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The Preliminary Study of Skylab Imagery

by

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Abstract

The Skylab is a space orbiting station for collecting earth data with several types of data collecting systems. Data obtained, such as imagery and magnetic tapes, are used in various disciplines, in the study of natural resources, medical sciences and other field of advance science. The data collection system is called EREP (Earth Resources Experiments Package) which can provide different kinds of data for education and experimentation.

Thailand is a country over which Skylab has collected data although only about 20% of the total area of the country was covered by Skylab. Moreover, most of the covered land areas were obscured by clouds. Nevertheless, the data could be used in the study of land use in some of the localities by selecting only the least cloud-covered imagery for study.

The results of the photo interpretation of test site areas together with ground truth survey was summarized on a map at 1:50,000 scale which provides enough detailed information. The map thus derived, when used together with the excisting topographical map, can provide us with more detailed, accurate and up-to-date data hitherto unavailable.

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The author is grateful to Mr. Suvit Vibulsresth, the Assistant Coordinator of the Thailand National Remote Sensing Program, who directed the study and made this report possible. She is also grateful to Mr. Joseph O. Morgan, the USGS Advisor to the Program, for his suggestions and supervision.

The author wishes to thank two colleagues for the ground survey team Mr. Kwanchai Lam-Ubol and Mr. Thawatchai Phantharakphong who assisted tremendously in the field; and also the staff of the TNRSP for helpful discussion.

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The Preliminary Study of Skylab Imagery

1. Introduction

Skylab, the first manned space station, was launched by the National Aeronautics and Space Administration on May 15, 1973. The objectives are to investigate and evaluate technical capabilities in space science and technology. Skylab orbits around the earth at an inclination of 50 degrees to the equator and at an altitude of 435 kilometers above the earth and completes one orbit in 93 minutes or 15.5 orbits in one day (Fig. 1 and 2).

Skylab orbital cluster, i.e. Command and Service Module, Multiple Docking Adapter, Airlock Module, Apollo Telescope Mount, and Orbital Workshop, is about 35.7 meters long with a mass of 90607 kilograms and 359.4 cubic meters in volume. The Orbital Workshop alone is 14.6 meters long with a diameter of 6.7 meters. Two solar arrays, 9 meters long by 8.5 meters wide, were extended from both sides to convert solar energy to electrical power for the cluster. Other 4 panels, 29.5 meters from one end to another in length, also supplied electrical power to operate this space station and experiments. (Fig. 3)

The instruments contained in Skylab, both controlled manually and automatically were designed for the study of the earth, the sun, stars, living creatures in orbital environment and the study of space technology. In operating the program on space flight, three crews of three men each were launched, one for each mission, to conduct the experiments in the Orbital workshop. The first crew was launched on May 25, 1973 and returned on June 22, 1973, for a duration of 28 days. On July 28, 1973, the second crew was launched and, after occupied the workshop for 59 days returned on September 25, 1973. Finally, the third crew was launched on November 16, 1973, remaining in orbital space for 84 days, then returned on February 8, 1974. The above missions were called Mission 2, 3, and 4.

After the completion of these missions, the Skylab Earth Resources Experimental Package (EREP) provided 35,704 frames of imagery and magnetic tape data 72,725 meters long. These data will be useful for earth resources investigation in applications to hydrology, oceanography, geology, forestry, agriculture, land use, geography and environment.

2. EREP Data Collection System

The Skylab Earth Resources Experimental Package (EREP) mounted inside and outside the Skylab, consisted of different sensors for specific spectral ranges. These instruments and sensors were aimed at observing and collecting earth information in many disciplines.

S-190 A Multispectral Photographic Camera, is an array of six 70 mm cameras with different film and filter combinations, definitely set so that they simultaneously take photographs of the same features covering an area of 160 kilometers by 160 kilometers (Fig. 4,5).

