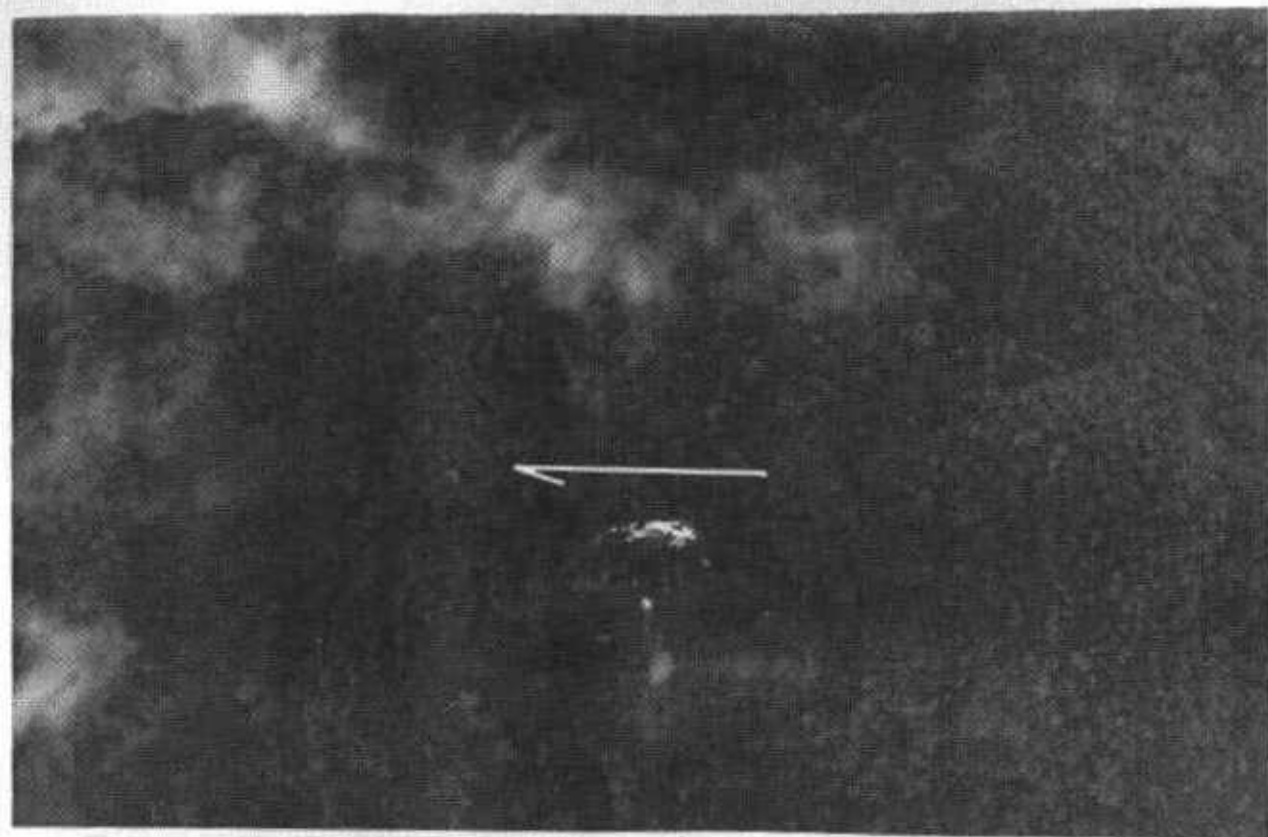


STATION SKETCH

NANDAN (15)



AZIMUTHS FROM
SOUTH (ASTRONOMIC)



PROJECT AF 60-13
NANDAN (15)

LAT. 04° 24' S LONG. 151° 43' E



PROJECT AF 60-13
NANDAN (15)

LAT. 04°24'S LONG. 151°43' E



PROJECT AF 60-13
NANDAN (15)

LAT. 04°24'S LONG. 151°43'E



PROJECT AF 60-13
NANDAN (15)

LAT. 04° 24' S LONG. 151° 43' E



PROJECT AF 60-13
NANDAN (15)

LAT. 04° 24' S LONG. 151° 43' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: KUMUN (19) LOCATION: Karker Island
Bismarck Archipelago
Territory of Papua and
New Guinea

DATE ESTABLISHED: November 1962

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 04° 41' S
Longitude: 145° 59' E

ELEVATION: 6006.9 Feet (Royal Australian Survey Corps, Jan 1964)

DESCRIPTION: Station KUMUN is located on the highest point of Karker Island, just off the north coast of New Guinea. It is on a high, narrow ridge of volcanic rock just to the south of the volcanic crater which is at the center of the island. The station is marked by an APCS Survey Control Station disk, stamped "KUMUN 1962", set in a concrete monument 10 inches square, protruding about one inch above the ground surface. The subsurface mark is a disk of the same description set in concrete, 26 inches below the surface mark.

REFERENCES: Reference Marks 1 and 2 are APCS azimuth mark disks, stamped "RM 1 1962" and "RM 2 1962" respectively, set in concrete monuments about 8 inches in diameter and projecting about 3 inches above the ground surface. Reference Mark No. 3 is an APCS azimuth mark disk, stamped "RM 3 1962", set in a concrete marker about 12 inches square, projecting about 4 inches above the ground surface.

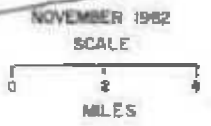
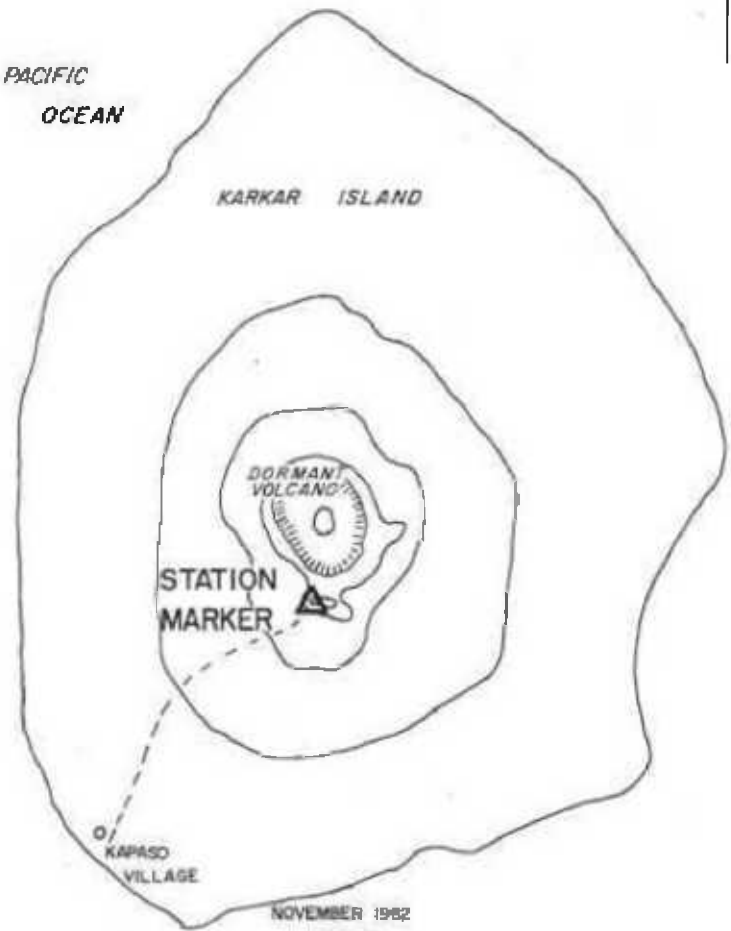
<u>OBJECT</u>	<u>DISTANCE (FEET)</u>	<u>AZIMUTH FROM NORTH (MAGNETIC)</u>
RM 1	43.45	112° 49'
RM 2	30.58	149° 19'
RM 3	34.65	294° 40'

ROUTE DESCRIPTION: The station is most easily reached by ship-based helicopter using a helicopter pad constructed near the station. Karker Island can also be reached by light plane or boat from Madang or Lae. There is an airstrip adequate for light planes on the northern part of the island. Small boats can dock at the Lutheran Mission on the SW part of the island. There is a poor, dry weather road encircling the island. The station can be reached on foot by an obscure jungle trail from Kapaso Village on the SW coast of the island, about 4 miles by road from the Lutheran Mission. A native guide must be obtained to reach the station from the village; walking time is approximately six hours.

AREA SKETCH
KUMUN (19)



PACIFIC
OCEAN

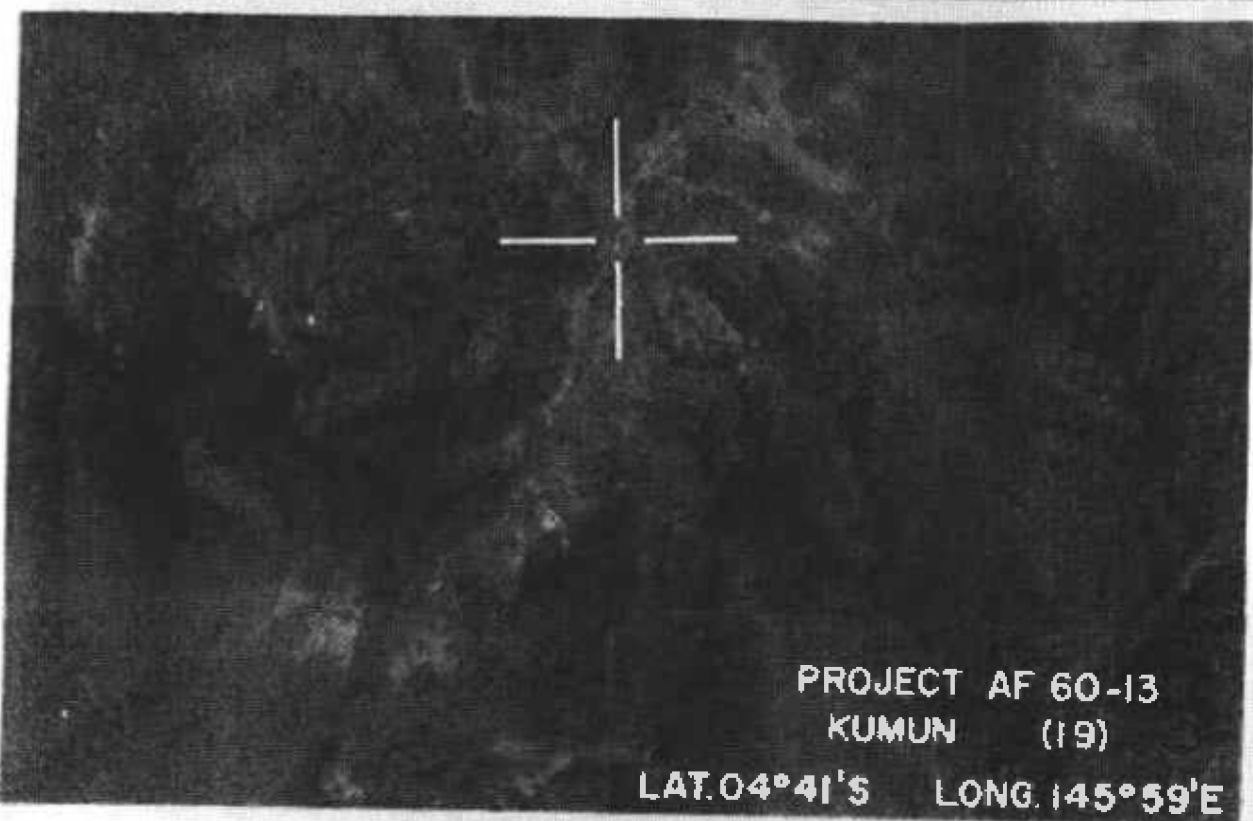
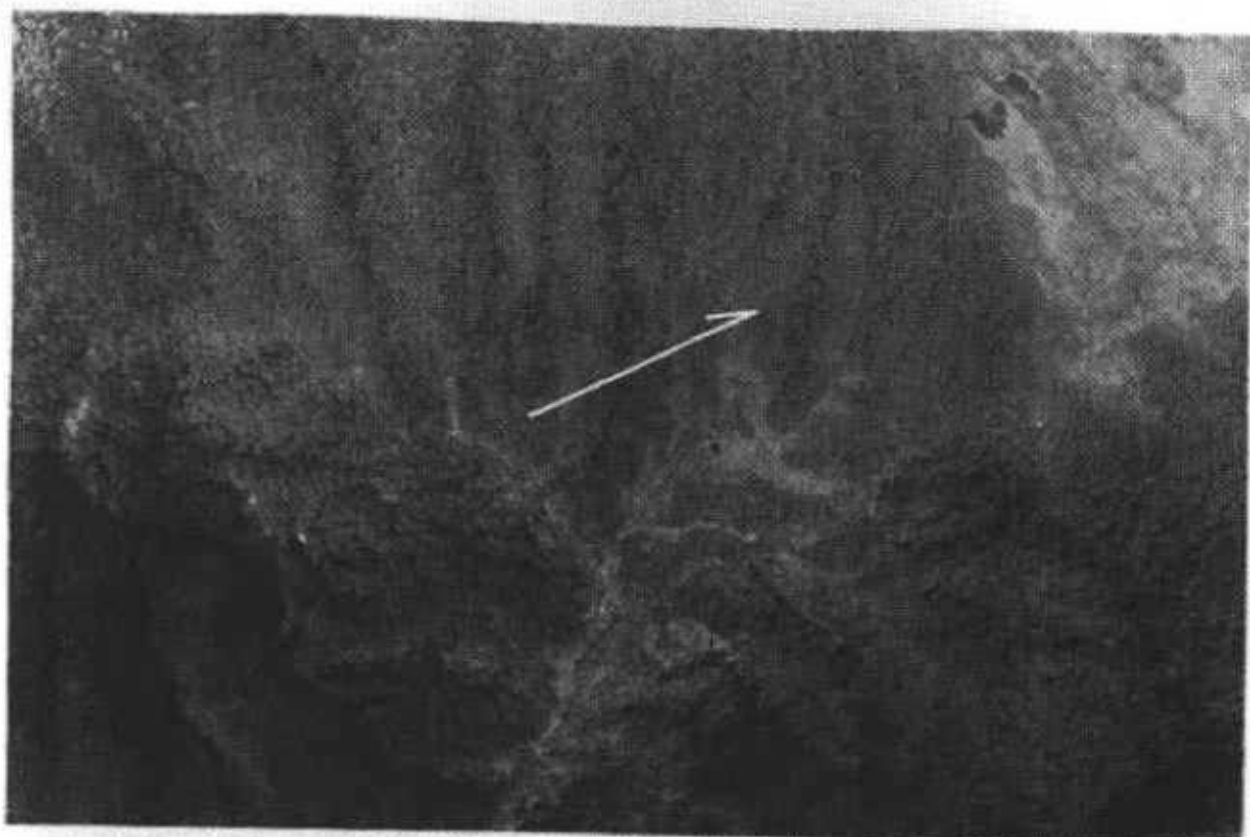


STATION SKETCH
KUMUN (19)



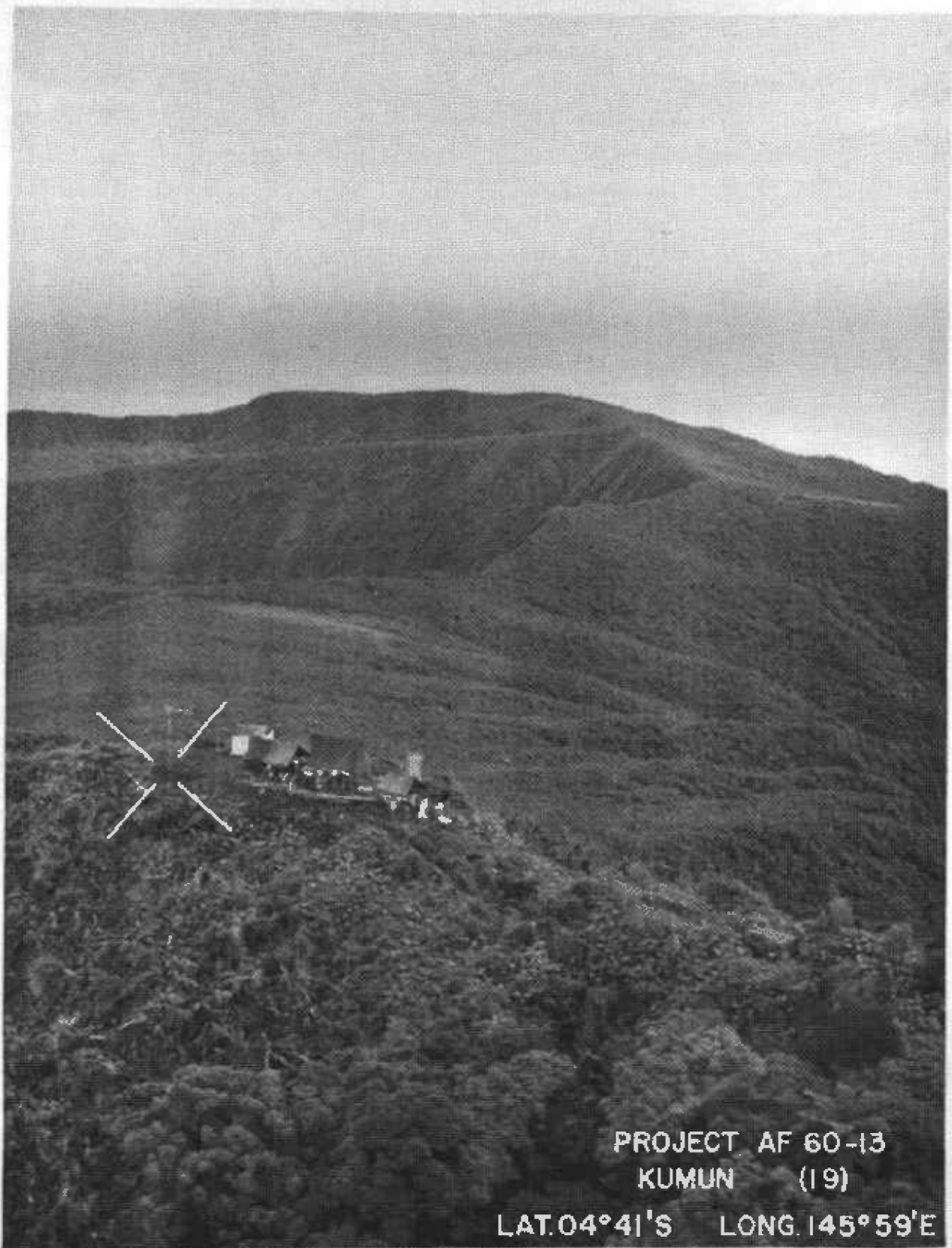
AZIMUTHS ARE MAGNETIC
FROM NORTH





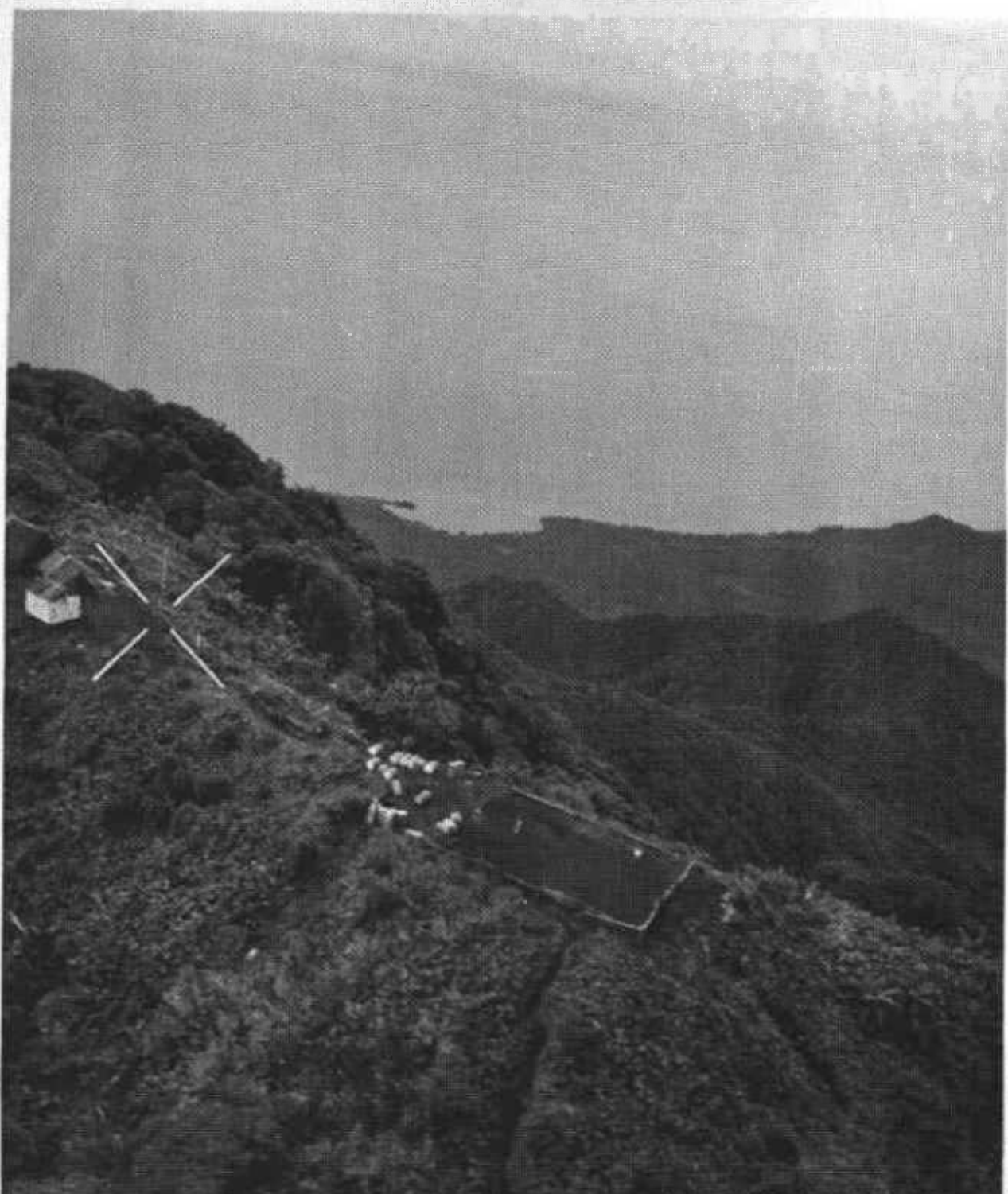
PROJECT AF 60-13
KUMUN (19)

LAT. 04° 41' S LONG. 145° 59' E



PROJECT AF 60-13
KUMUN (19)

LAT. 04° 41' S LONG. 145° 59' E



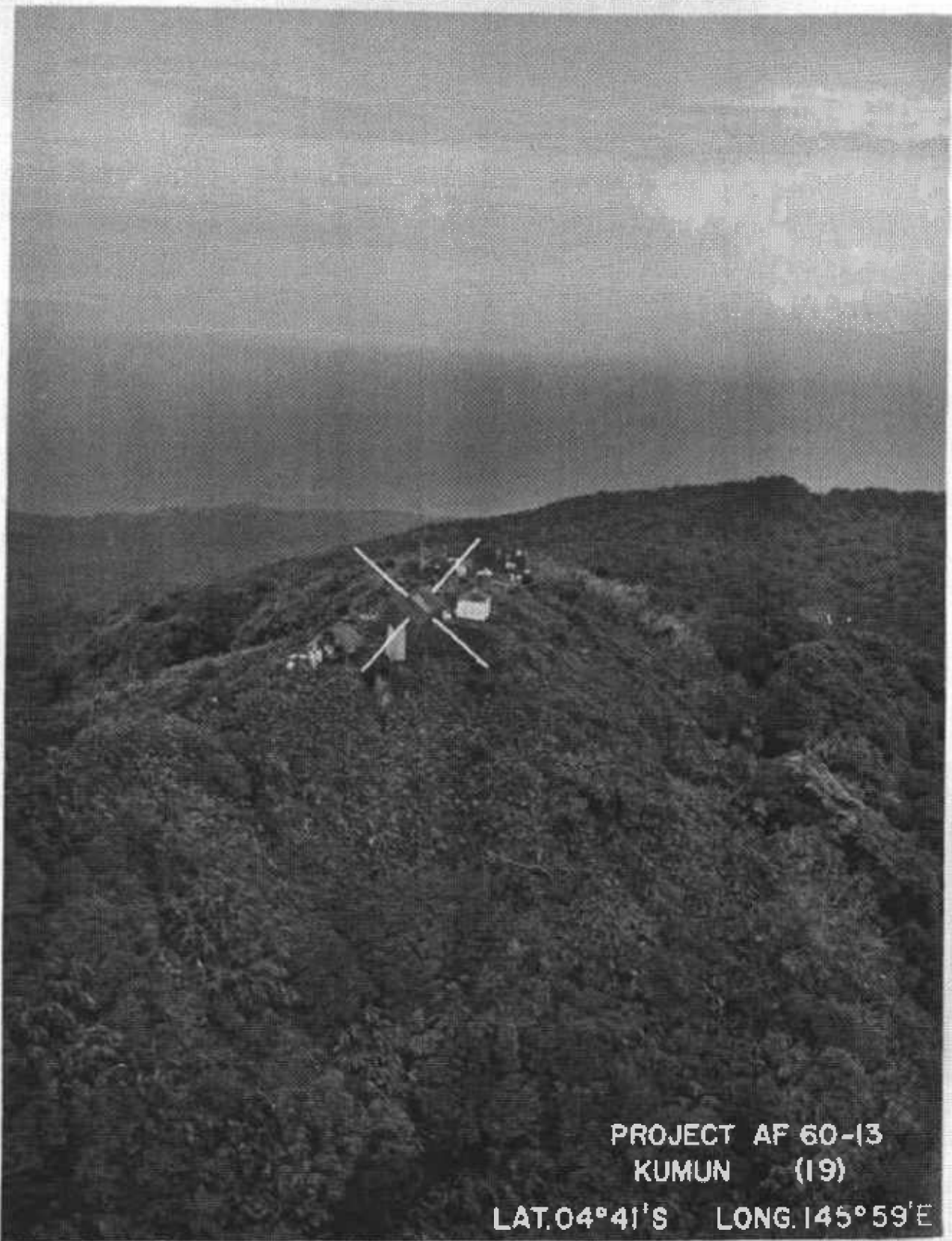
PROJECT AF 60-13
KUMUN (19)

LAT. 04° 41' S LONG 145° 59' E



PROJECT AF 60-13
KUMUN (19)

LAT. 04°41'S LONG. 145°59'E



PROJECT AF 60-13
KUMUN (19)

LAT. 04° 41' S LONG. 145° 59' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: NOEL (20)

LOCATION: Nolei Island
Luscany Islands
Territory of Papua and
New Guinea

DATE ESTABLISHED: December 1962

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 08° 34' S
Longitude: 150° 17' E

ELEVATION: 236 feet (Differential leveling from local MSL,
USAF, 1962)

DESCRIPTION: Station NOEL is located on the highest point of the small island of Nolei (Nauria) of the Luscany Islands, about 100 miles north of the eastern end of Papua. The station is on a knoll, covered with 3 foot high kunai grass, somewhat to the SW of the center of the island. It is marked by an APCS Survey Control Station disk, stamped "NOEL 1962", set in an irregular mass of concrete about 15 inches in diameter, flush with the ground surface. The subsurface mark is an identical disk set in concrete, 22 inches below the surface mark.

REFERENCES: Reference Marks No. 1 and No. 2 are USAF Geodetic Survey reference mark disks, stamped "RM 1 1962" and "RM 2 1962", cemented into outcrops of volcanic rock protruding above the general ground surface about 2 feet and 4 inches, respectively. A U.S. Army astronomic station is marked by a Corps of Engineers survey disk stamped "NOEL ASTRO 29 ENGR 1963", set in the top of a concrete monument 7 inches square, projecting 4 inches above the ground level. A Sodano light-crossing observation station is marked by a U.S. Army Corps of Engineers survey disk, stamped "NOEL SODANO LT AMS 1963", centered within an aluminum tribrach set in the top of a concrete pier 14 inches square and 4 feet high. The azimuth mark is a U.S. Army Corps of Engineers survey disk, stamped "NOEL SODANO LT AZ MK AMS 1963", set in a drill hole in a coral outcrop on the beach of the neighboring island of Kawa, 6 feet east of a trail leading to Kawa village, and about 15 feet above sea level.

<u>OBJECT</u>	<u>DISTANCE (METERS)</u>	<u>AZIMUTH (ASTRONOMIC FROM SOUTH)</u>
RM 1	5.134	338° 13' 47"
RM 2	5.754	147° 51' 08"
ASTRO	3.564	262° 15' 46"
SODANO	7.555	78° 28' 11"

MEASURED FROM SODANO:

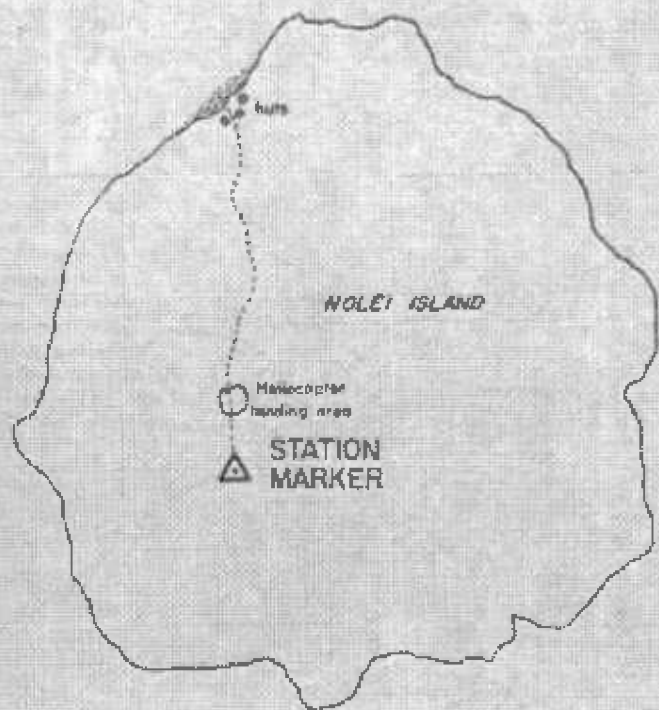
AZ MK	2.5 miles (approx)	198° 47' 42.06"
-------	--------------------	-----------------

NOEL (20)

ROUTE DESCRIPTION: The station can be most easily reached by ship-borne helicopter, landing on a cleared area just north of the station. The island can also be reached by boat, landing on the beach on the northern shore. From the beach there is a well defined foot trail leading southward to the station; walking time is about 10 minutes.

REMARKS: Nolei Island is uninhabited except that it is visited by natives of Kawa Island for the purpose of raising crops. There is no source of fresh water on the island.

AREA SKETCH NOEL (20)

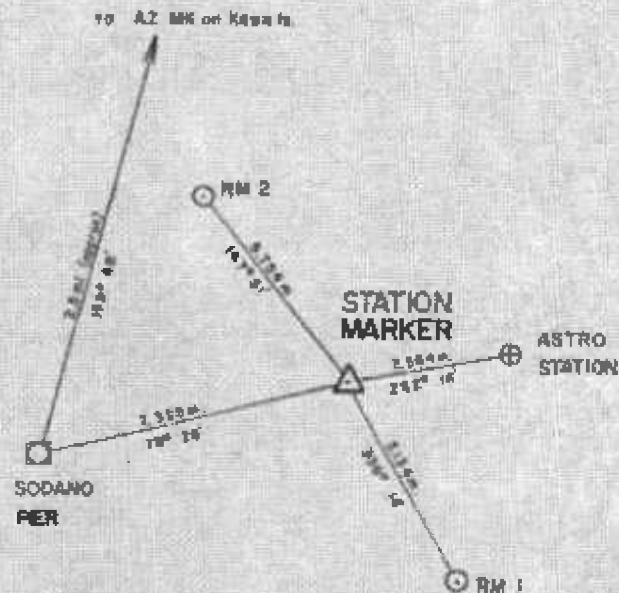


PACIFIC OCEAN

DECEMBER 1962
SCALE



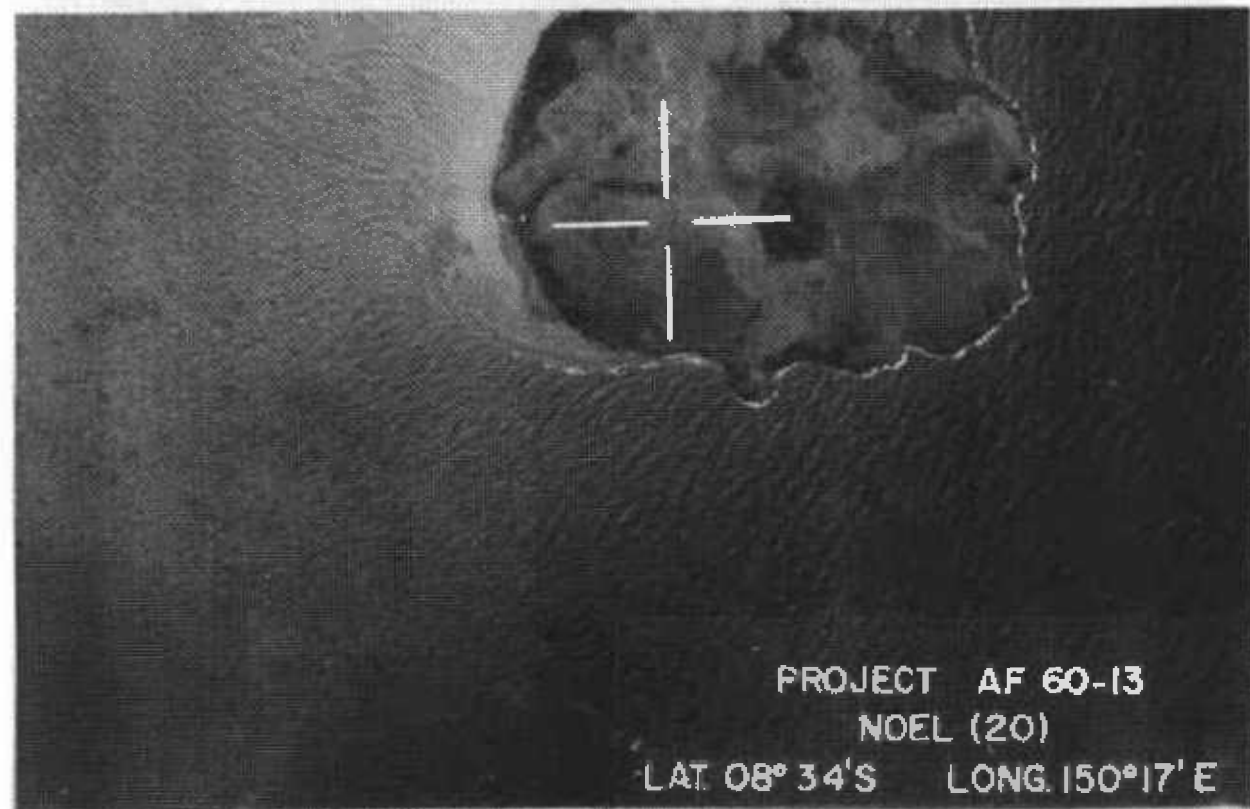
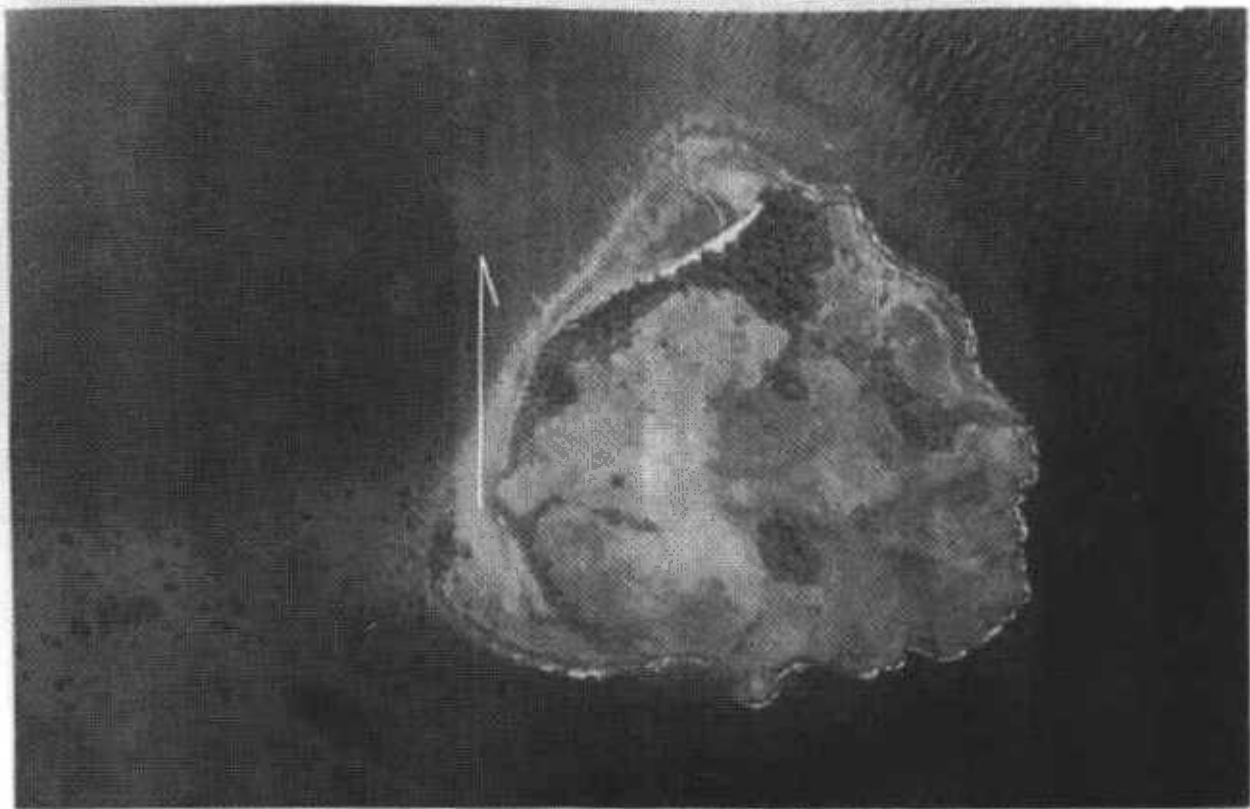
STATION SKETCH NOEL (20)



AZIMUTHS ARE ASTRONOMIC
FROM SOUTH.

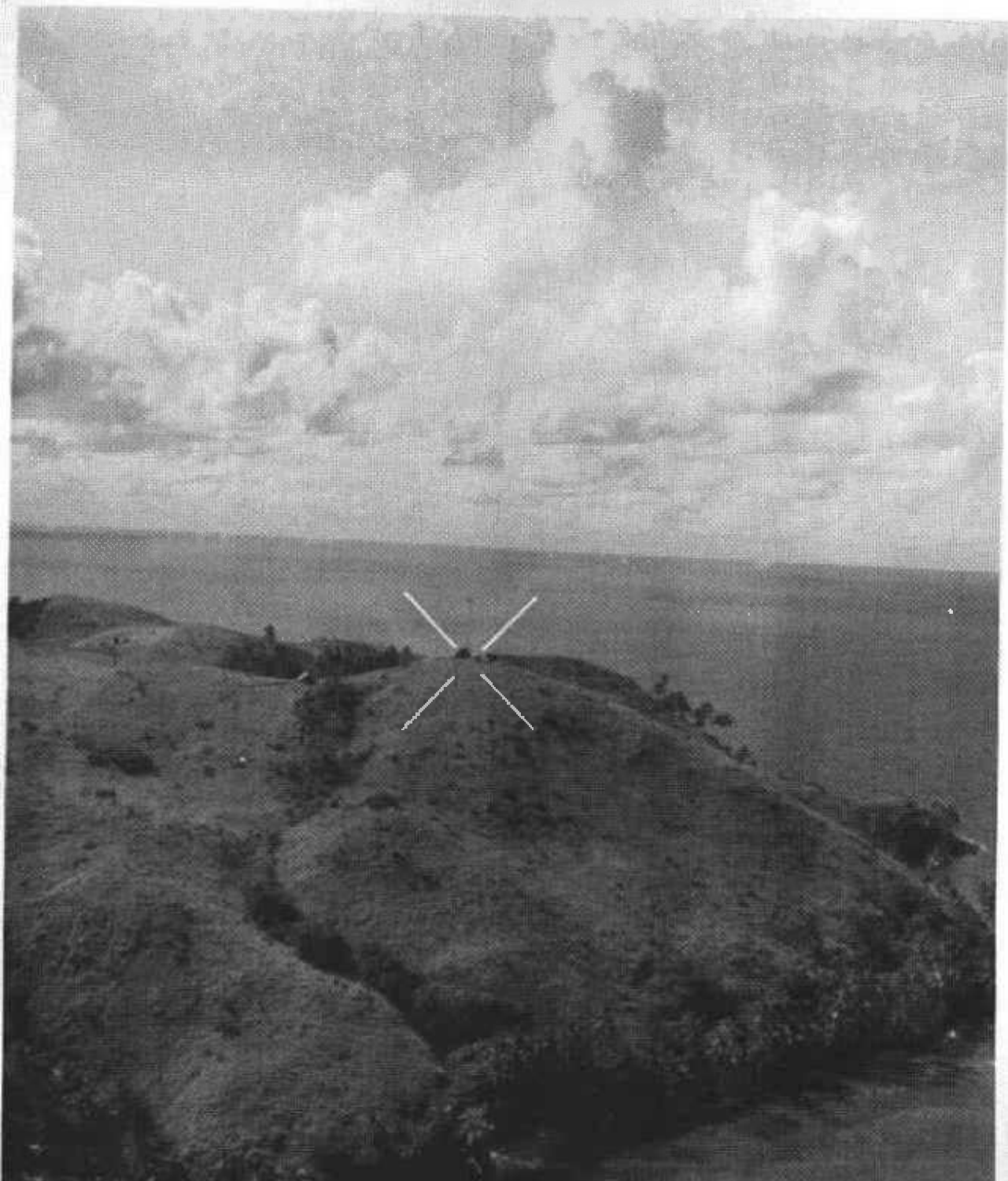
DECEMBER 1962
SCALE



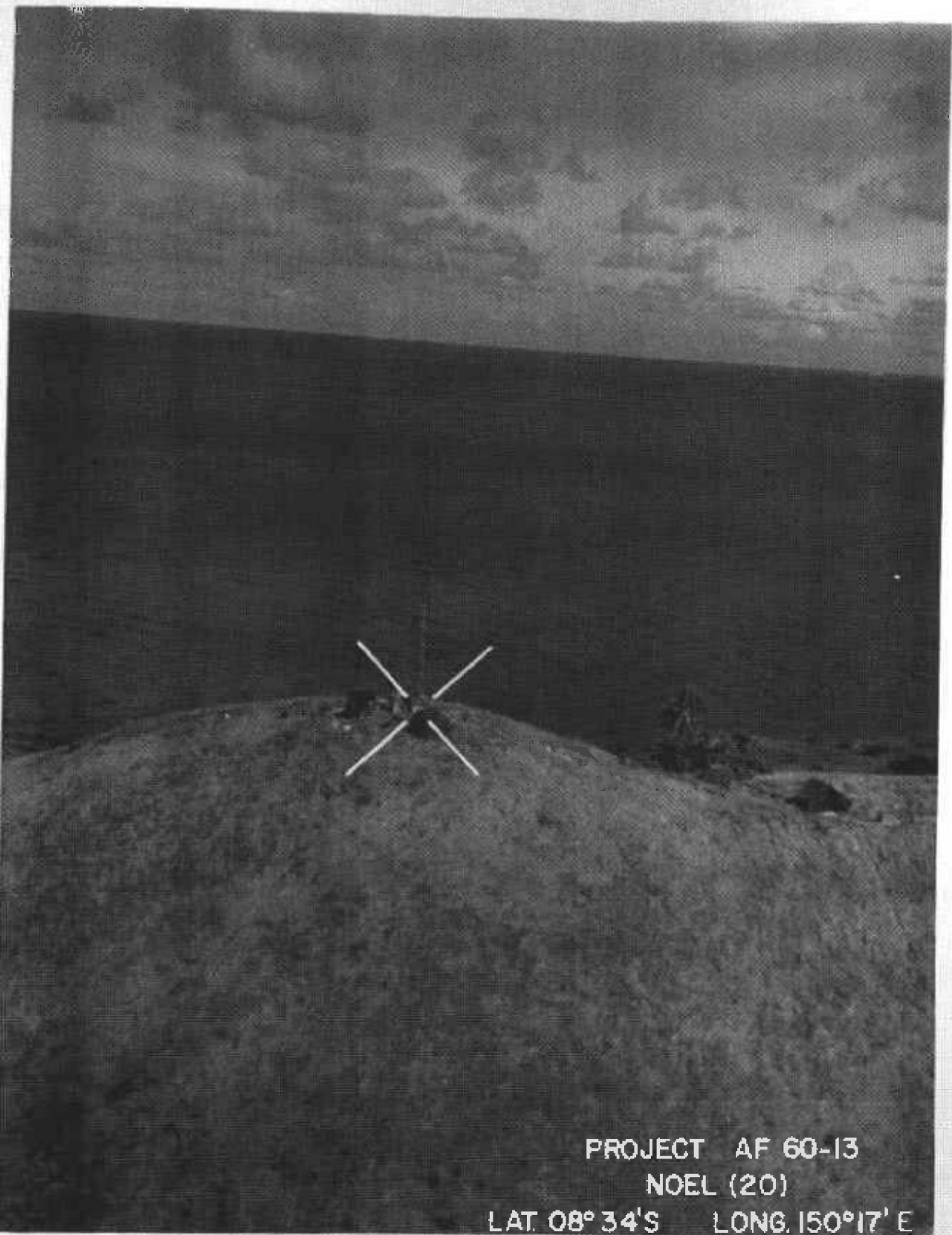


PROJECT AF 60-13
NOEL (20)

LAT. 08° 34' S LONG. 150° 17' E



PROJECT AF 60-13
NOEL (20)
LAT. 08° 34' S LONG. 150° 17' E



PROJECT AF 60-13
NOEL (20)

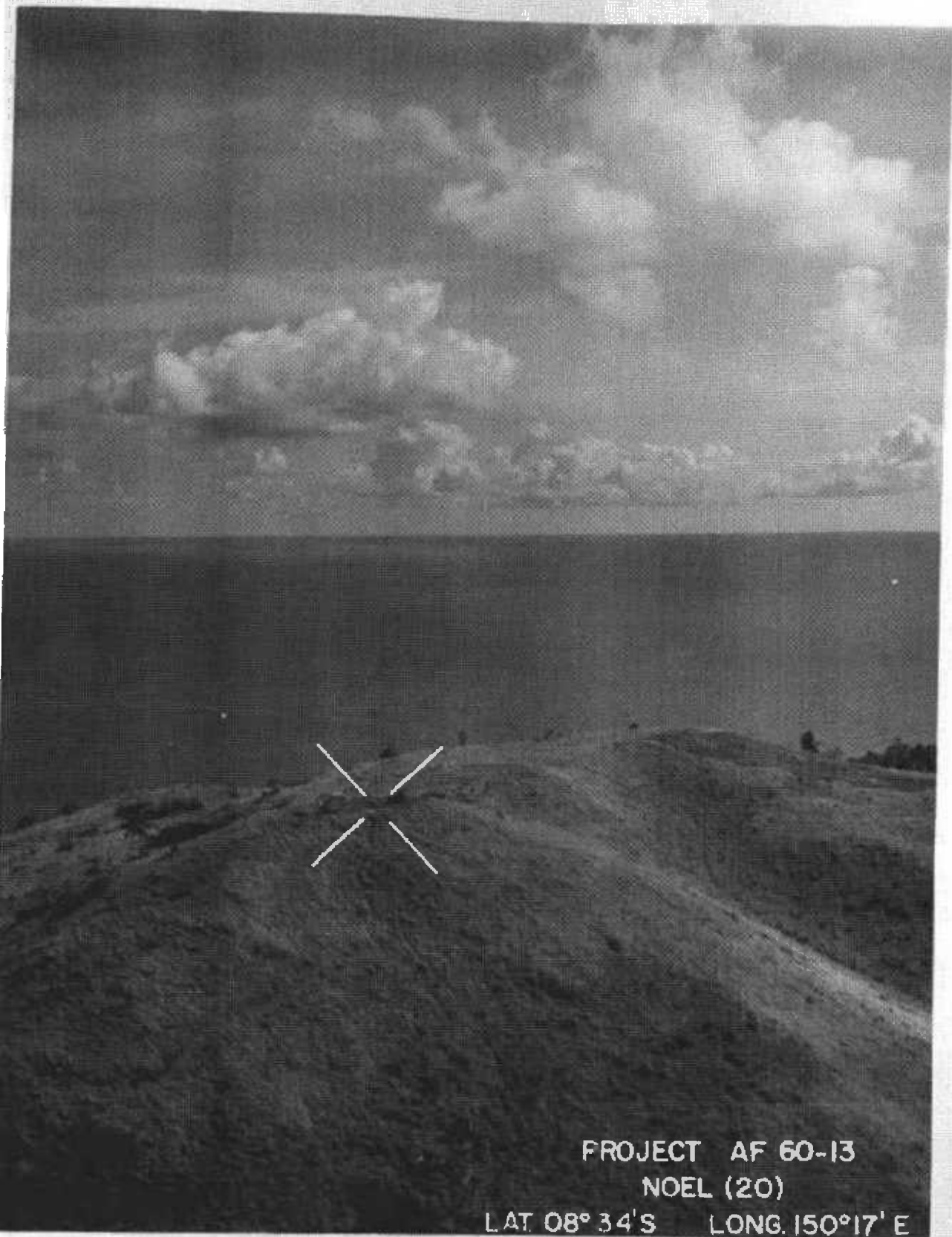
LAT. 08° 34'S LONG. 150° 17' E



PROJECT AF 60-13

NOEL (20)

LAT. 08° 34' S LONG. 150° 17' E



PROJECT AF 60-13
NOEL (20)

LAT. 08° 34' S LONG. 150° 17' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: SUAU (21) LOCATION: Ewema's Peak
Suau District
Territory of Papua and
New Guinea

DATE ESTABLISHED: December 1962

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 10° 34' S
Longitude: 150° 14' E

ELEVATION: 4431.5 feet (Royal Australian Survey Corps, 1964)

DESCRIPTION: Station SUAU is located on top of a peak, locally known as Ewema's, of the mountain range in the extreme south-eastern part of Papua, about 4 miles NNW of Mount Nelson and 6 miles NNE of Baxter Harbor. The peak is actually a knife ridge, trending roughly NW-SE, which was cleared of vegetation and leveled off sufficiently for operational purposes, to a width of 15 to 20 feet. (A lower peak just to the east was also cleared and leveled as a helicopter landing area.) The station is near the NW end of the ridge and is marked by an APCS Survey Control Station disk, stamped "SUAU 1962", cemented into the top of a boulder about 18 inches in diameter which projects about 18 inches above the general ground level. There is no subsurface mark.