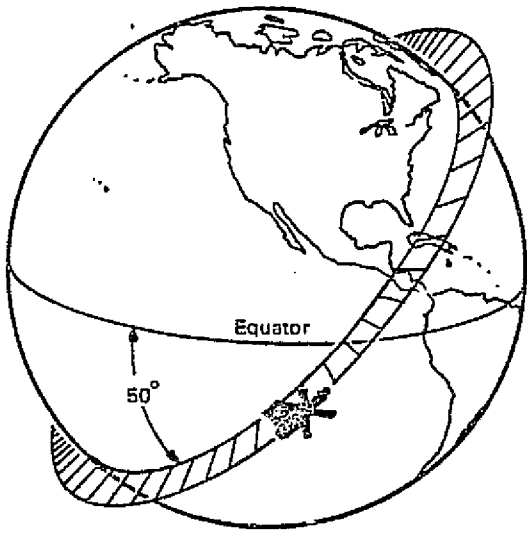


Figure 1 Skylab Flight Path and Ground Track

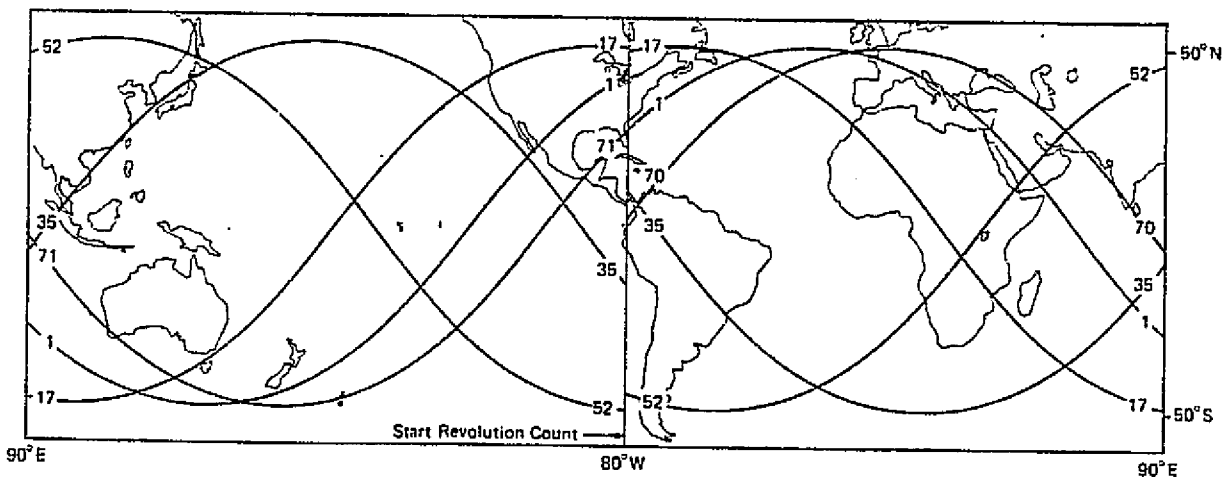


Figure 2 Skylab Ground Tracks

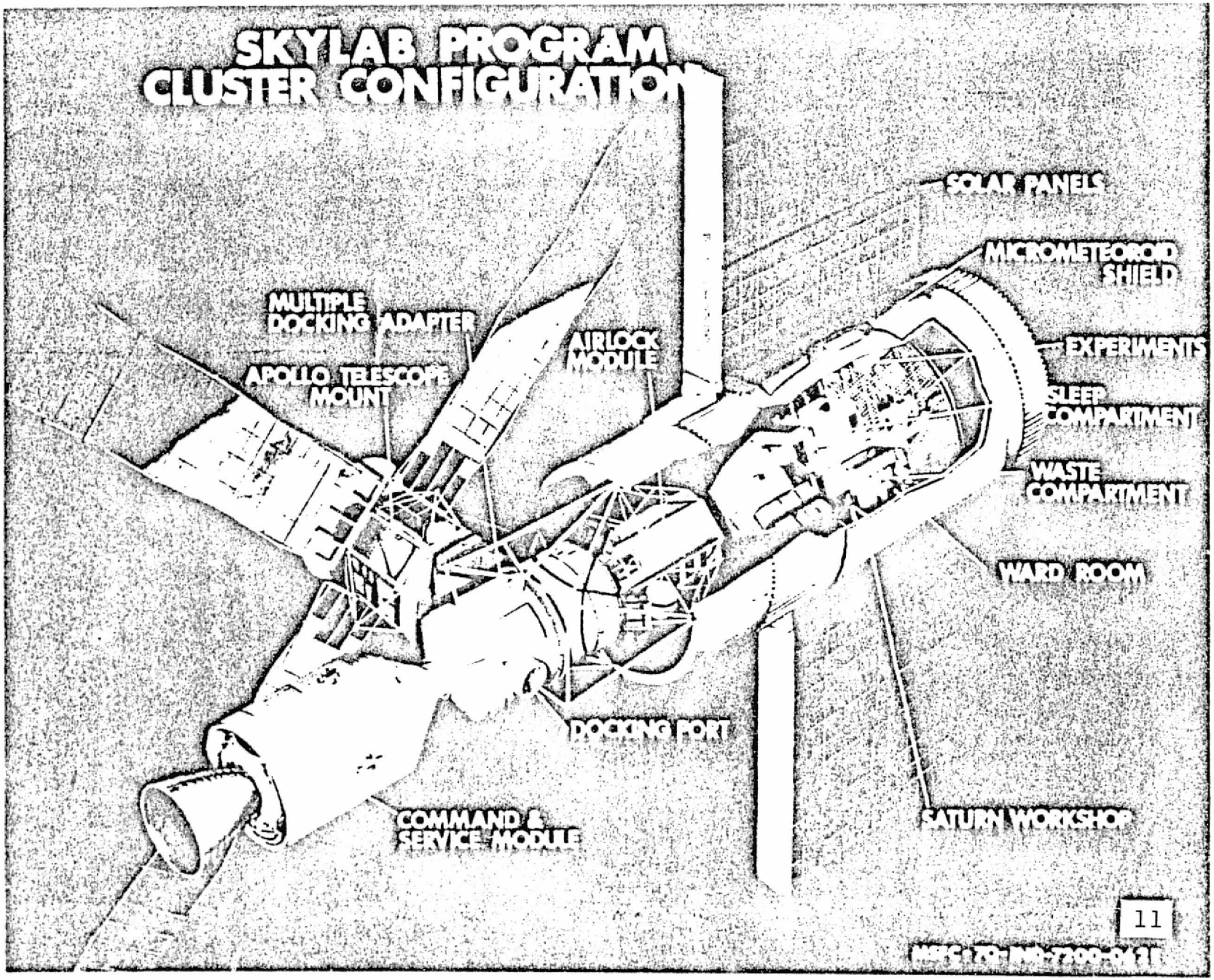
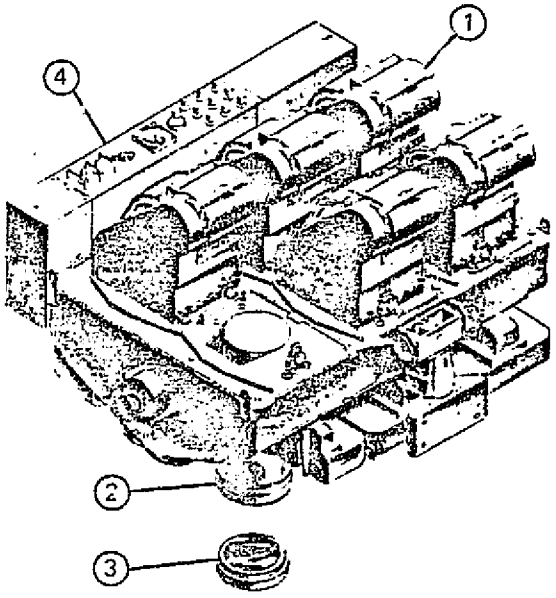