REFERENCES: Reference Mark No. 1 is an APCS reference mark disk, stamped "SUAU 1 1962", cemented into the top of an egg-shaped boulder, about 5 feet by 3½ feet in dimensions, projecting 2 feet above the ground surface, located down the west slope of the ridge. Reference Mark No. 2 is an APCS reference mark disk, stamped "SUAU 2 1962", cemented into the top of a very large boulder, about 15 feet by 8 feet in dimensions, projecting 6 feet above the ground level at the NW end of the ridge. A U.S. Army astronomic station is marked by a Corps of Engineers survey disk stamped "SUAU ASTRO 29 ENGR 1963" set in the top of a concrete monument eight inches square, projecting four inches above the ground surface. A Sodano light-crossing observation station is marked by a U.S. Army Corps of Engineers survey disk, stamped "SUAU SODANO LT AMS 1963", centered within an aluminum tribrach set in the top of a concrete pier about 14 inches square and 4.2 feet high. The azimuth mark is a U.S. Army Corps of Engineers survey disk stamped "SUAU SODANO LT AZ MK AMS 1963", centered within an aluminum tribrach set in the top of a concrete monument 14 inches in diameter projecting 3 inches above the ground surface.

SUAU (21)

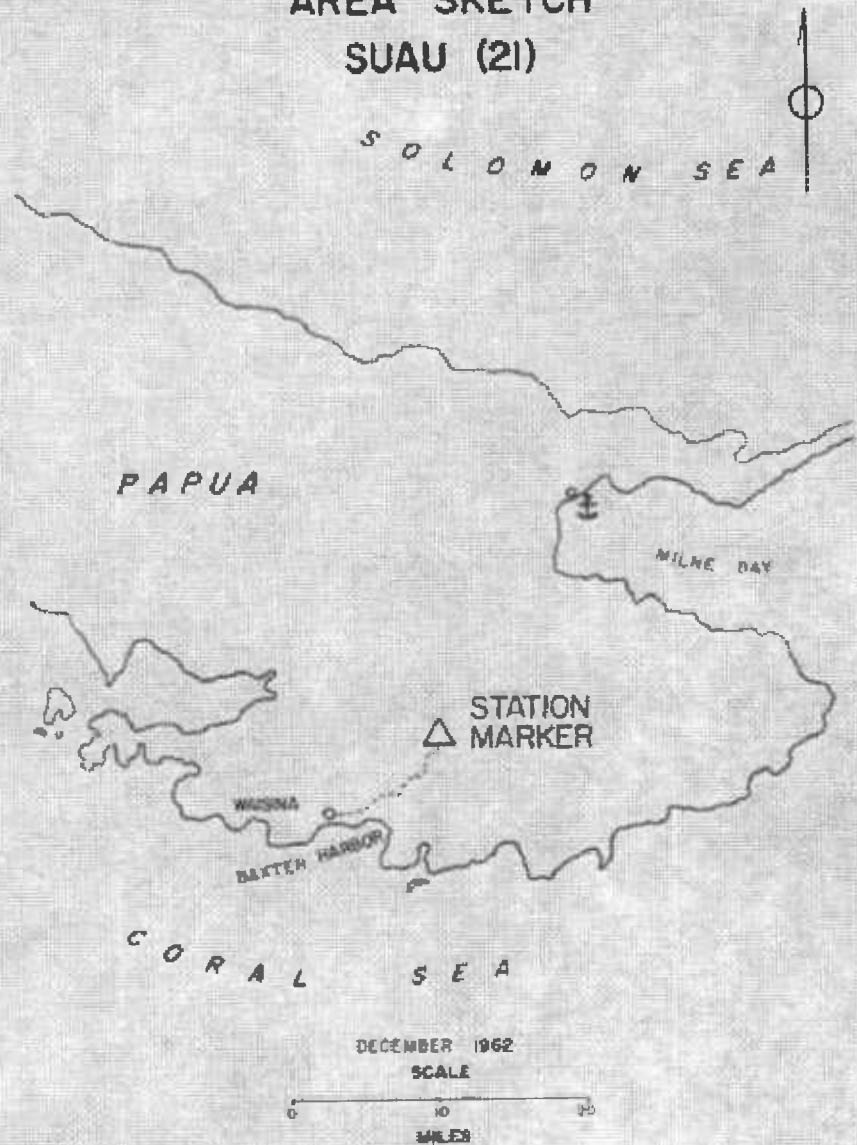
<u>OBJECT</u>	<u>DISTANCE (METERS)</u>	<u>AZIMUTH (ASTRONOMIC FROM SOUTH)</u>
RM 1	34.47 (Slope Distance)	19° 29' 16"
RM 2	20.079	180° 58' 56"
ASTRO	18.861	329° 51' 54"
SODANO	40.745	337° 29' 15"

MEASURED FROM SODANO:

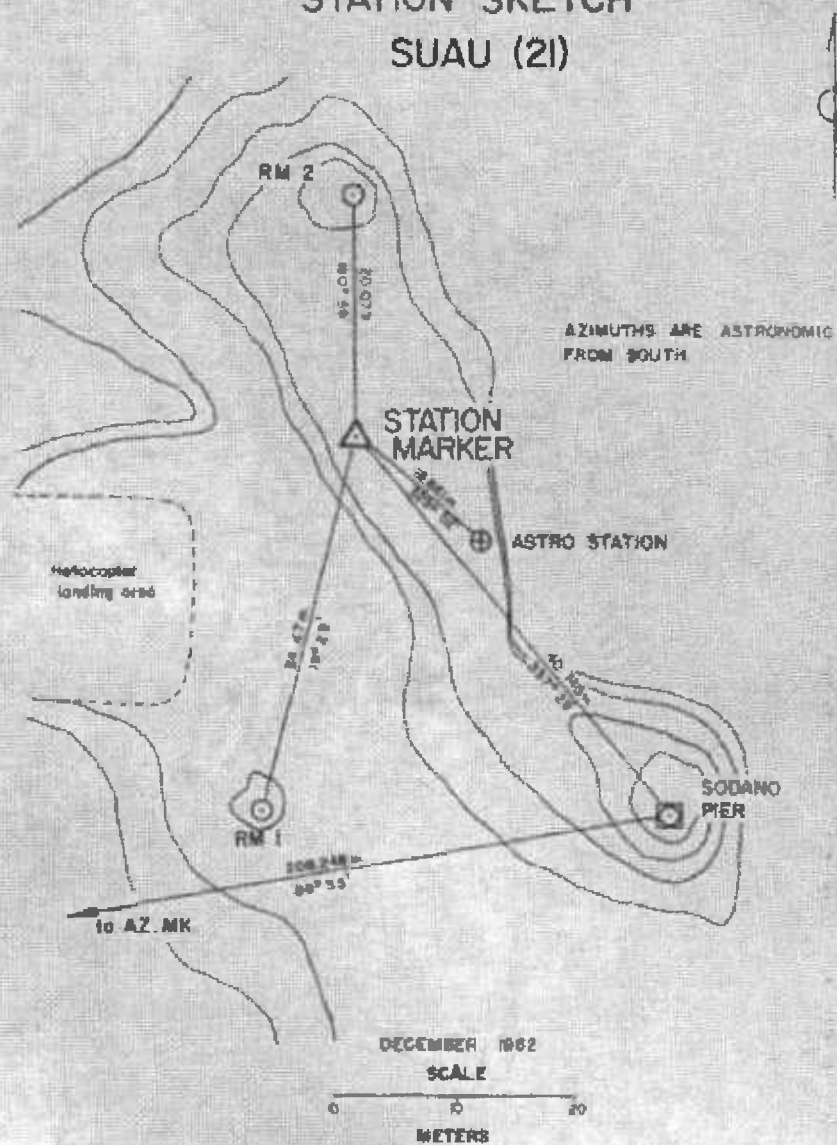
AZ MK	208.248	86° 52' 36.42
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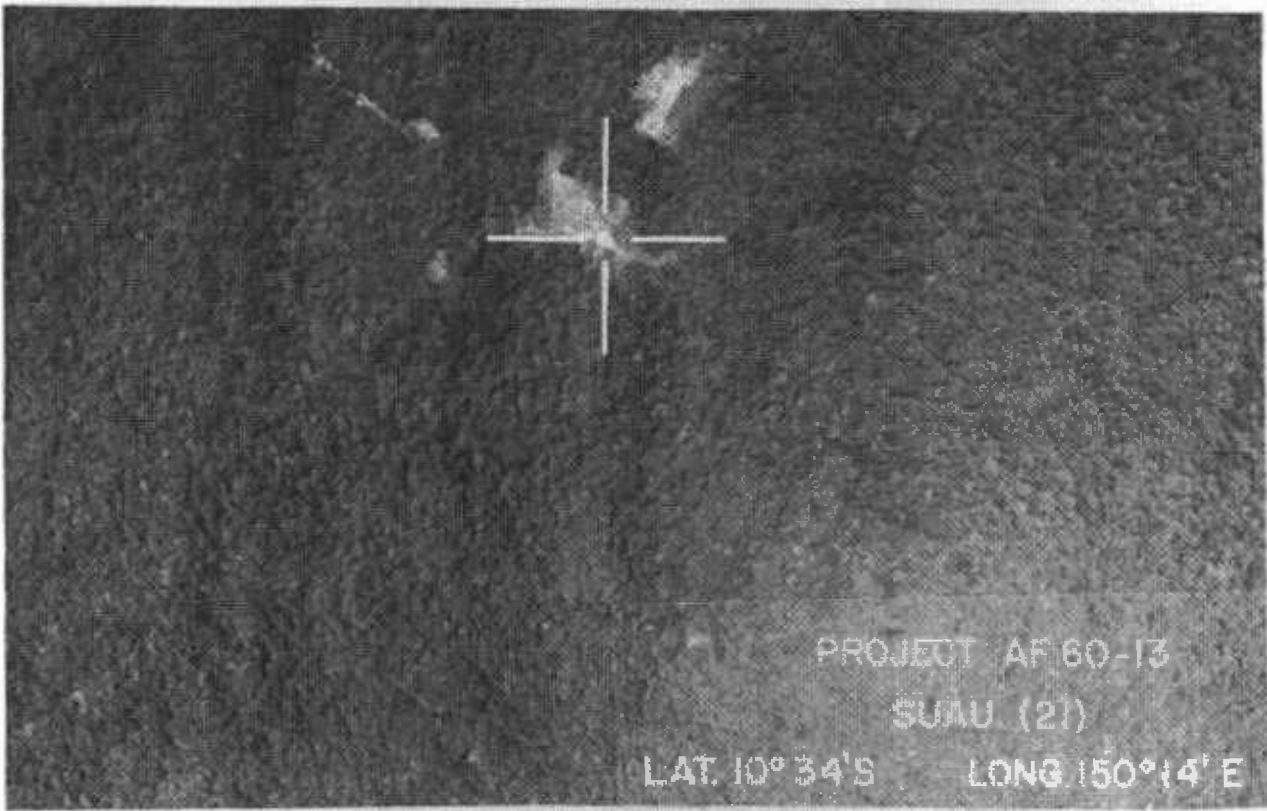
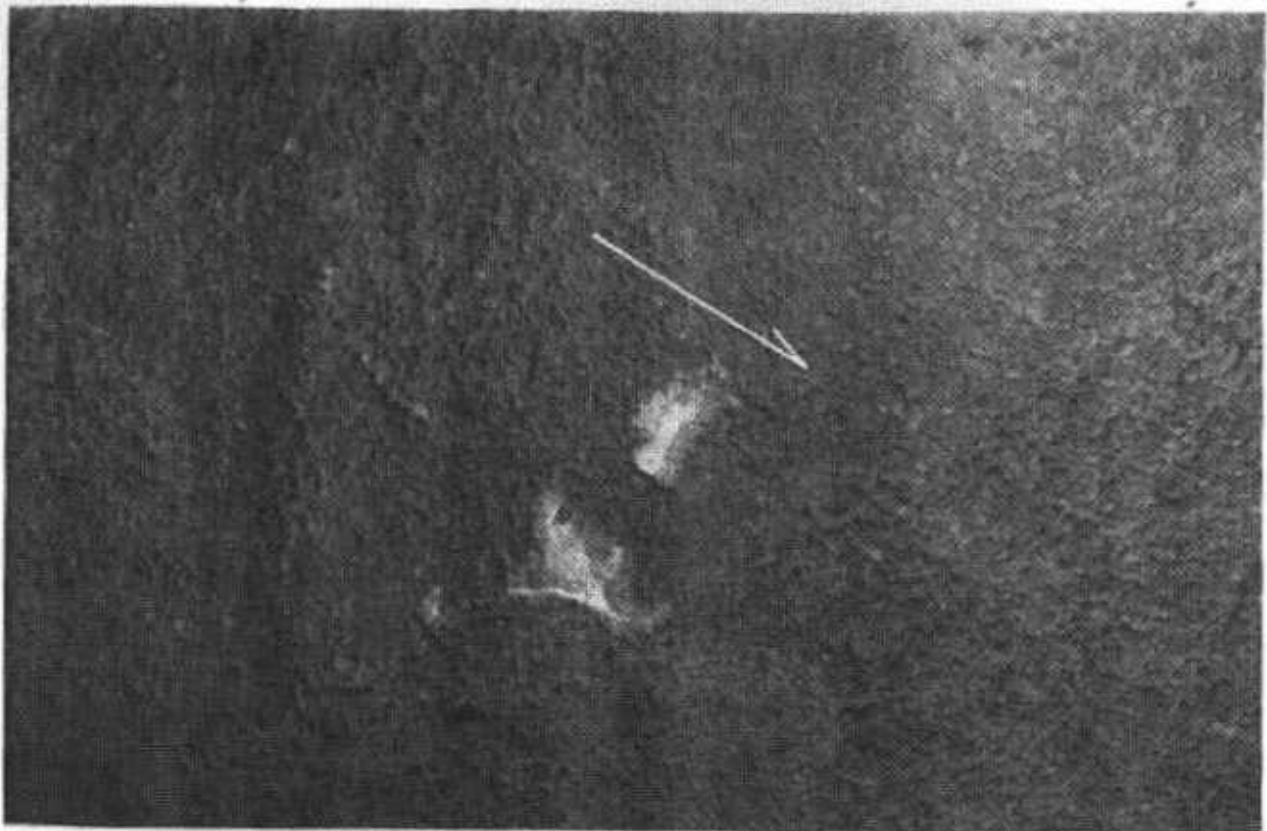
ROUTE DESCRIPTION: The station is most readily reached by helicopter from Baxter Harbor or from Milne Bay, about 20 miles to the NE. It can also be reached on foot from the village of Waisena, on the north shore of Baxter Harbor, by following a trail in a general NNE direction. It is essential to use the services of a local guide, who can be engaged through the office of the District Commissioner at Samarai. Walking time from Waisena to the site with light cargo loads is two days.

AREA SKETCH
SUAU (21)



STATION SKETCH
SUAU (21)





PROJECT AF 60-13
SUMU. (21)

LAT. 10° 34' S LONG 150° 14' E



PROJECT AF 60-13

SUAU (21)

LAT 10° 34' S

LONG 150° 14' E



PROJECT AF 60-13

SUAU (21)

LAT. 10° 34' S

LONG. 150° 14' E



PROJECT AF 60-13

SUAU (21)

LAT. 10° 34' S

LONG. 150° 14' E



PROJECT AF 60-13

SUAU (21)

LAT. 10° 34' S

LONG 150° 14' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: MYOLA (22) **LOCATION:** Mount Kenievi
 Owen Stanley Range
 Territory of Papua and
 New Guinea

DATE ESTABLISHED: January 1963

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 09° 08' S
 Longitude: 147° 49' E

ELEVATION: 11,317 feet (Trigonometric Leveling, Royal Australian
 Survey Corps)

DESCRIPTION: Station MYOLA is located on the highest point of Mount Kenievi (locally known as Holilobo) of the Owen Stanley Range in east-central Papua, about 50 miles ENE of Port Moresby. The mountain has four peaks, of which the highest is the site of the station. Most of the region is covered by a heavy growth of large trees; these were cleared from a small area around the station and from another area, about 200 feet to the west, which was used for helicopter landing. The station is marked by an APCS Survey Control Station disk, stamped "MYOLA 1963", cemented into a large boulder flush with the ground level. There is no subsurface mark.

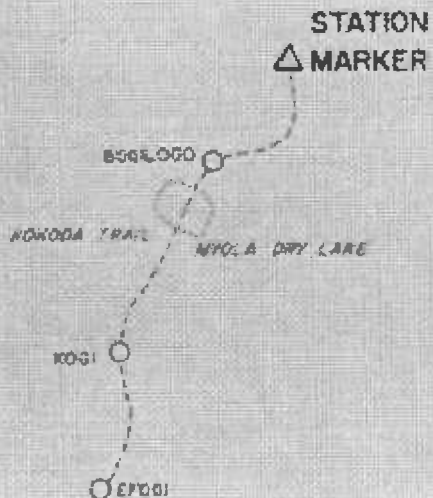
REFERENCES: Reference Marks are APCS reference mark disks, stamped "MYOLA 1 1963" and "MYOLA 2 1963" respectively, cemented into large boulders flush with the ground, both approximately 4 feet below the elevation of the station mark.

<u>OBJECT</u>	<u>DISTANCE (FEET)</u>	<u>AZIMUTH FROM NORTH (MAGNETIC)</u>
RM 1	34.0	138°
RM 2	32.7	298°

(NOTE: Azimuths by Brunton compass)

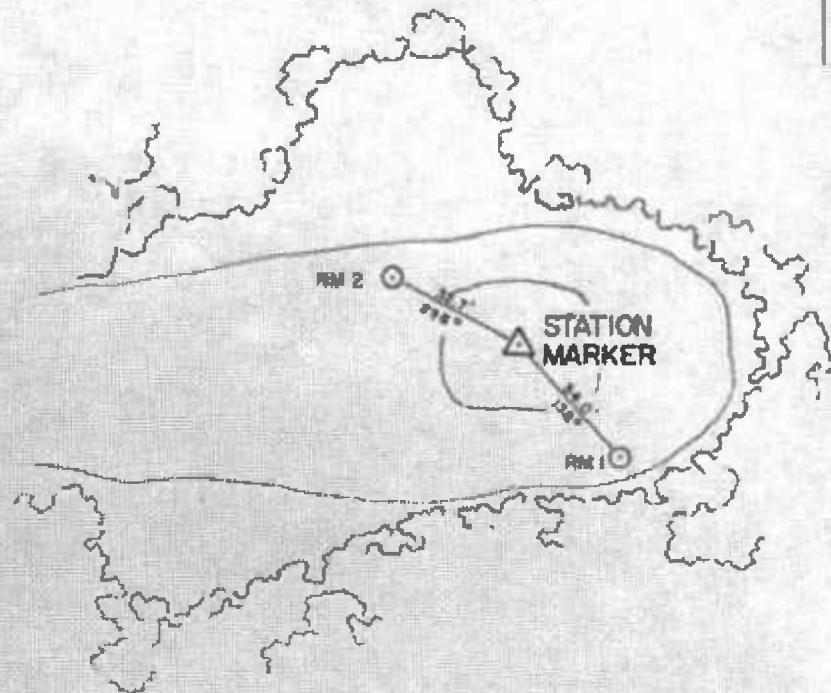
ROUTE DESCRIPTION: The station is reached by helicopter or by foot trail from the village of Efogi, 30 miles NE of Port Moresby. Efogi has a dirt airstrip, with no facilities, usable by light aircraft. The trail from Efogi leads north to Kogi (2½ hours walking time); thence NE along the Kokoda trail to Myola Dry Lake (4½ hours) and the site of an old Wasp aircraft; thence NE over a new trail to Bogilogo (3½ hours); thence ENE to a large grass area below the summit (used as a base camp site) (6 hours); thence NE up a long ridge to the summit and station site. A guide and carriers should be obtained in Efogi before attempting the trail. The village policeman, Sasi, knows the trail well. Most of the trail is quite steep (80-90% grade), limiting carrier loads to 25 pounds.