Figure 3 Skylab Configuration



1. Film Magazine
2. Lens
3. Filter
4. Camera Control Panel

Figure 4 Multispectral Photographic Camera

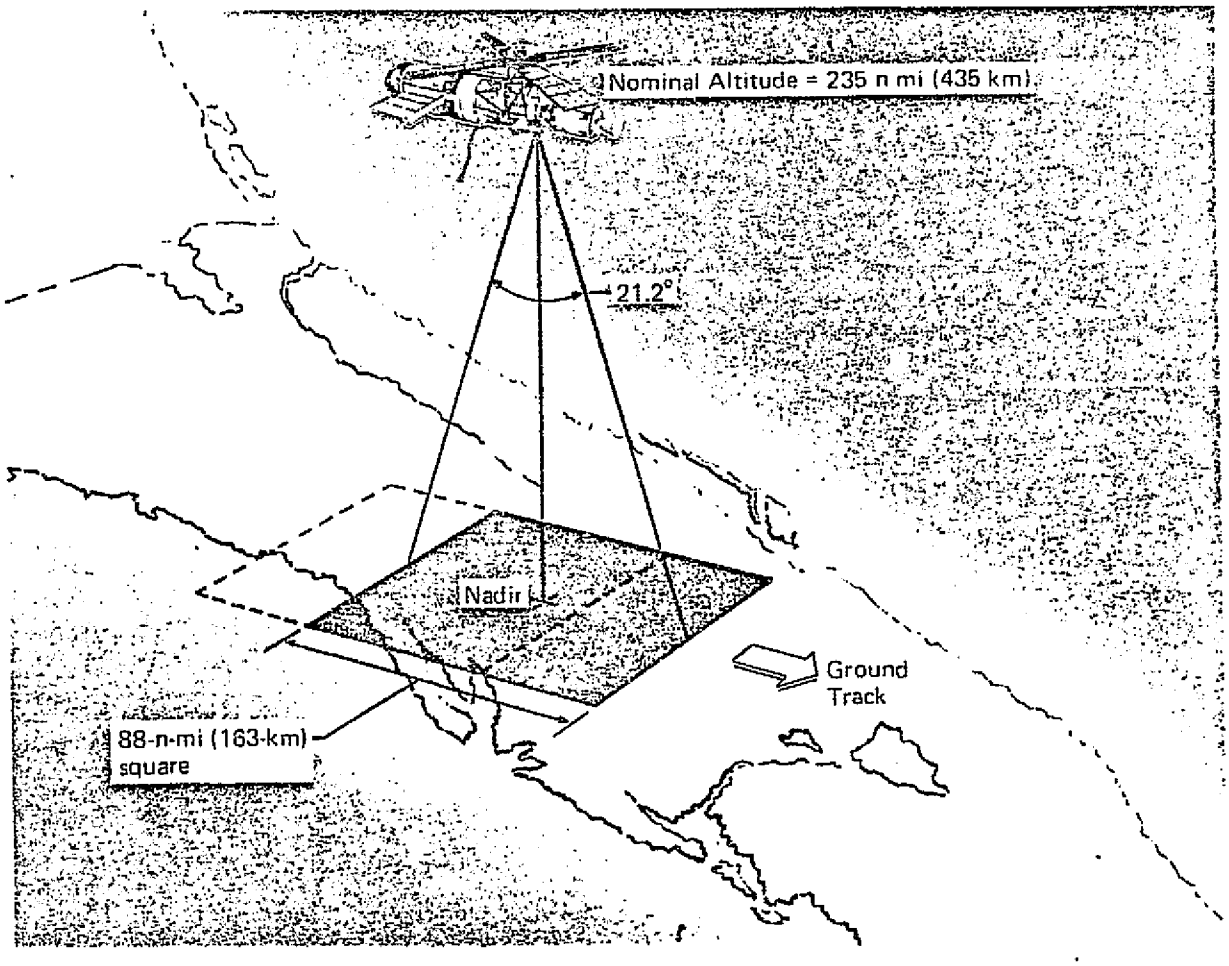


Figure 5 The Ground Coverage of the Multispectral Camera

S-190B is the earth terrain camera, using 5 inch film (Fig 6). One ground coverage taken is a square of 109 kilometers on each side (Fig. 7)

S-191 or infrared spectrometer consists of a cassegrain optical system to generate a ground image, a filter wheel spectrometer for image intensity measuring of different spectral bands (0.4 micrometers to 2.5 micrometers and 6.6 micrometers to 16.0 micrometers), and a viewfinder system for the astronaut to view and photograph the same ground coverage as the spectrometer. (Fig. 8 and 9)

S-192 Multispectral Scanner which received radiation from the earth in 13 separated spectral bands from 0.4 micrometers to 12.5 micrometers. The conical line scan of the multispectral scanner scaned the ground with 74.08 kilometer swath width, providing ground resolution of 79 meters. (Fig. 10 and 11)

S-193 consists of Microwave Radiometer, Scatterometer and Altimeter (Fig. 12). The radiometer and scatterometer measured radar scattering and microwave emissivity in four scanning modes (Fig. 13)

S-194, L-band Radiometer (Fig. 14), used a fixed antenna to receive the energy in microwave region and recorded on magnetic tape (Fig. 15).

3. Objectives

There are only two ground tracks of Skylab over Thailand; EREP Pass 13 was over Chiangmai Lampang, Pitsanulok and terminated over Nakhon Ratchasima (Skylab Mission 3-SL3) and EREP Pass 70 was over Phetburi to the Gulf of Thailand (Skylab Mission 4SL4) (Fig. 16).