AREA SKETCH MYOLA (22)



JANUARY 1963
SCALE
0 10 20
MILES

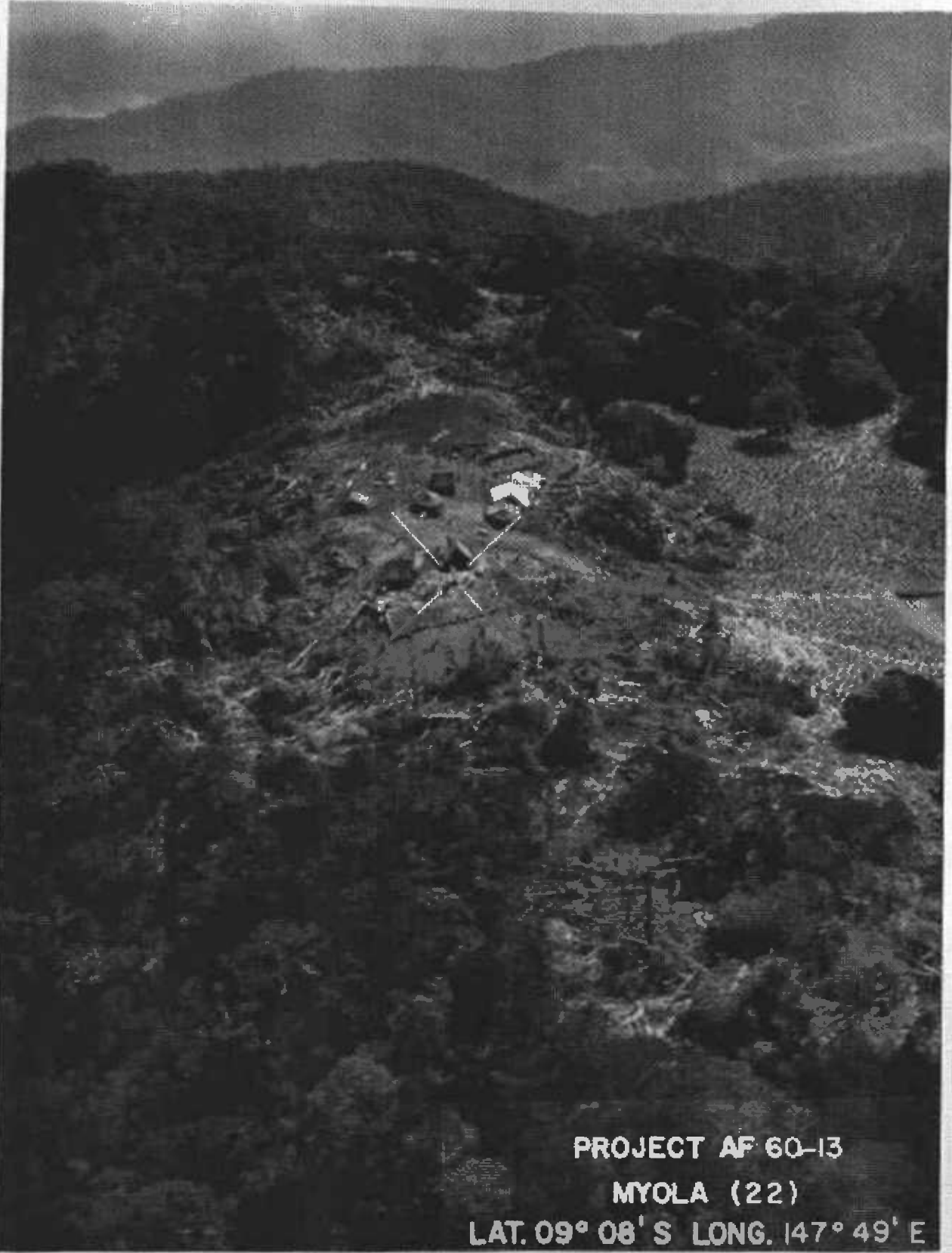
STATION SKETCH MYOLA (22)



AZIMUTHS ARE MAGNETIC FROM NORTH

JANUARY 1963
SCALE
0 20 40
FEET

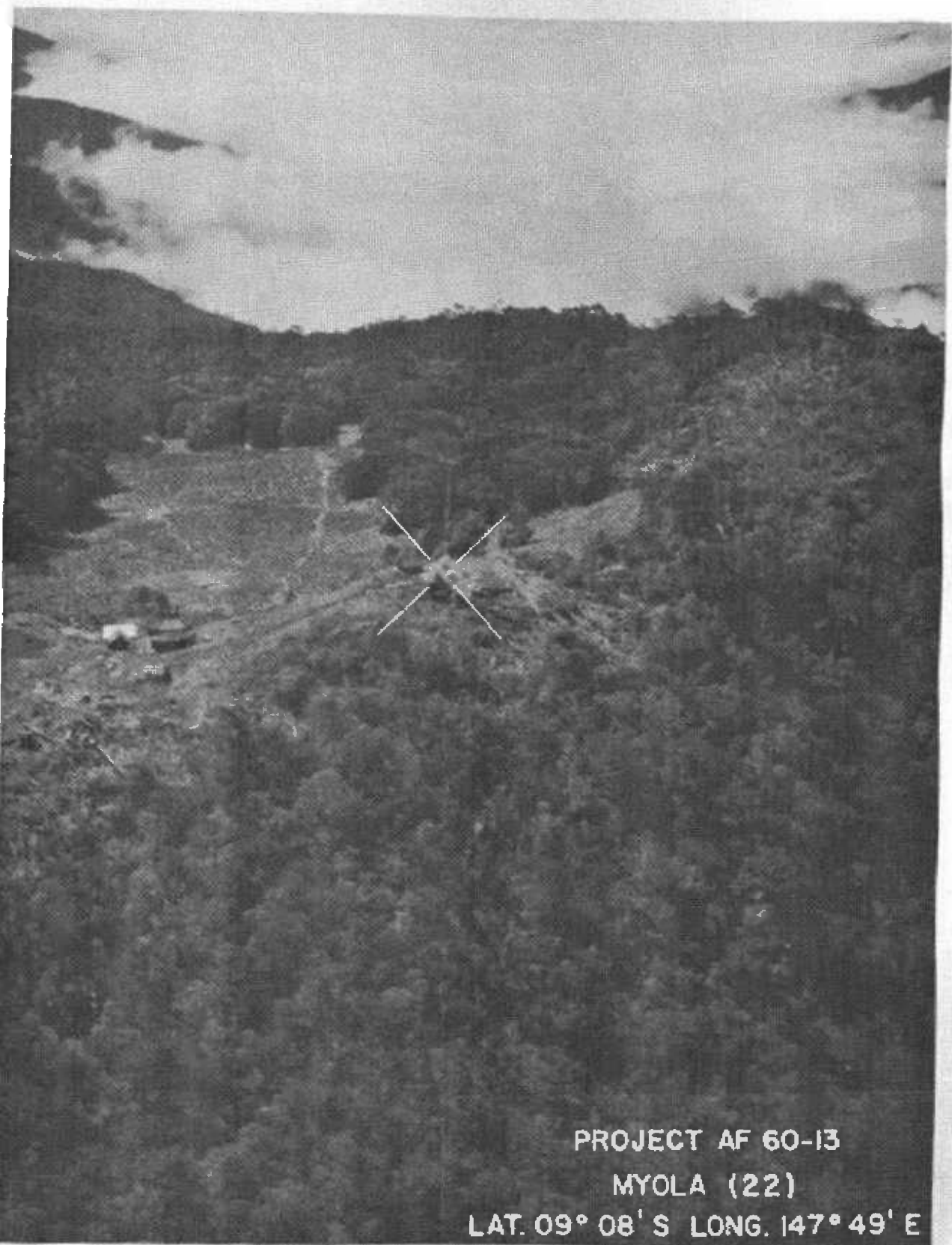




PROJECT AF 60-13

MYOLA (22)

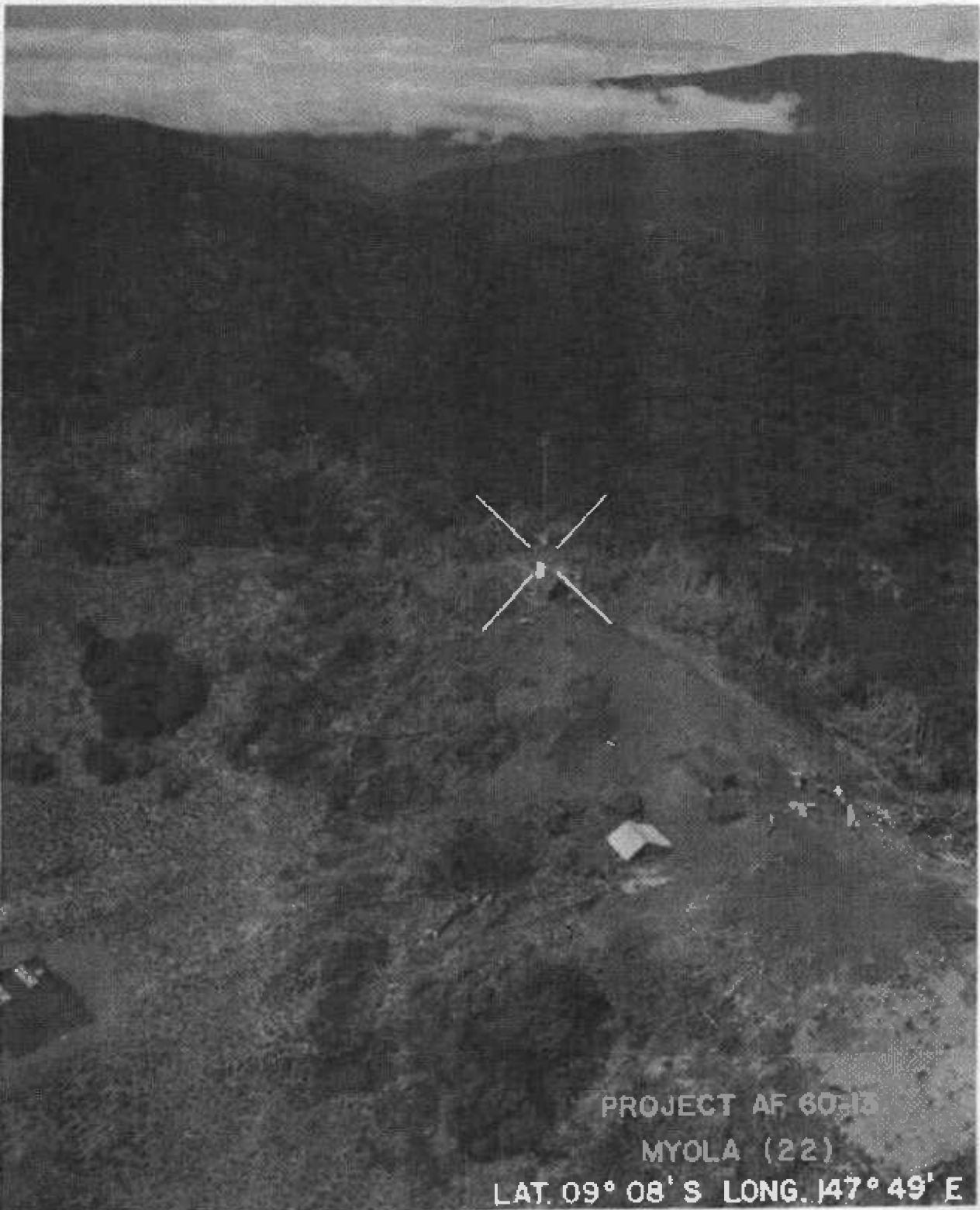
LAT. 09° 08' S LONG. 147° 49' E



PROJECT AF 60-13

MYOLA (22)

LAT. 09° 08' S LONG. 147° 49' E



PROJECT AF 60-13

MYOLA (22)

LAT. 09° 08' S LONG. 147° 49' E



PROJECT AF 60-13

MYOLA (22)

LAT. 09° 08' S LONG. 147° 49' E



**SPECIAL REPORT OF RESULTS
AUSTRALIAN CONTROLLED TERRITORY
SOUTHWEST PACIFIC SURVEY
PROJECT AF 60 - 13**

VOL. III



15 JAN 1965

**1370TH PHOTO-MAPPING WING
AIR PHOTOGRAPHIC & CHARTING SERVICE (MATS)**

528.7
(94)
SPE.3
v.3

TABLE OF CONTENTS

This volume contains station descriptions, sketches, and identification photography for the following Hiran ground stations:

<u>NUMBER</u>	<u>NAME</u>
35	MOUNT DUNDAS U214
36	TURU
37	SEPIK HIRAN
38	SUKI
60	BISHOP CREEK A427
61	HILLTOP A411

Also included are identification photography and data sheets for the following Secondary Control Points:

TENCH ISLAND
GAROVE ISLAND, VITU ISLANDS
NUGARBA ISLAND, NUCURIA ISLANDS
OSPREY REEF
RAINE ISLAND
KREIS REEF
BRAMBLE CAY
MAER ISLAND, MURRAY ISLANDS

5287
1941
SPC 3
43

HIRAN STATION DESCRIPTION

NAME AND NUMBER: MOUNT DUNDAS U214 (35) LOCATION: Near Yirrkala Mission
Arnhem Land Aboriginal Reserve
Northern Territory
Australia

DATE ESTABLISHED: August 1960 (Royal Australian Survey Corps)

DATE RECOVERED: April 1963

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 12° 13' S
Longitude: 136° 52' E

ELEVATION: 237 feet (Trigonometric leveling from local MSL, Royal Australian Survey Corps)

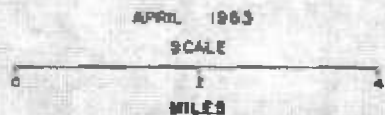
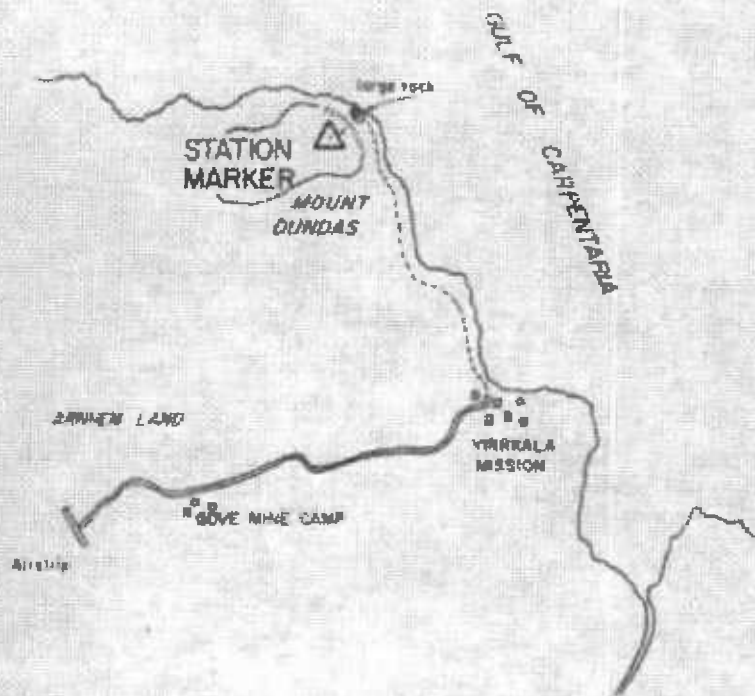
DESCRIPTION: Station MOUNT DUNDAS U214 was established as a first order tellurometer traverse station by the Royal Australian Survey Corps. It is located on Mount Dundas, a hill near the northern shore of the Gove Peninsula, 3 miles NW of Yirrkala Mission and 12 miles NW of Cape Arnhem, the easternmost point on the northwestern coast of the Gulf of Carpentaria. The station is situated in a level clearing near the top and at the eastern extremity of Mount Dundas, which is otherwise heavily wooded. The station is marked by an Australian Survey Corps survey mark disk, unstamped, set in an irregular mass of concrete, flush with the ground level. There is no subsurface mark.

REFERENCES: Reference Mark No. 1 is a brass cartridge case cemented into the top of a 2 foot round boulder. Reference Marks No. 2 and No 3 are brass cartridge cases cemented into the bedrock. (RM 2 is aligned with RASC tellurometer station U 312). (Note: RM 2 and RM 3 were reported in April 1964 as having been destroyed).

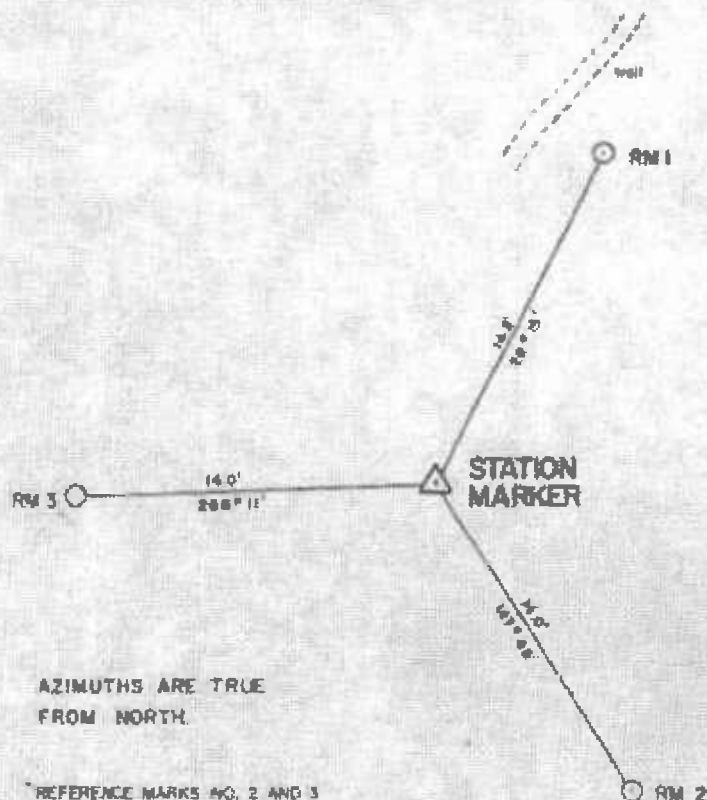
<u>OBJECT</u>	<u>DISTANCE (FEET)</u>	<u>AZIMUTH (TRUE FROM NORTH)</u>
RM 1	14.3	28° 15'
RM 2	14.0	147° 45'
RM 3	14.0	268° 10'

ROUTE DESCRIPTION: The site is accessible by helicopter, either ship-borne or from the airstrip located about five miles SW of Mount Dundas. It can also be reached by land from Yirrkala Mission, approximately three miles to the SE, by following the coast to the base of Mount Dundas, which rises in a steep bluff from the rocky beach, and climbing the hill at a point opposite a conspicuous, isolated large rock on the beach. (Note: The station is located on an Aboriginal Reservation. Entry requires government permission, and there are many rules and restrictions which must be observed).

AREA SKETCH
MT. DUNDAS U214 (35)



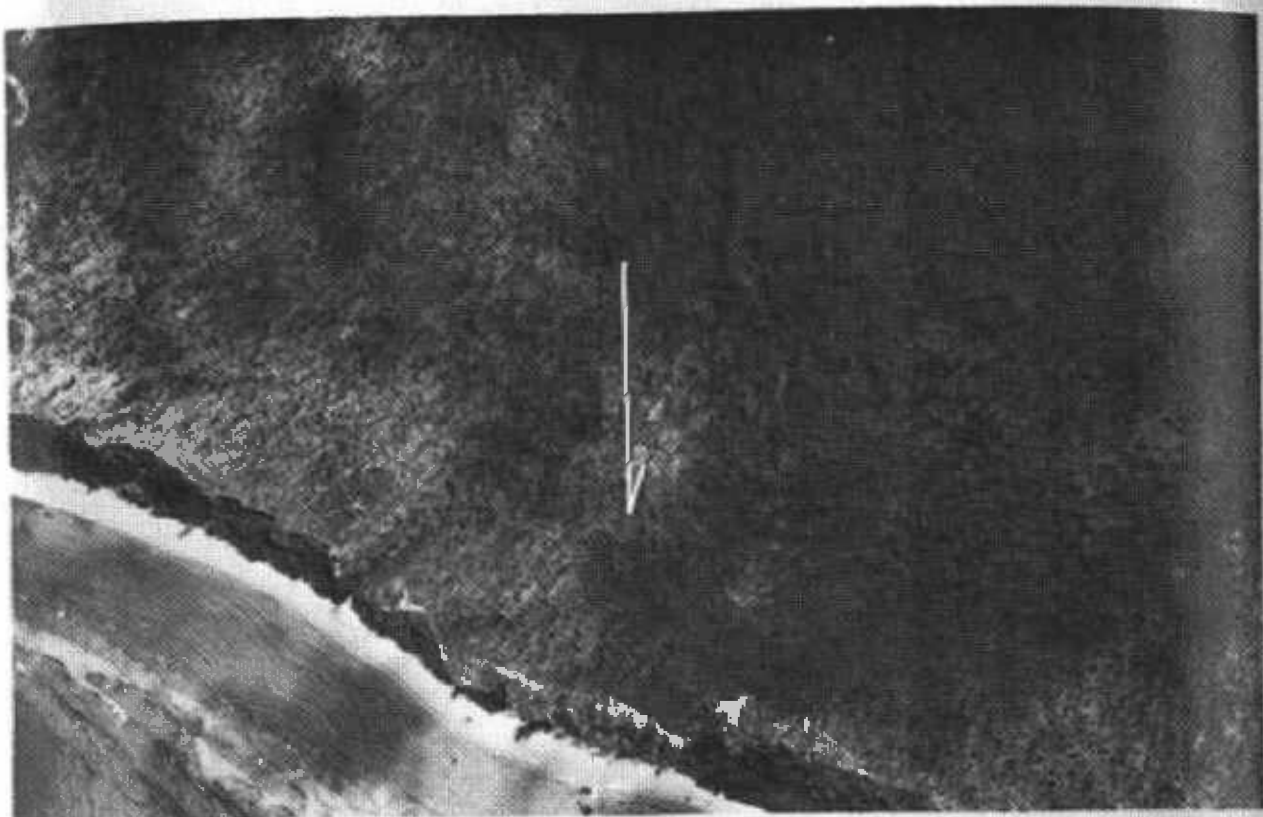
STATION SKETCH
MT. DUNDAS U214 (35)



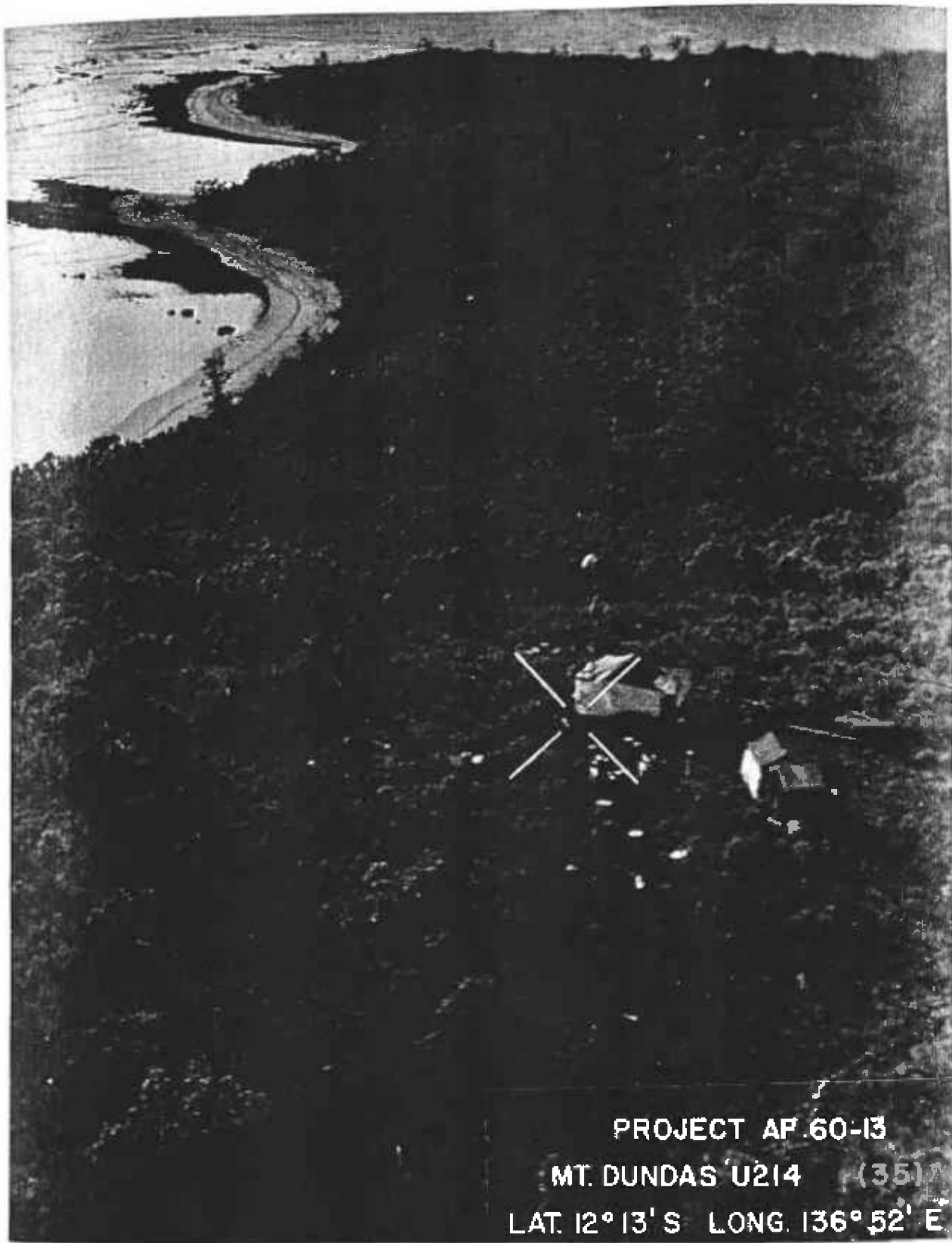
AZIMUTHS ARE TRUE
FROM NORTH.

*REFERENCE MARKS NO. 2 AND 3
WERE REPORTED IN APRIL 1964
AS DESTROYED*





PROJECT AF 60-13
MT DUNDAS U (35)
LAT. 12° 13' S LONG. 152° 00' E



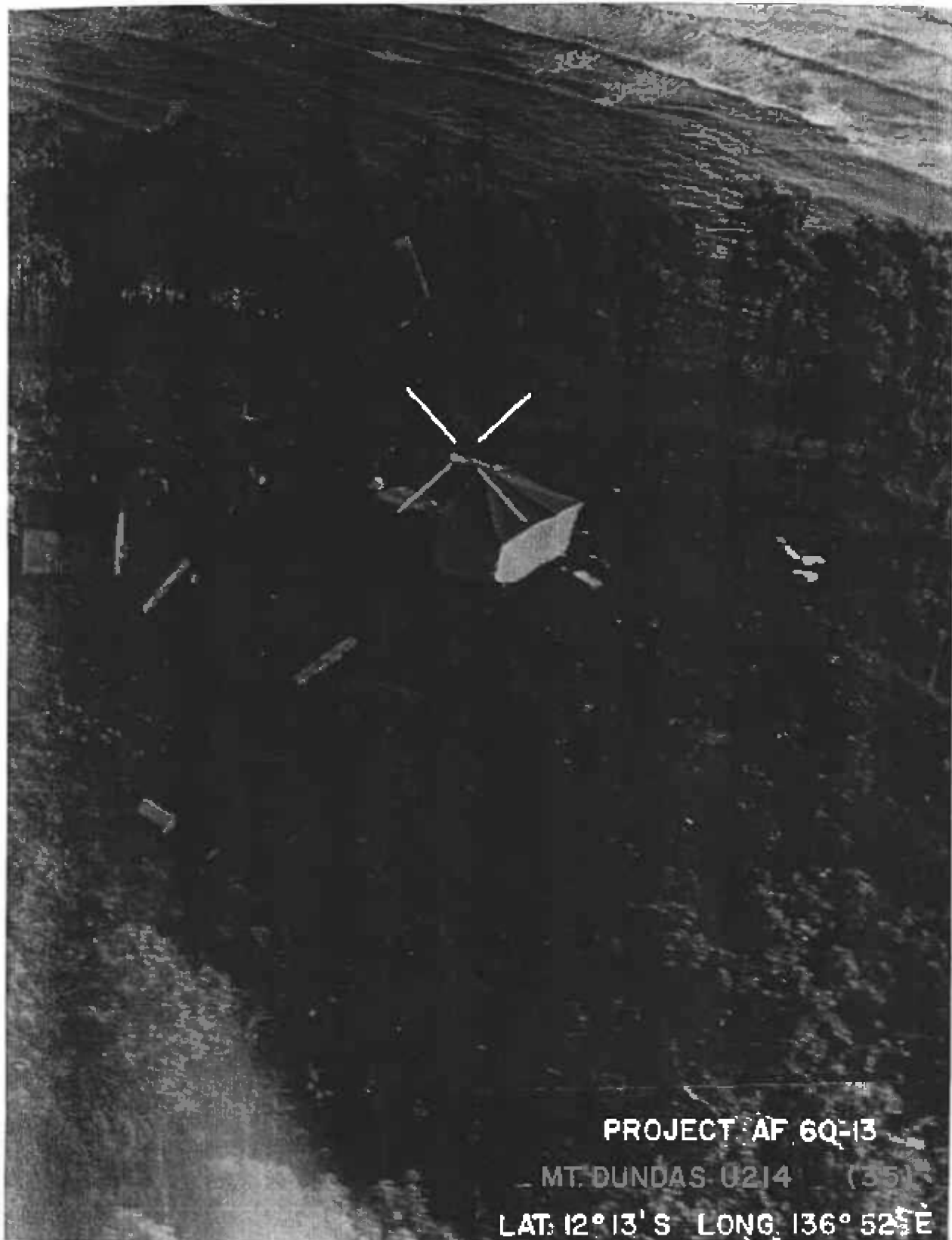
PROJECT AF 60-13

MT. DUNDAS U214 (35)

LAT. 12° 13' S LONG. 136° 52' E



PROJECT AF 60-13
MT. DUNDAS U214 (35)
LAT. 12° 13' S LONG. 136° 52' E



PROJECT AF 6Q-13

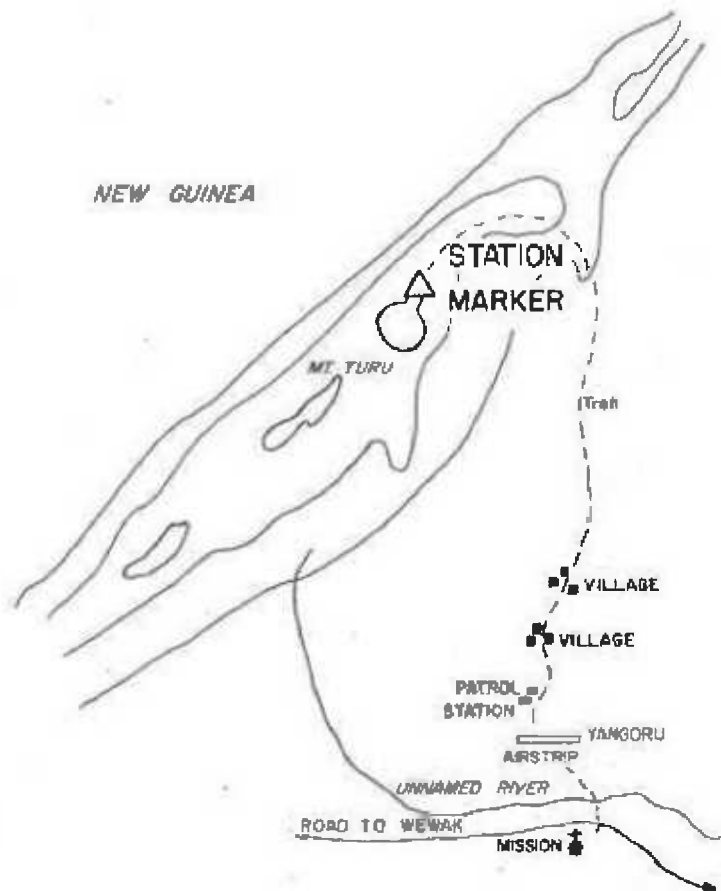
MT. DUNDAS U214 (35)

LAT: 12° 13' S LONG: 136° 52' E



PROJECT AF 60-13
MT. DUNDAS U214 (35)
LAT. 12° 13' S LONG. 136° 52' E

AREA SKETCH TURU (36)

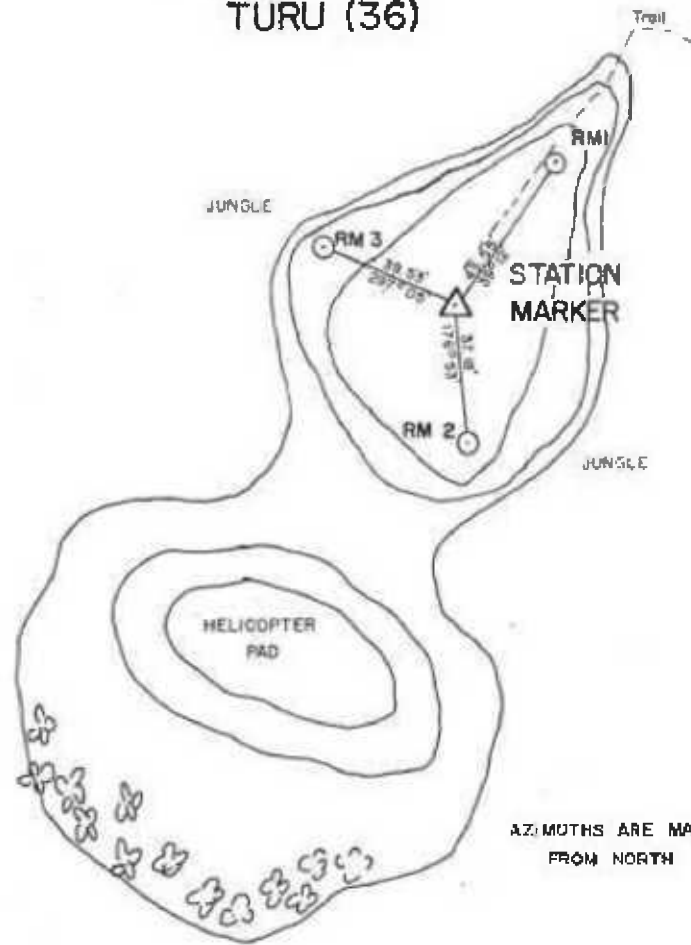


NOVEMBER 1962

SCALE



STATION SKETCH TURU (36)

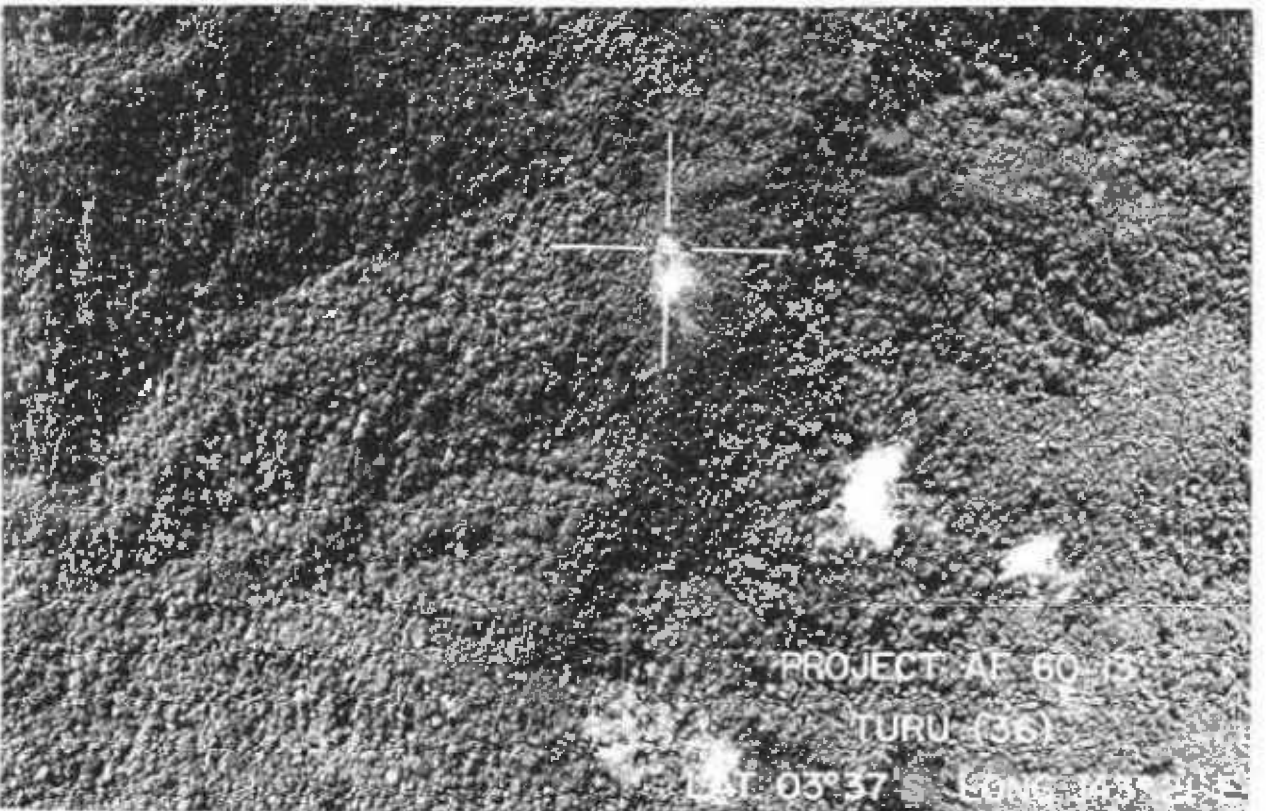
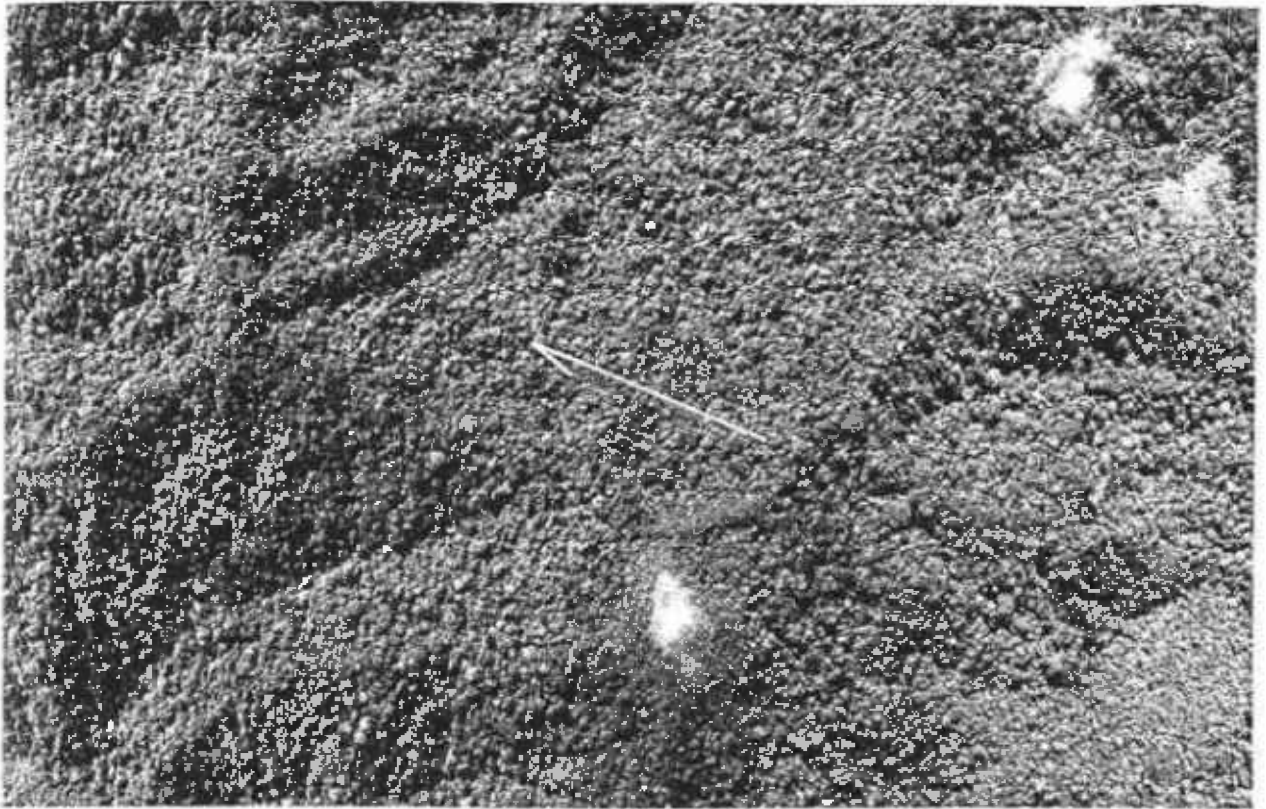


AZIMUTHS ARE MAGNETIC
FROM NORTH

NOVEMBER 1962

SCALE





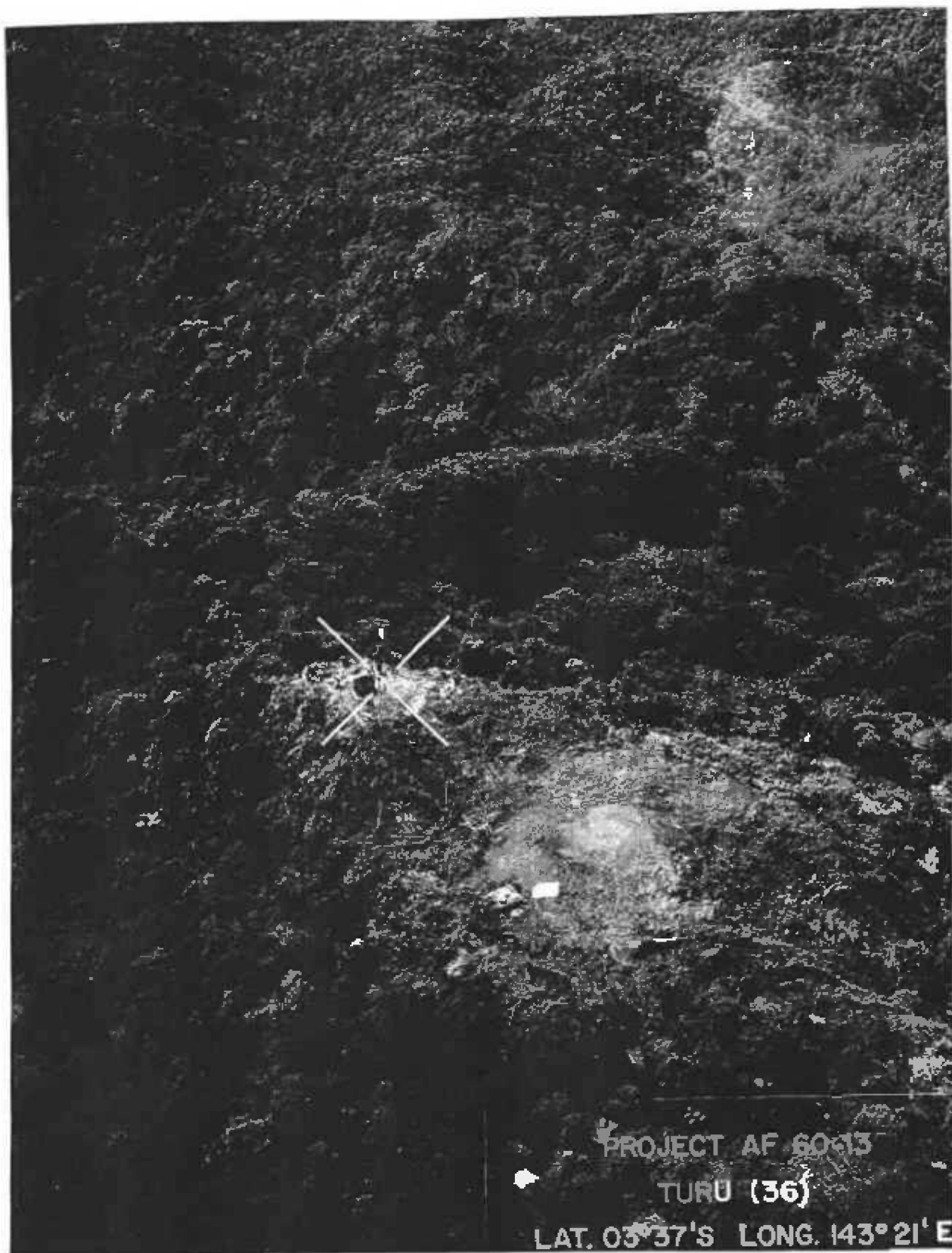
PROJECT AF 60-13

TURU (36)

LAT 03° 37' S LONG 103° 21' E



PROJECT AF-60-13
TURU (36)
LAT. 03°37' S LONG. 143°21' E



PROJECT AF 60-13

TURU (36)

LAT. 03° 37' S LONG. 143° 21' E



PROJECT AF 60-13

TURU (36)

LAT. 03°37'S LONG. 143°21' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: SEPIK HIRAN (37) LOCATION: Hindenburg Range
 Near Telefomin
 Territory of Papua and
 New Guinea

DATE ESTABLISHED: September 1963

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 05° 09' S
 Longitude: 141° 23' E

ELEVATION: 10,258 feet (Barometric Leveling, USAF)

DESCRIPTION: Station SEPIK HIRAN is located on a mountain top at the western end of the Hindenburg Range south of the Telefomin Valley and approximately 11 miles SW of the town of Telefomin. It is approximately one half mile north of the border between the Territory of Papua and the Territory of New Guinea, in a region of tropical rain forest. An area on the mountaintop was cleared for helicopter landings. The station is marked by a USAF Geodetic Survey Control station disk stamped "SEPIK 1963 HIRAN", cemented in the top of a 10 foot high solid rock pinnacle. There is no subsurface mark.

REFERENCES: Reference Marks No. 1 and No. 2 are USAF Geodetic Survey reference mark disks, stamped "SEPIK 1963 RM 1" and "SEPIK 1963 RM 2" respectively, cemented into rock outcrops. Reference Mark No. 3 is a U.S. Navy Hydrographic Office reference mark disk, stamped "RM 3 SEPIK 1963", cemented into the top of a rock pinnacle about six feet high.

<u>OBJECT</u>	<u>DISTANCE (FEET)</u>	<u>AZIMUTH FROM NORTH (MAGNETIC)</u>
RM 1	97.05	13° 05'
RM 2	62.56	64° 06'
RM 3	31.62	177° 10'

ROUTE DESCRIPTION: The station is most easily reached by helicopter from Telefomin, which has an airstrip (no facilities) usable by DC-3's. It can also be reached by foot trail from the village of Tifalmin, about 10 miles west of Telefomin, which is reached from Telefomin by light aircraft or by a two day walk by jungle trail. The trail from Tifalmin to the station leads westward to the village of Bupilmin; about $\frac{1}{4}$ mile west of Bupilmin the trail turns to the south and leads up to the top of the Hindenburg Range; reaching the top, it leads NW for about $\frac{1}{2}$ mile, then bears west another $\frac{1}{2}$ mile to the station, which is on the most prominent ridge south of Bupilmin. Two days are required to walk from Tifalmin to the station, and a native guide must be employed.