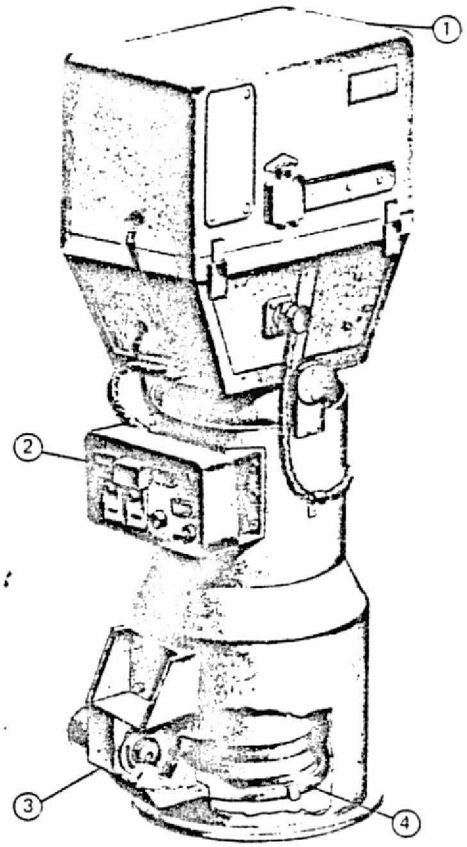
The EREP data of Thailand provided by NASA, as shown in Table 3 and 4, encouraged us in investigation of land use and urbanization advantageously.

The photographs obtained from the earth terrain camera, provides a ground resolution of 21 meters, which is very high in comparison with LANDSAT imagery having a square ground resolution of 80 meters. In view of the fact that Skylab data over Thailand were limited and mostly covered with clouds, only three test sites, Chiangmai, Nakhon Ratchasima and Phetburi were selected for resource study in land use and urbanization.

4. Instruments and Material

The instruments and material used are as follows:

1. The earth terrain camera (S-190B) photographs, which provide a ground resolution of about 21 meters. Type of data used is 9 inch color transparencies with a scale of 1:475,000 as indicated below.