AREA SKETCH
SEPIK HIRAN (37)

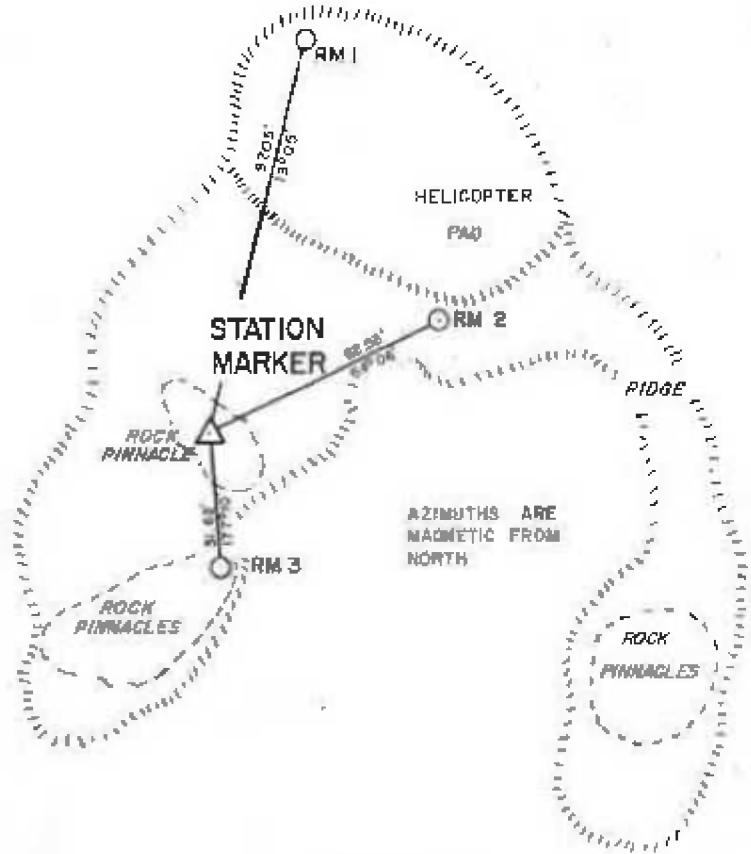


SEPTEMBER 1963

SCALE



STATION SKETCH
SEPIK HIRAN (37)



AZIMUTHS ARE
MAGNETIC FROM
NORTH

SEPTEMBER 1963

SCALE

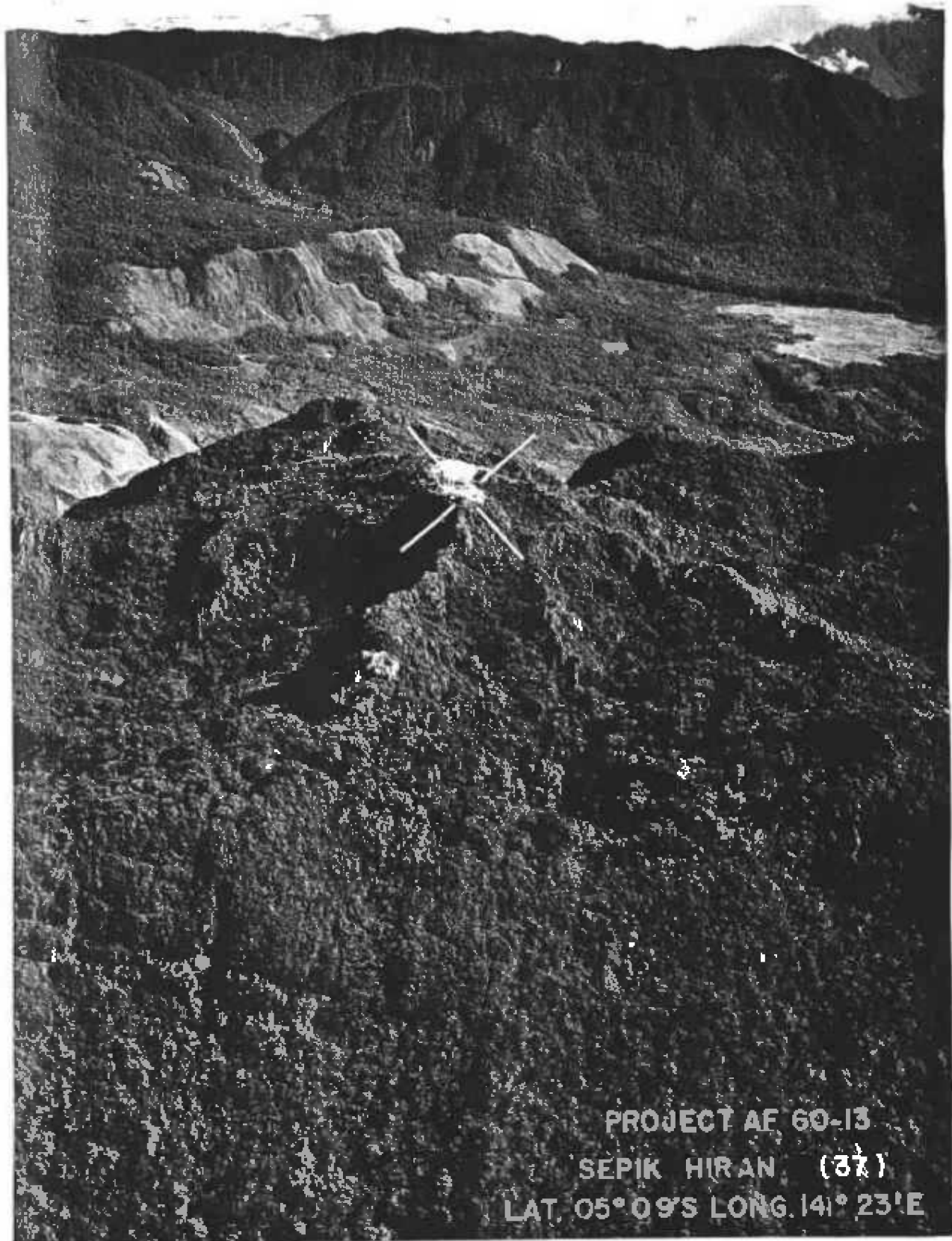




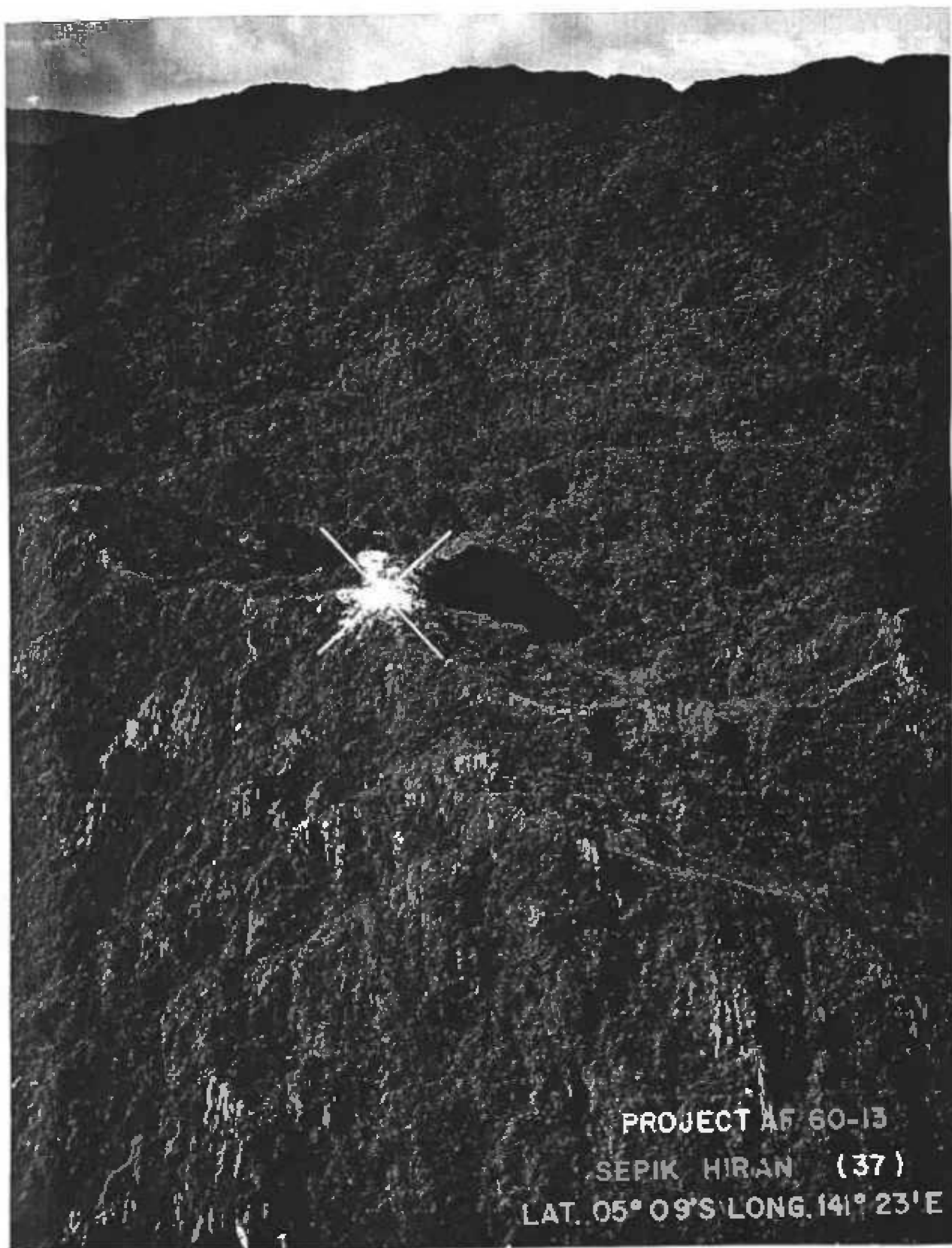
PROJECT AF 60-13
SEPIK HIRAN (37)
LAT. 05° 09' S LONG. 141° 23' E



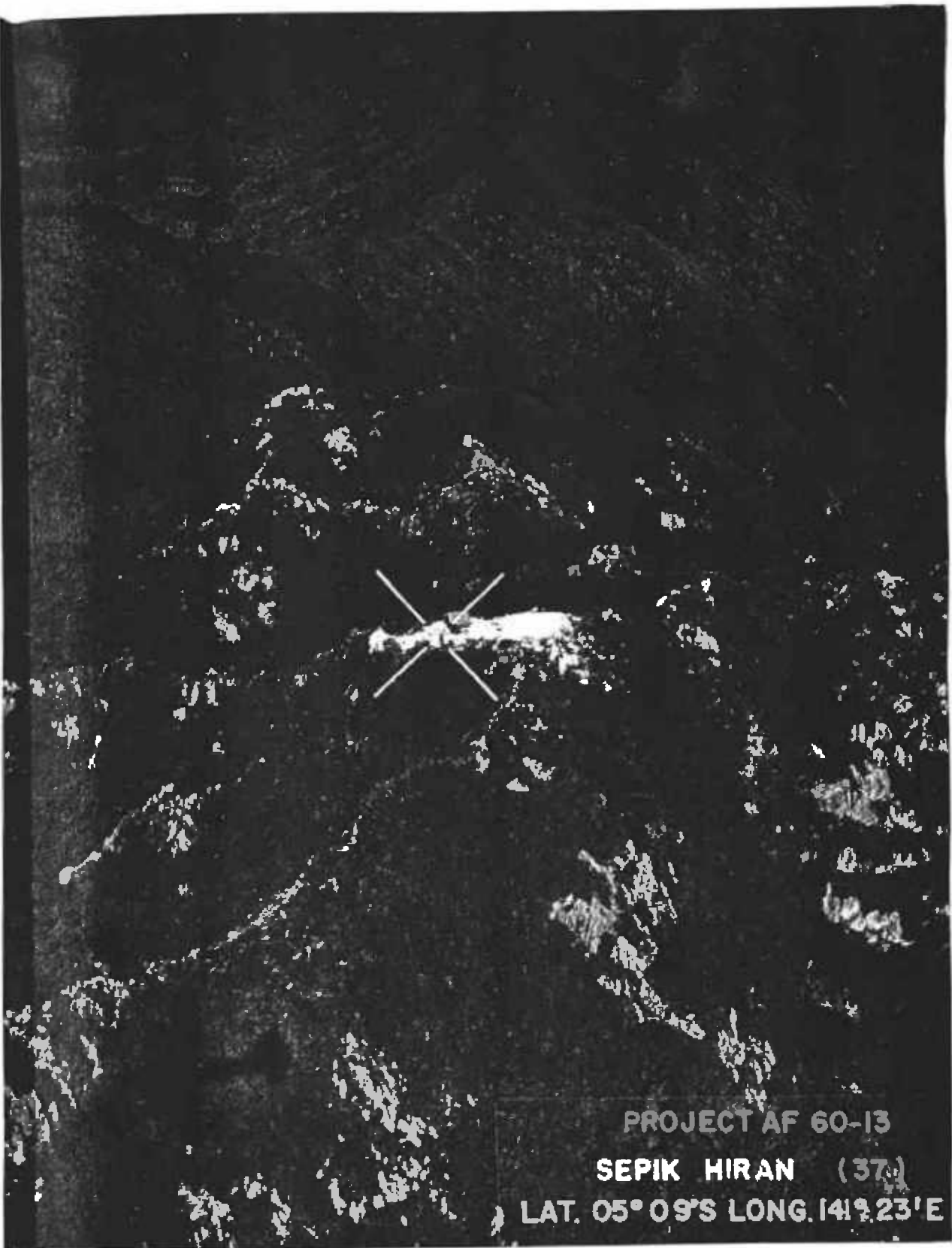
PROJECT AF 60-13
SEPIK HIRAN (37)
LAT. 05° 09'S LONG. 141° 23'E



PROJECT AF 60-13
SEPIK HIRAN (37)
LAT. 05° 09' S LONG. 141° 23' E



PROJECT AF 60-13
SEPIK HIRAN (37)
LAT. 05° 09' S LONG. 141° 23' E



PROJECT AF 60-13
SEPIK HIRAN (37)
LAT. 05° 09' S LONG. 141° 23' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: SUKI (38) LOCATION: Suki Mission
Gwiboku Village
Territory of Papua and
New Guinea

DATE ESTABLISHED: January 1963

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 08° 02' S
Longitude: 141° 44' E

ELEVATION: 76 Feet (Barometric Leveling, USAF)

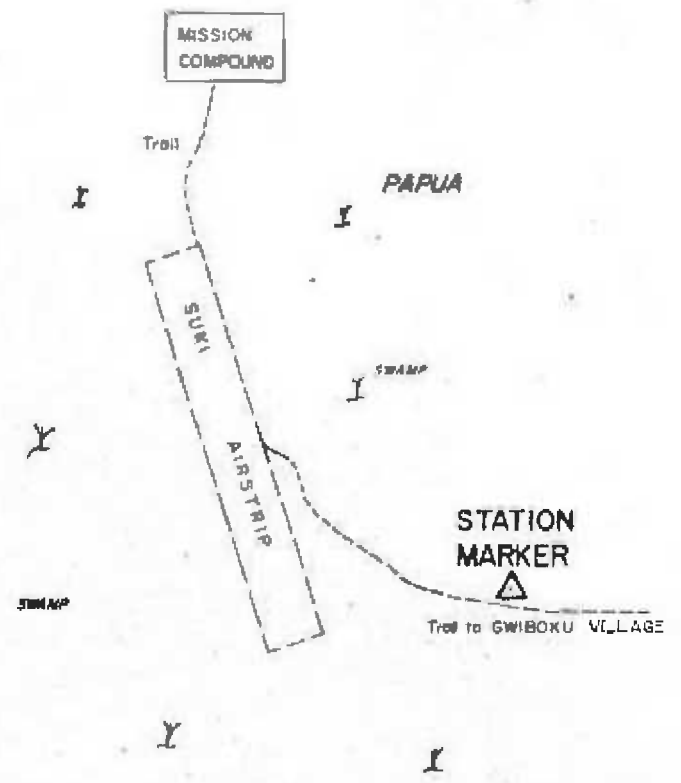
DESCRIPTION: Station SUKI is located at the Unevangelized Field Mission "Suki", near Gwiboku Village, about 75 miles NE of the southwesternmost point in Papua, and about 120 miles WNW of the coastal island of Daru (site of Hiran Station 24), near the mouth of the Fly River. It is on a narrow strip of dry land connecting the mission compound and airstrip with the native village located about $\frac{1}{2}$ mile to the east. The surrounding region is almost entirely lagoon and swamp. The station is about 75 feet north of the trail connecting the mission with the village and about 1000 feet east of the airstrip, in an open area of tall grass, about 50 feet from the edge of an area of scattered trees. The station is marked by a USAF Geodetic Survey Control Station disk, stamped "SUKI 1963", set in a concrete monument 6 inches in diameter and flush with the ground level. The subsurface mark is a disk of the same description set in concrete 26 inches below the surface mark.

REFERENCES: Reference marks are USAF Geodetic Survey reference mark disks, stamped "SUKI 1963 1" and "SUKI 1963 2" respectively, set in concrete monuments 6 inches in diameter, flush with the ground level.

<u>OBJECT</u>	<u>DISTANCE (FEET)</u>	<u>AZIMUTH FROM NORTH (MAGNETIC)</u>
RM 1	28.45	109° 18'
RM 2	30.16	02° 57'

ROUTE DESCRIPTION: The station can be reached from Daru by light aircraft, utilizing the airstrip (no facilities) at the Suki Mission. To reach the station from the airstrip, follow the foot trail from the east side of the strip, going first SSE and then curving around to the east, for about 1500 feet; about 100 feet before reaching the first tree alongside the trail leave the trail and walk north about 75 feet through the grassy area to the station.

AREA SKETCH SUKI (38)

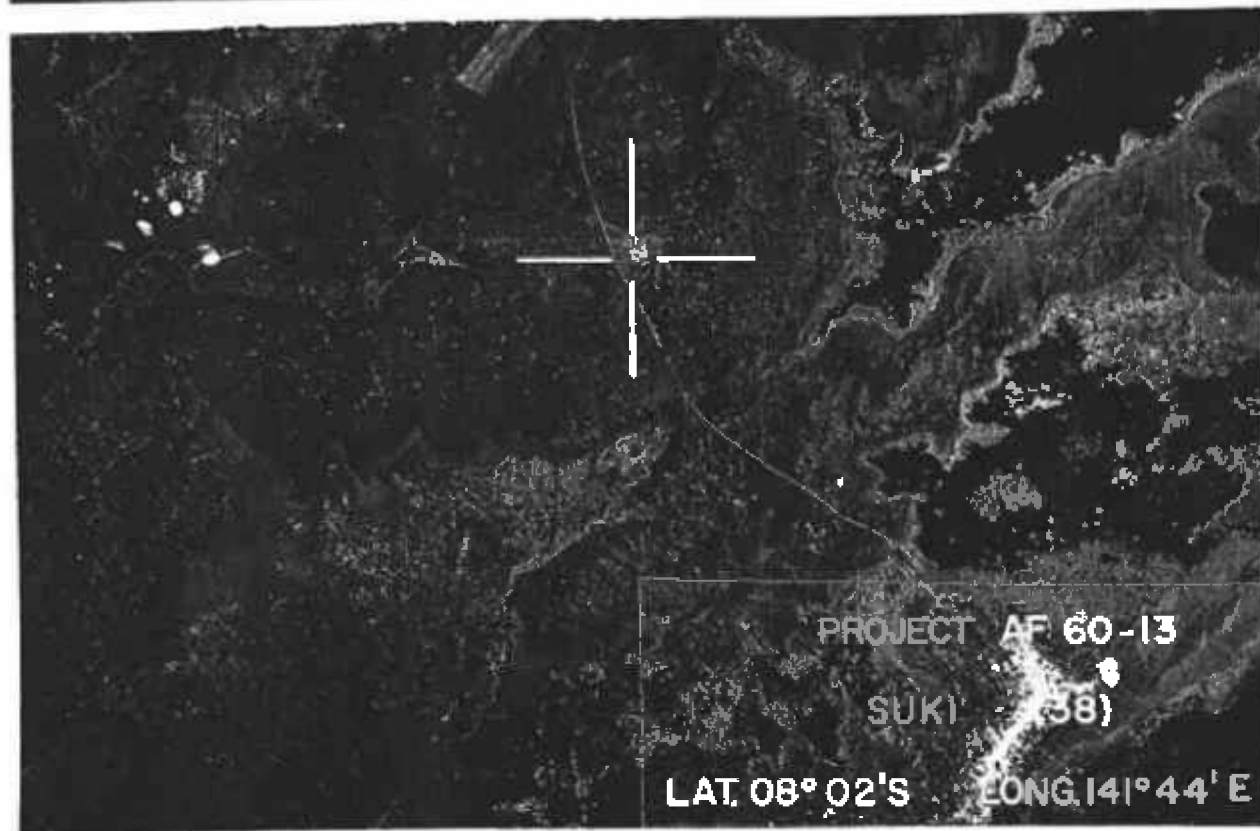
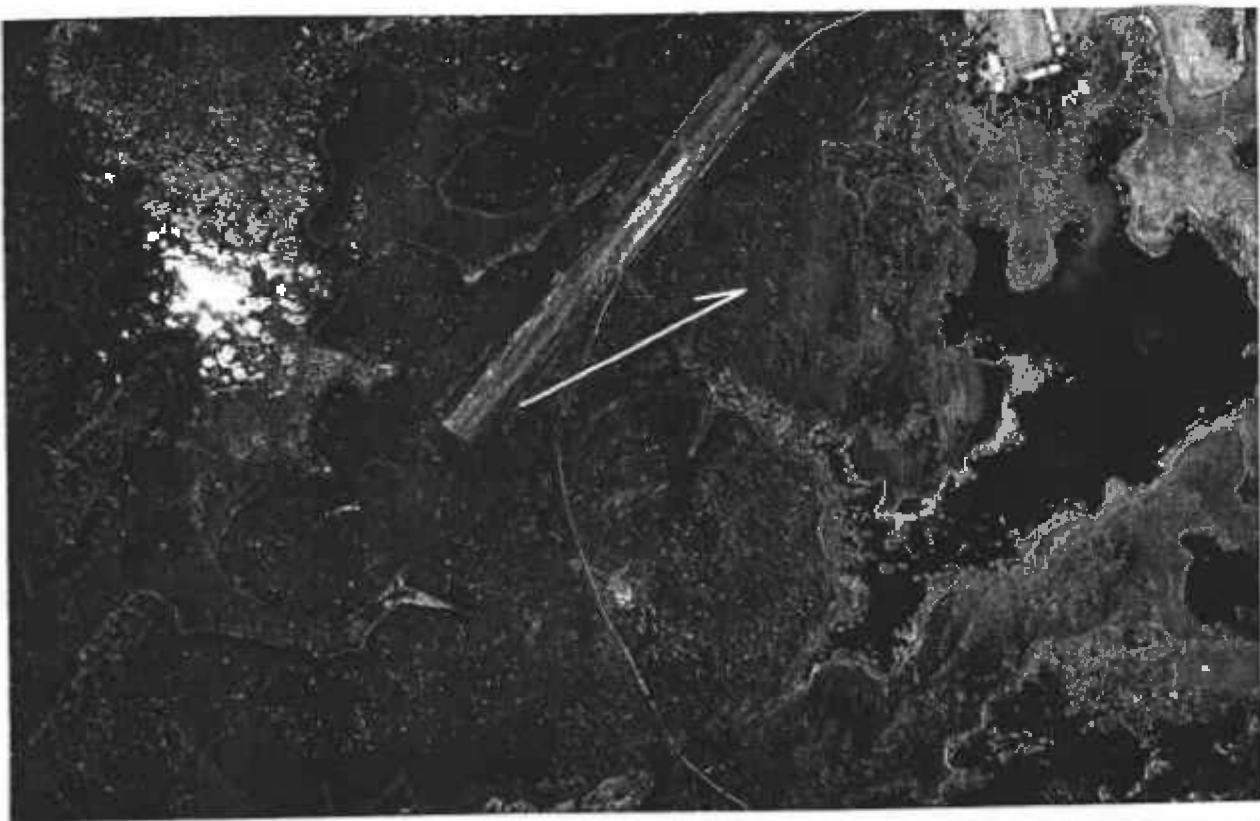


JANUARY 1963
SCALE
0 500 1000
FEET

STATION SKETCH SUKI (38)



JANUARY 1963
SCALE
0 15 30
FEET



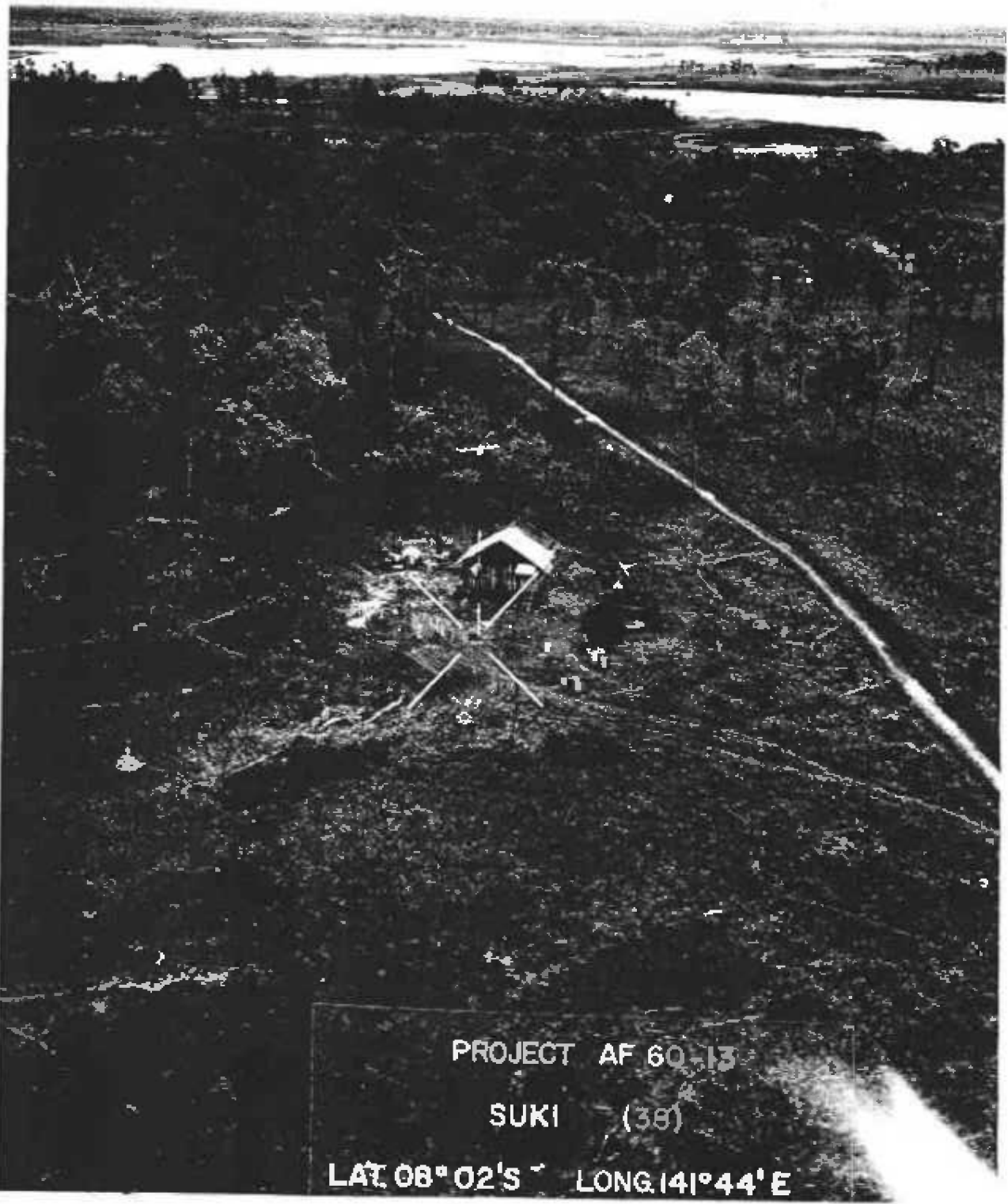


PROJECT AF 60-13

SUKI (38)