1. Film Magazine Assembly
2. Camera Control Panel
3. Forward Motion Compensator
4. Lens Assembly

Figure 6 Earth Terrain Camera

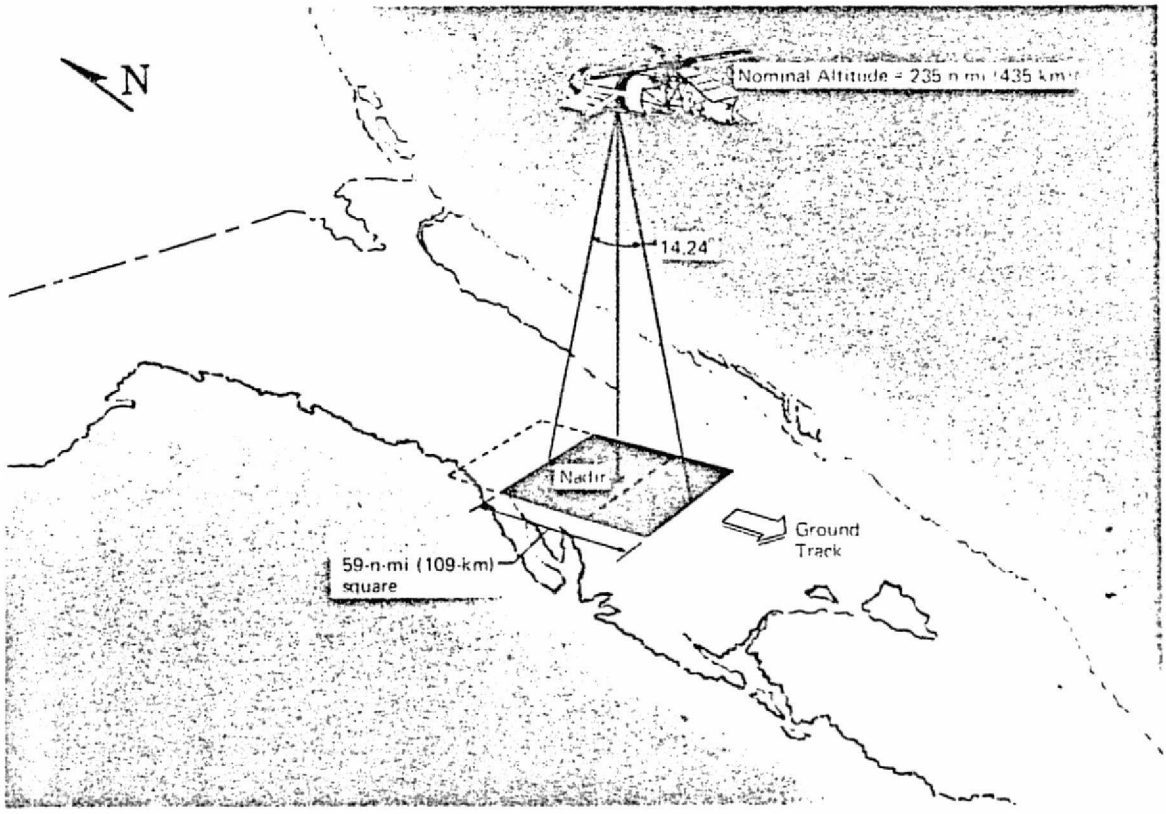


Figure 7 The Ground Coverage of Earth Terrain Camera

Table 1 Multispectral Camera Station Characteristics and Film Rolls Used

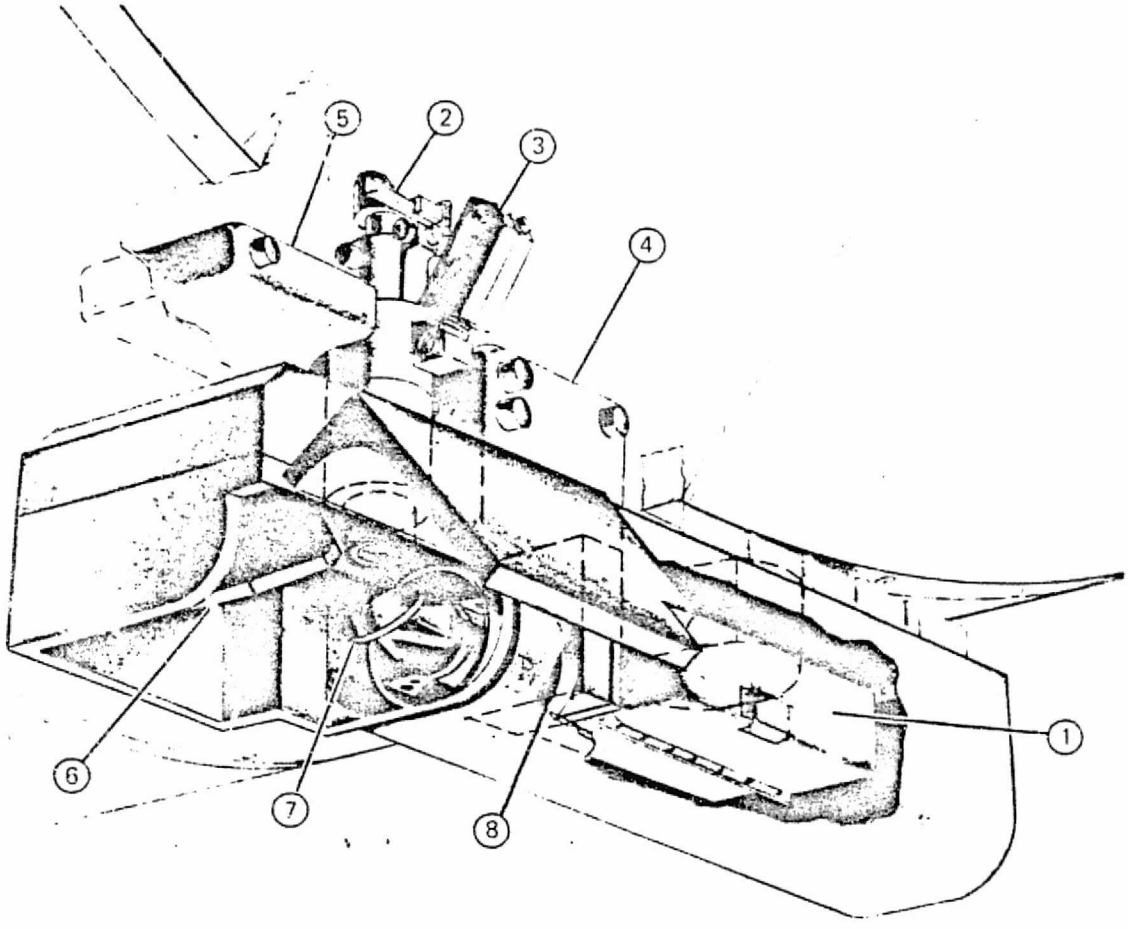
Sta	Filter	Filter Bandpass, micrometer	Film Type*	Estimated Ground Resolution††, feet (meters)	Mission & Roll No.		
					SL-2†	SL-3	SL-4
1	CC	0.7 – 0.8	EK 2424 (B&W infrared)	240 – 260 (73 – 79)	01‡,07,13	19,25,31, 37,43	49§,55,61, 67,73, A1,1B
2	DD	0.8 – 0.9	EK 2424 (B&W infrared)	240 – 260 (73 – 79)	02,08,14	20,26,32, 38,44	50§,56,62, 68,74, A2,2B
3	EE	0.5 – 0.88	EK 2443 (color infrared)	240 – 260 (73 – 79)	03,09,15	21,27,33, 39,45	51§,57,63, 69,75, A3,3B
4	FF	0.4 – 0.7	SO-356 (hi-resolution color)	130 – 150 (40 – 46)	04,10,16	22,28,34, 40,46	52§,58,64,70 76,A4,4B
5	BB	0.6 – 0.7	SO-022 (PANATOMIC-X B&W)	100 – 125 (30 – 38)	05,11,17	23,29,35, 41,47	53§,59,65, 71,77,A5,5B
6	AA	0.5 – 0.6	SO-022 (PANATOMIC-X B&W)	130 – 150 (40 – 46)	06,12,18	24,30,36, 42,48	54§,60,66, 72,78,A6,6B