LAT. 08° 02'S

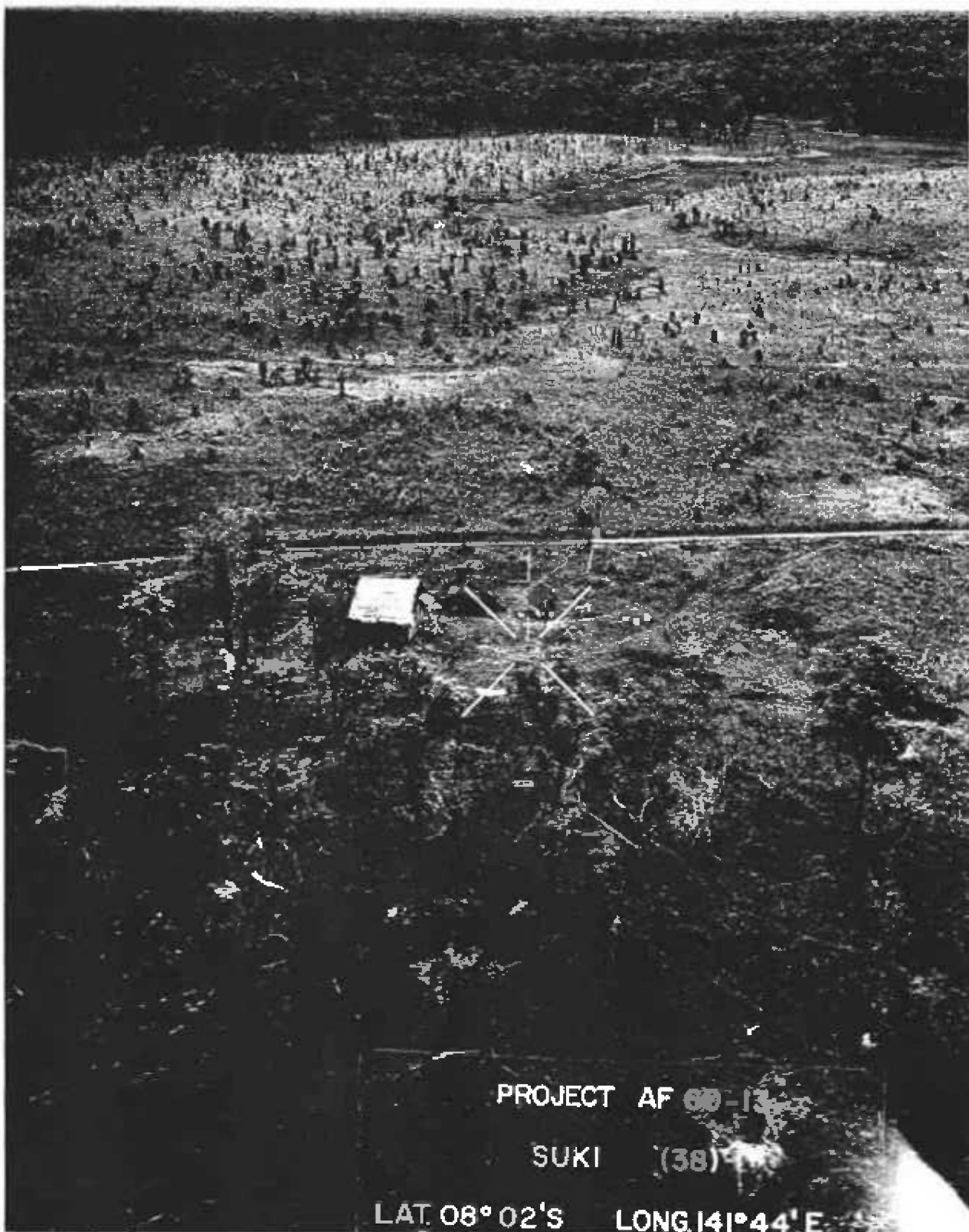
LONG. 141° 44' E



PROJECT AF 60-13

SUKI (38)

LAT. 08° 02' S ~ LONG. 141° 44' E



PROJECT AF 60-13

SUKI (38)

LAT. 08° 02' S LONG. 141° 44' E



PROJECT AF 60-13

SUKI (38)

LAT. 08° 02' S LONG. 141° 44' E

HIRAN STATION DESCRIPTION

NAME AND NUMBER: BISHOP CREEK A427 (60) LOCATION: Near Cloncurry
Queensland
Australia

DATE ESTABLISHED: July 1958 (Royal Australian Survey Corps)

DATE RECOVERED: June 1964

APPROXIMATE GEOGRAPHIC COORDINATES: Latitude: 20° 47' S
Longitude: 140° 42' E

ELEVATION: 836 feet (Trigonometric leveling from MSL, Brisbane,
Royal Australian Survey Corps)

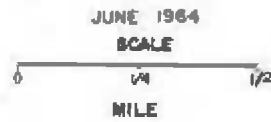
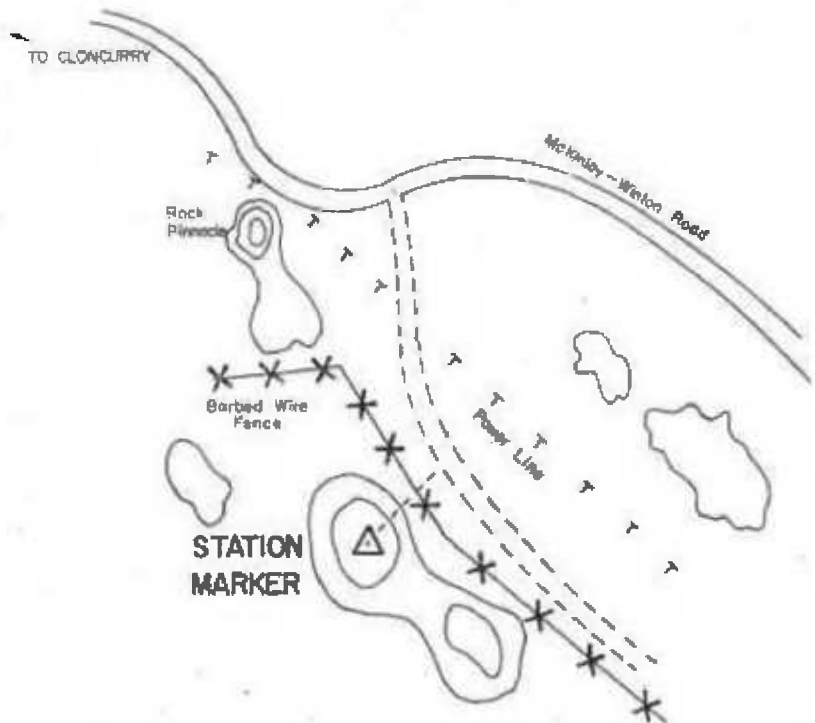
DESCRIPTION: Station BISHOP CREEK A427 is located approximately 17 miles SE of the town of Cloncurry, on the top of the higher and more westerly of two rounded hills, 0.6 mile south of the Cloncurry-McKinlay Road. The area is one of scrub grass and rocky ground. The station is marked by an Australian Survey Corps survey mark disk, stamped "A427", set in the top of a concrete monument 8 inches square, flush with the ground level. There is no subsurface mark.

REFERENCES: Reference Marks Nos. 1, 2 and 3 are brass cartridges imbedded in the tops of concrete monuments 6 inches square, flush with the ground level. The witness post is a white wooden post 4 feet high and 4 inches square marked "A427" on its east side.

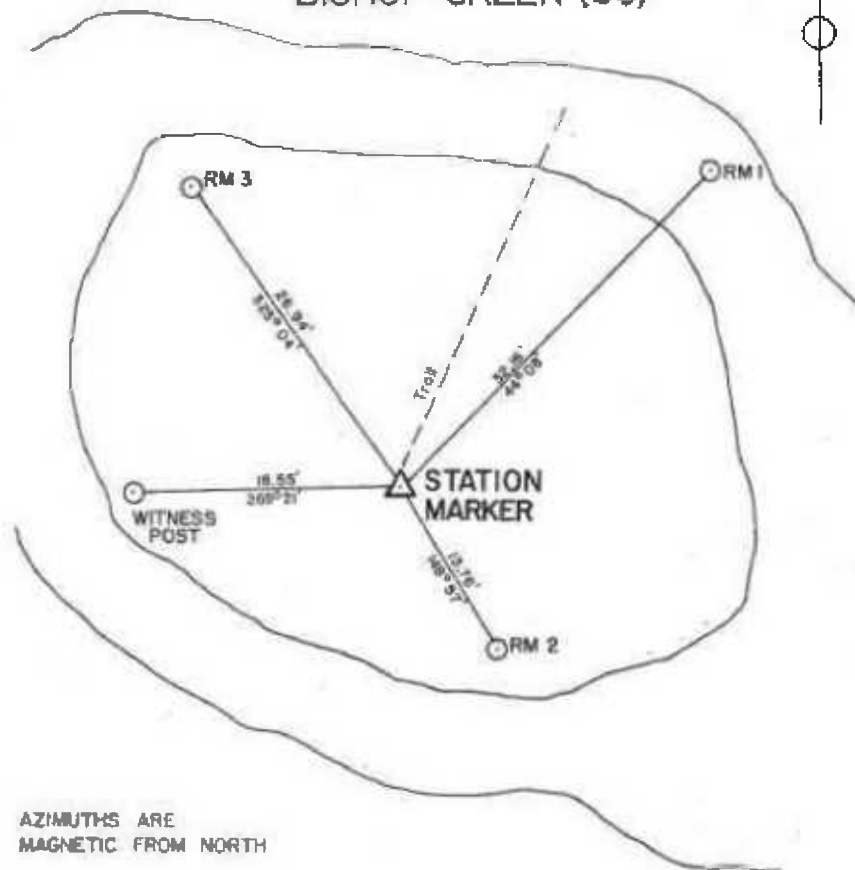
<u>OBJECT</u>	<u>DISTANCE (FEET)</u>	<u>AZIMUTH (MAGNETIC FROM NORTH)</u>
RM 1	32.16	44° 08'
RM 2	13.76	143° 57'
RM 3	26.94	325° 04'
WITNESS POST	18.55	269° 21'

ROUTE DESCRIPTION: Cloncurry is served by commercial air. To reach the station from Cloncurry go east on Ramsay Street to the first fork in the road; here take the right (SE) fork onto the dirt and gravel road known as the McKinlay-Winton Road; proceed for 0.9 miles to a railroad crossing; continue straight for 15.5 miles to a large rock pinnacle on the right; 0.4 mile past the pinnacle turn right (south) on an obscure wagon trail and proceed 0.7 mile to a barbed wire fence at the base of the rounded hills; cross the fence and proceed approximately 340 yards up the more westerly hill to the station.

AREA SKETCH
BISHOP CREEK (60)

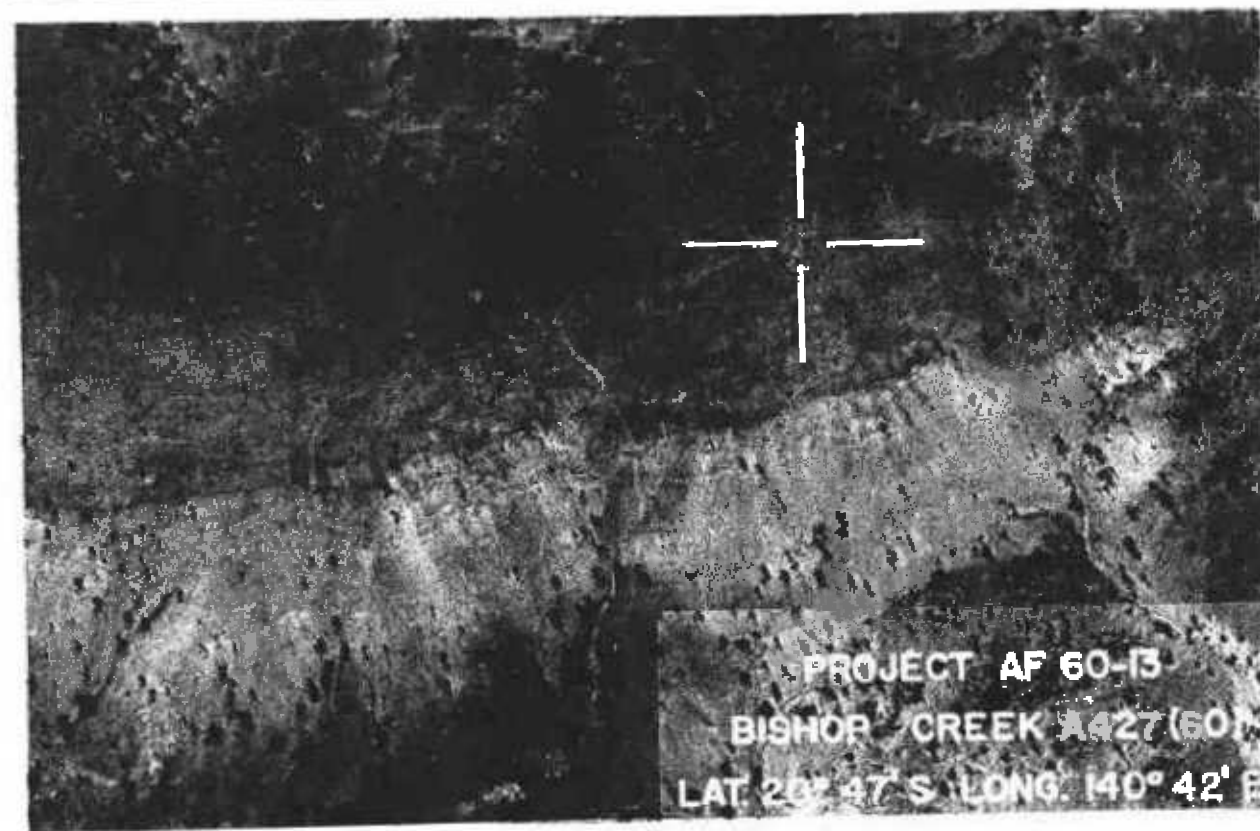
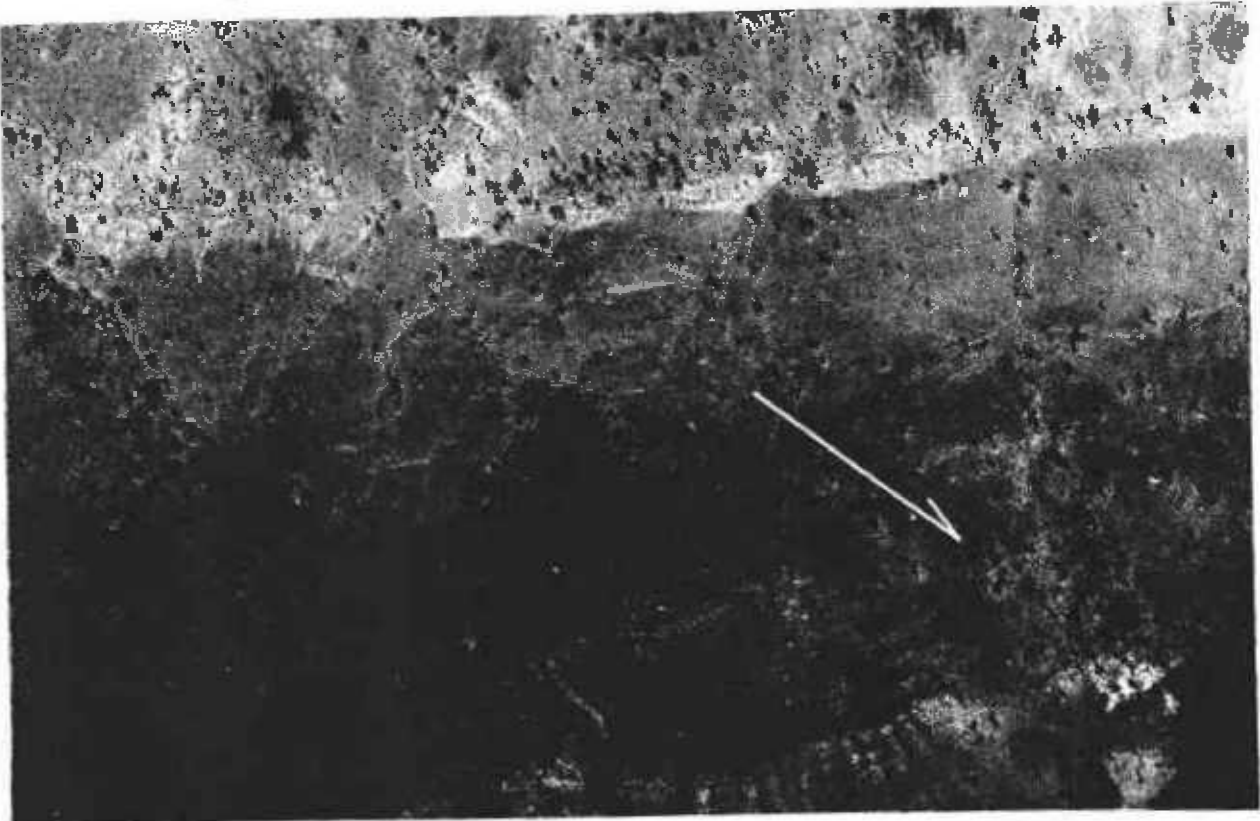


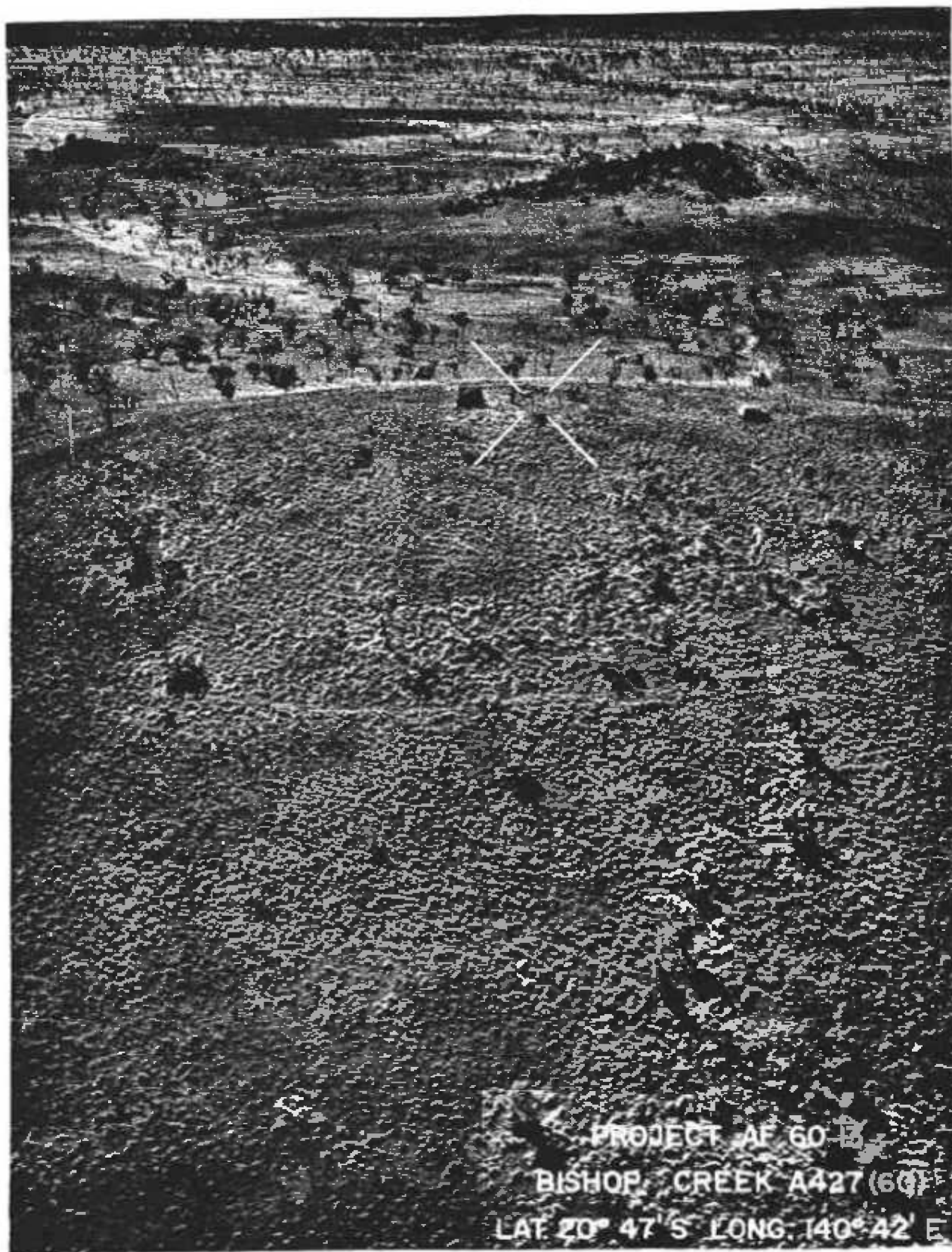
STATION SKETCH
BISHOP CREEK (60)