* Eastman Kodak Company
† SL-1 was the launch of Skylab without crew.
†† At low contrast
‡ Note that all roll numbers are 2-digit numbers. Single-digit numbers were used in other cameras.
§ Without filter

Table 2 Earth Terrain Camera Film Characteristics and Rolls Used

Film Type*	Wratten Filter	Filter Bandpass, micrometer	Estimated Ground Resolution††, feet (meters)	Mission & Roll No.		
				SL-2	SL-3	SL-4
SO-242 (hi-resolution color)	none	0.4 – 0.7	70 (21)	81	83,84, 86,88	90,91, 92,94
EK 3414 (hi-definition B&W)	12†	0.5 – 0.7	55 (17)	82	85	89
EK 3443 (SL-2 & SL-3) (infrared color)	12	0.5 – 0.88	100 (30)	–	87	–
SO-131 (SL-4) (hi-resolution infrared color)	12	0.5 – 0.88	75 (23)	–	–	93

* Eastman Kodak Company
† "Minus blue" filter
†† at low contrast



1. Infrared Spectrometer
2. Telescope
3. Data Acquisition Camera
4. Spectrometer Electronics
5. Viewfinder and Tracking System Control Panel
6. Gimbaled Mirror
7. Pickoff Mirror
8. Cassegrainian Optics