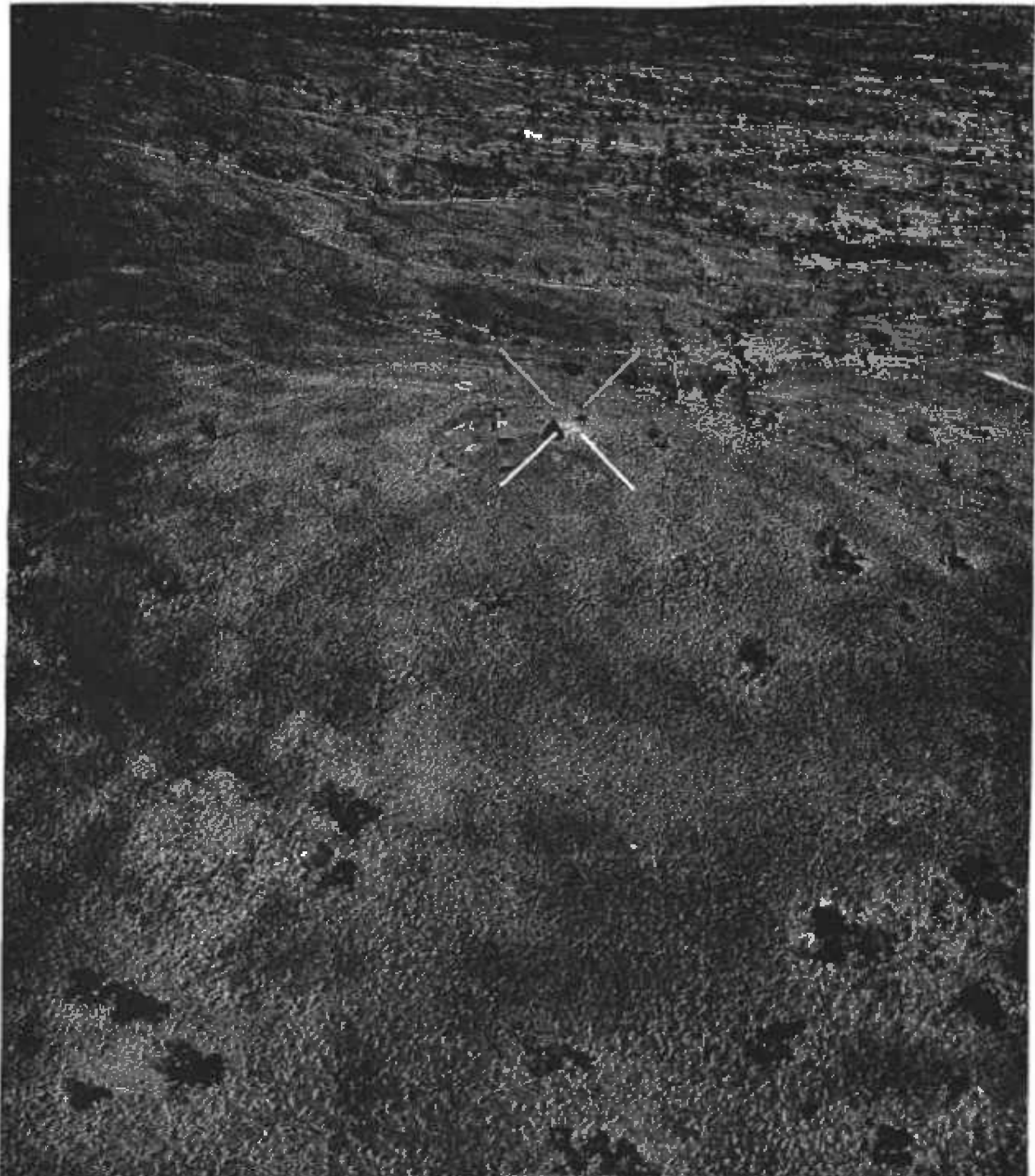
AZIMUTHS ARE
MAGNETIC FROM NORTH



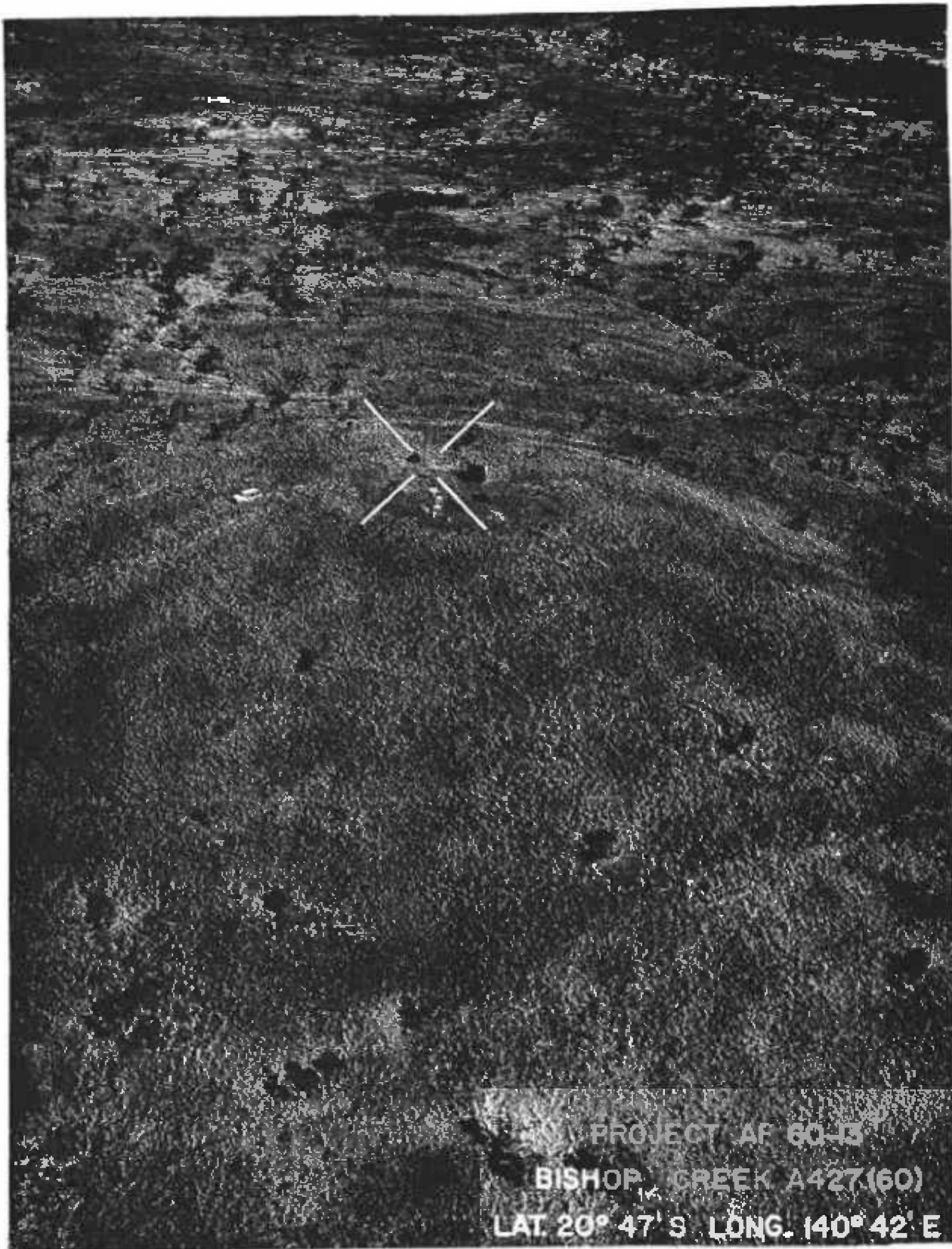




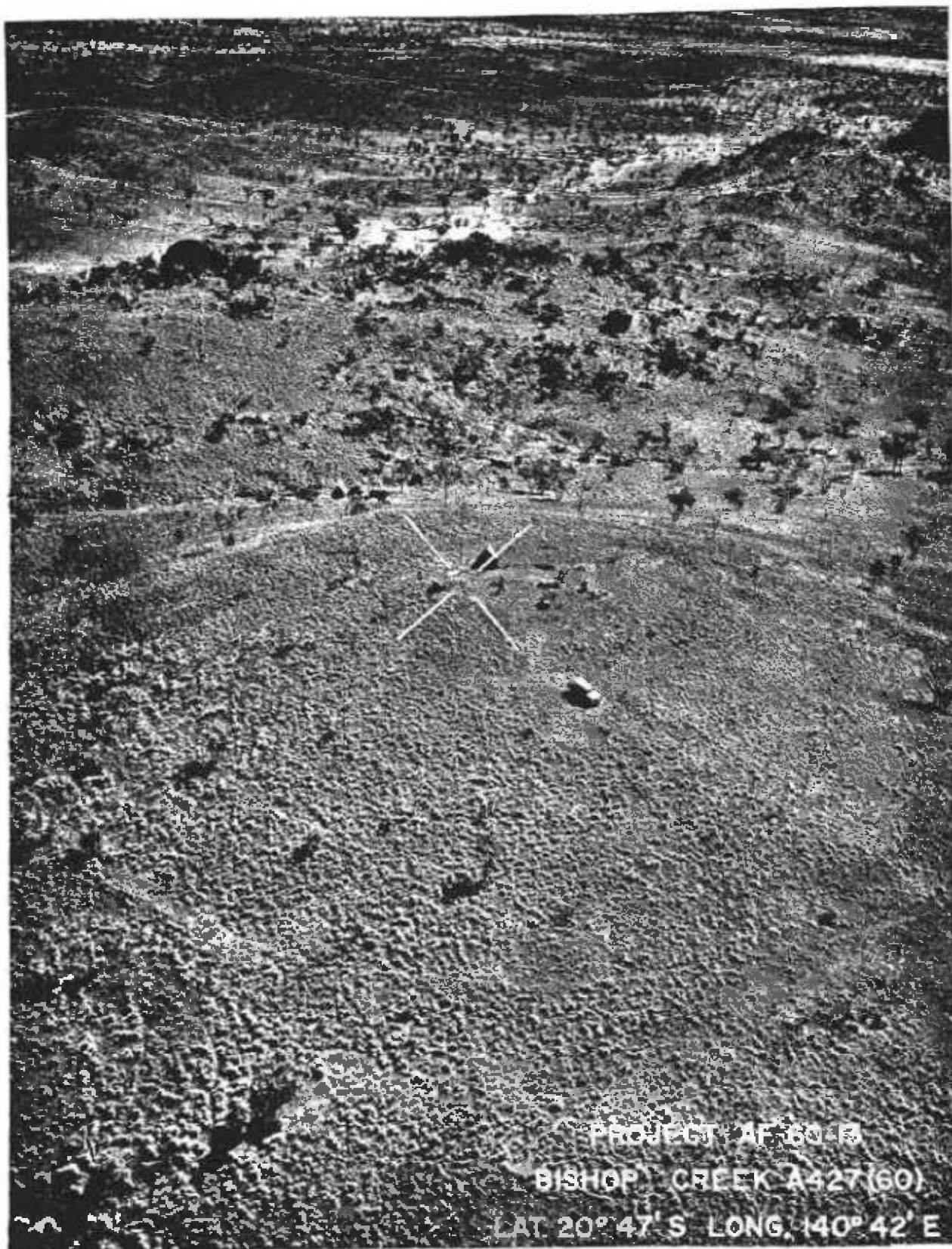
PROJECT AF 60-13
BISHOP CREEK A427 (60)
LAT 20° 47' S LONG 140° 42' E



PROJECT AF 60-13
BISHOP CREEK A427(60)
LAT: 20° 47' S LONG: 140° 42' E



PROJECT AF 60-13
BISHOP CREEK A427(60)
LAT. 20° 47' S LONG. 140° 42' E

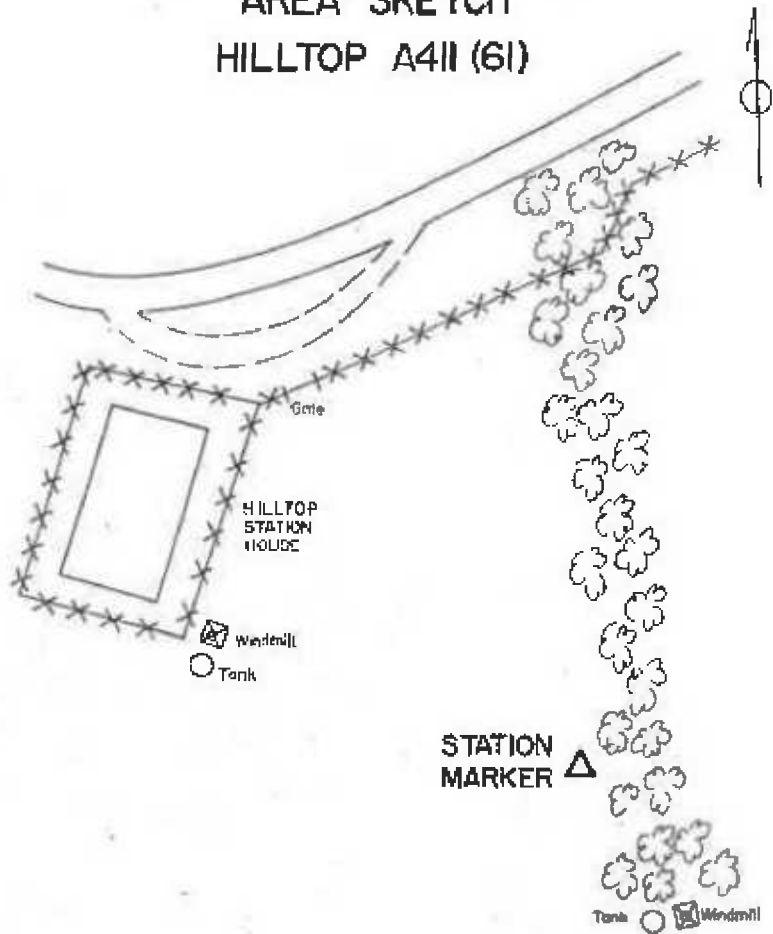


PROJECT AF 5043

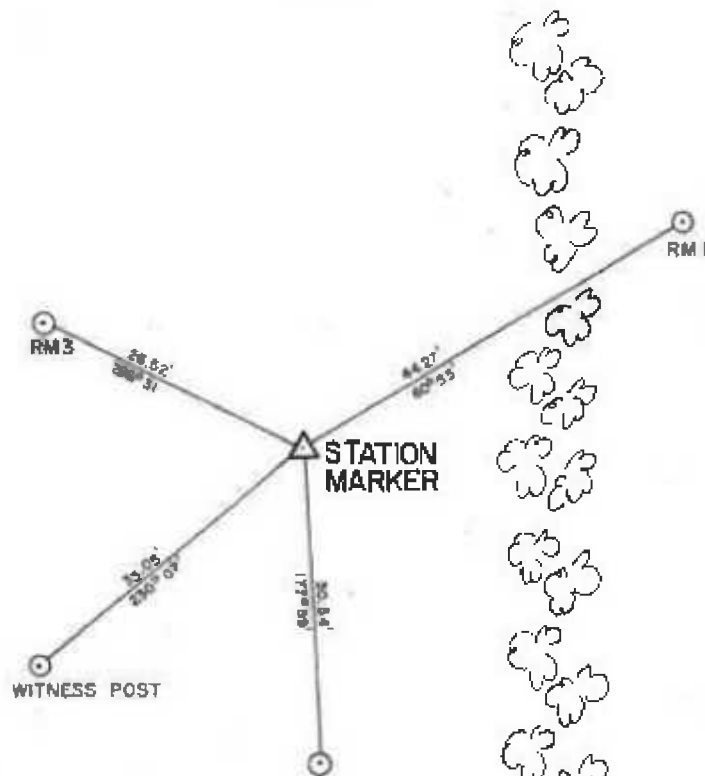
BISHOP CREEK A427(60)

LAT 20° 47' S LONG 140° 42' E

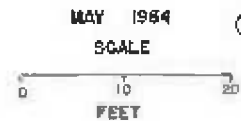
AREA SKETCH
HILLTOP A4II (6I)

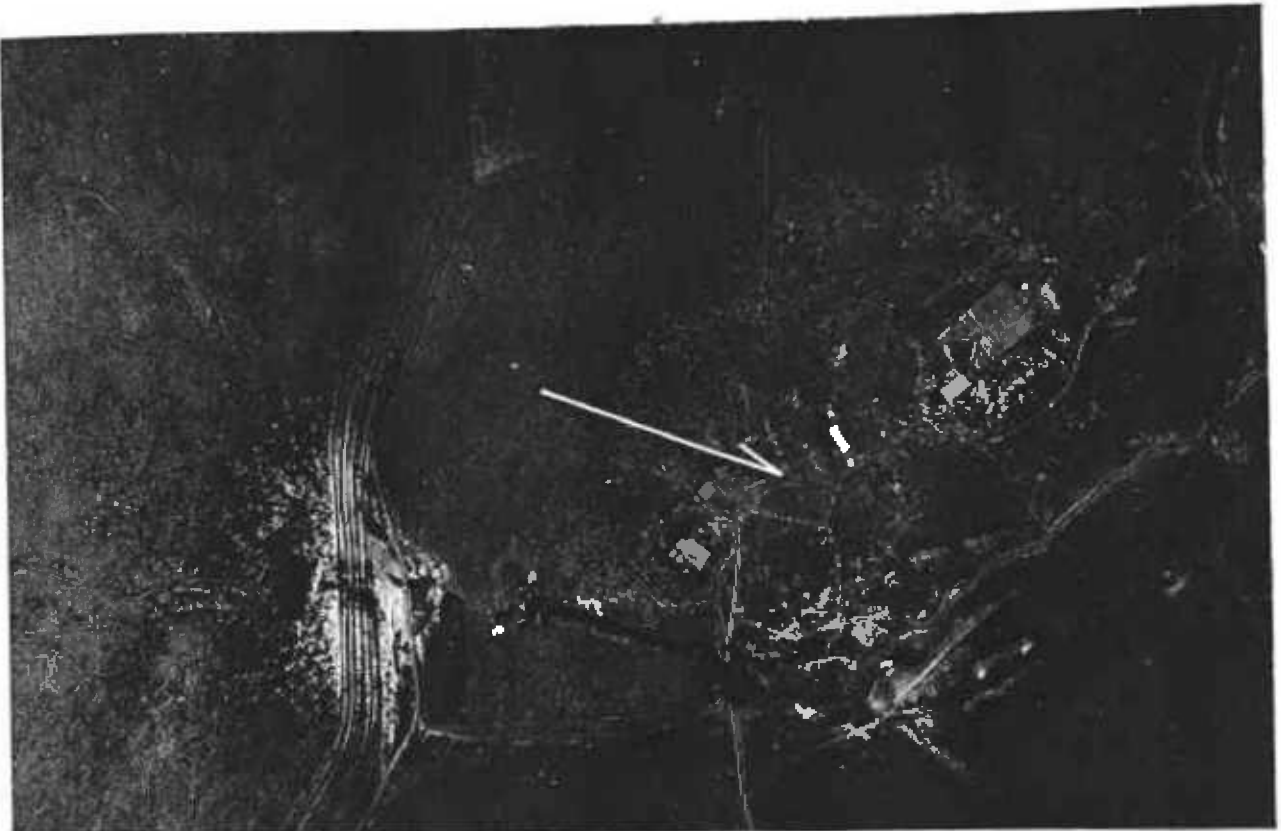


STATION SKETCH
HILLTOP A4II (6I)

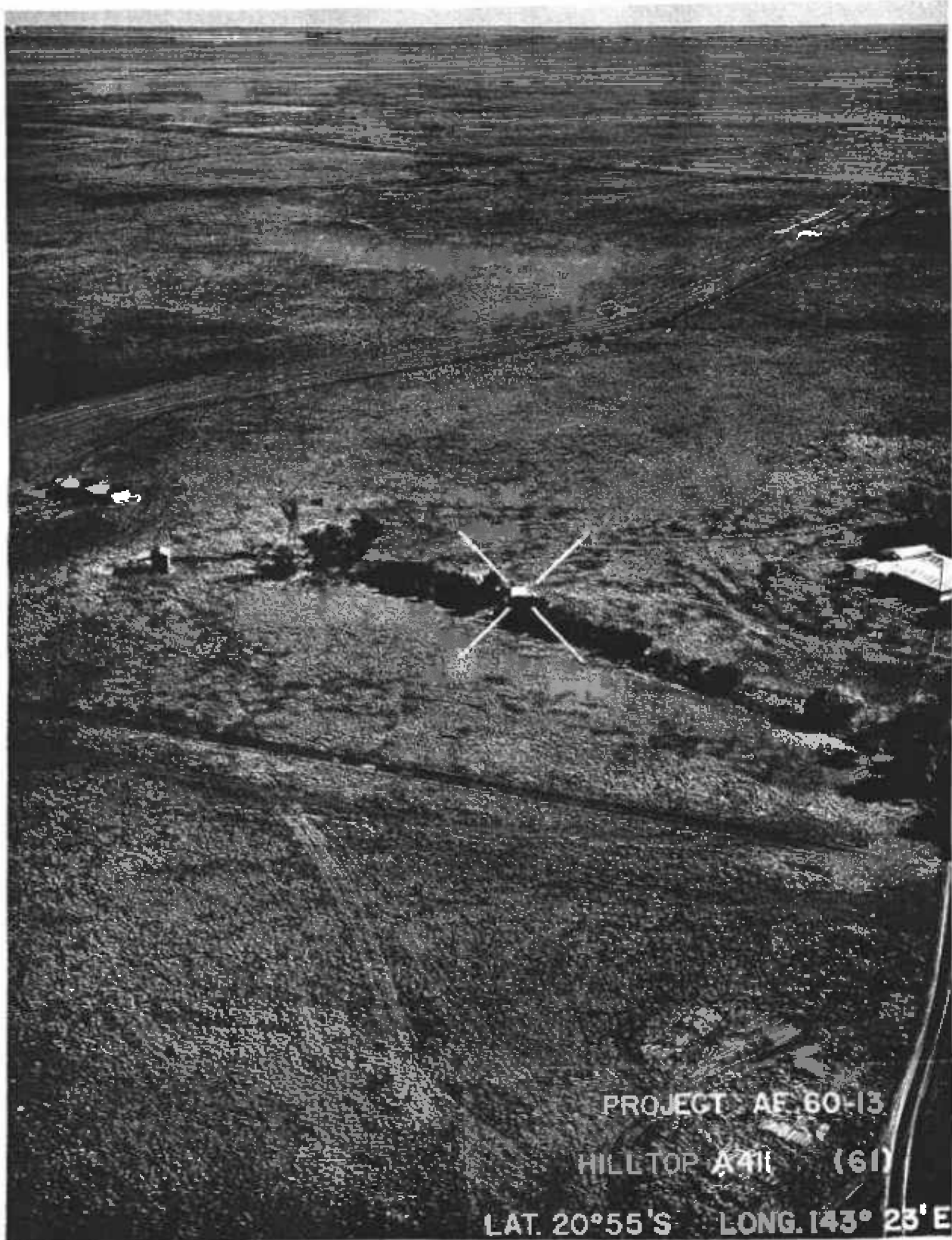


AZIMUTHS ARE
MAGNETIC FROM
NORTH





PROJECT AF 60-13
HILLTOP A411 (61)
LAT. 20°55'S LONG. 143° 23'E



PROJECT AF 60-13

HILLTOP A411 (61)

LAT. 20°55'S LONG. 143° 23' E



PROJECT AF 60-13
HILLTOP A4II (61)

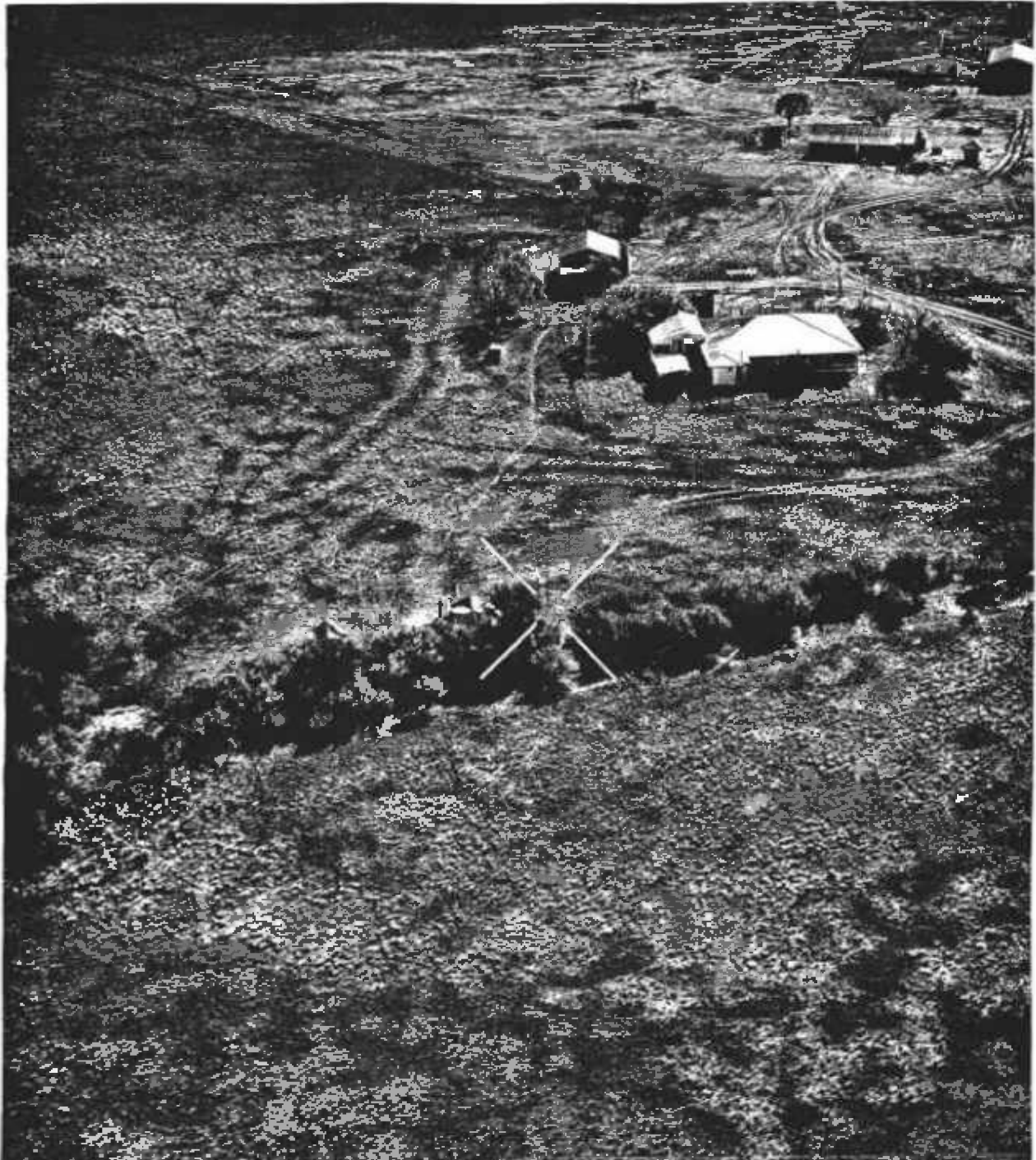
LAT. 20°55'S LONG. 143° 23' E



PROJECT AP 60-13

HILLTOP A II (64)

LAT. 20°55'S LONG. 143° 23' E



PROJECT AF 60-13

HILLTOP A411 (61)

LAT. 20°55'S LONG. 143° 23' E