Figure 8 Infrared Spectrometer

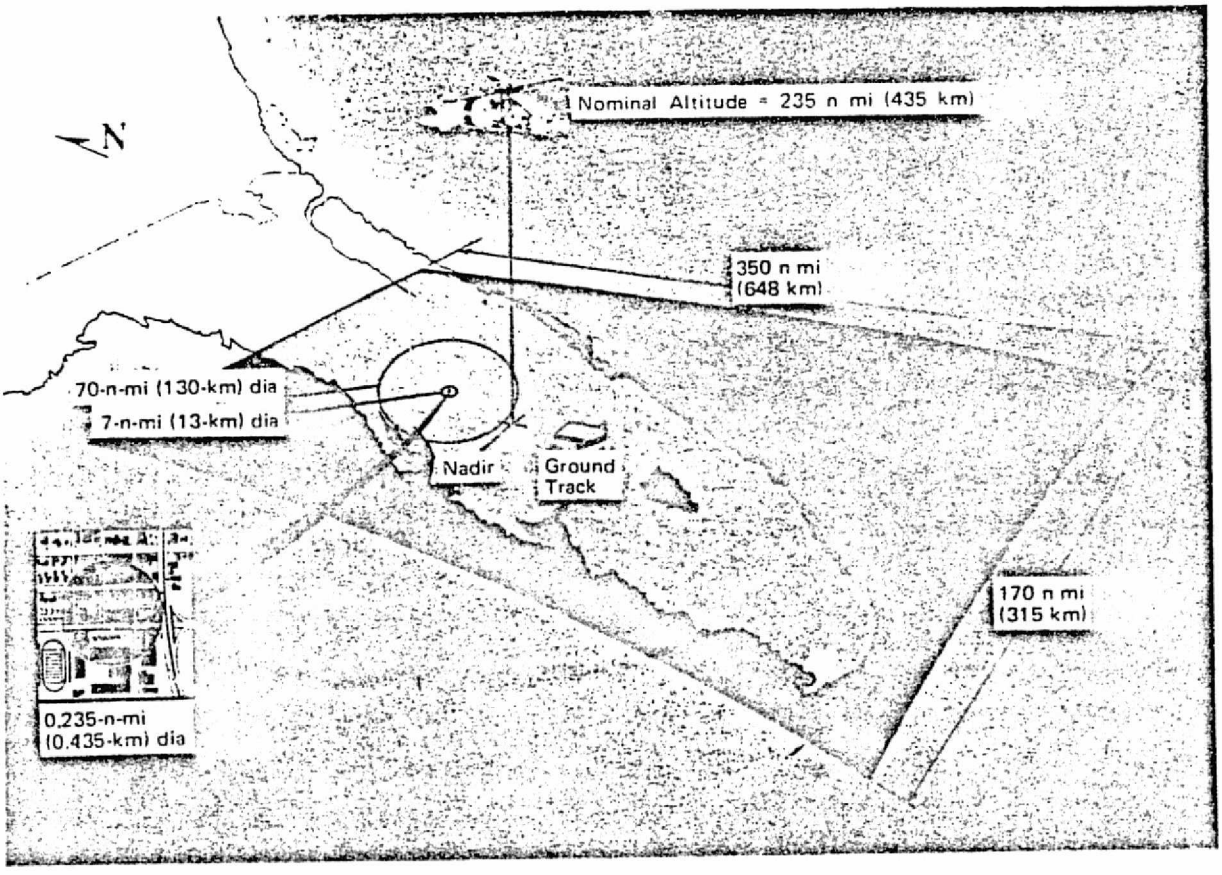
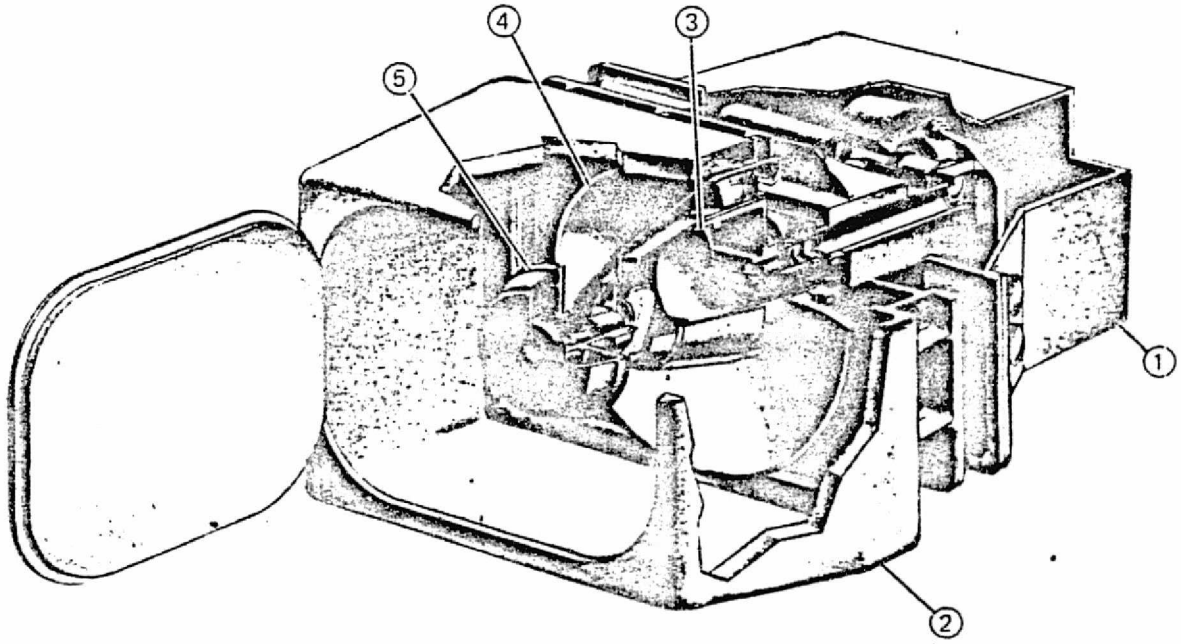


Figure 9 The Ground Coverage of the Infrared Spectrometer



1. Internal Scanner Assembly
2. External Scanner Assembly
3. Spherical Primary Mirror
4. Reflective Collector Mirror
5. Secondary Mirror

Figure 10 Multispectral Scanner

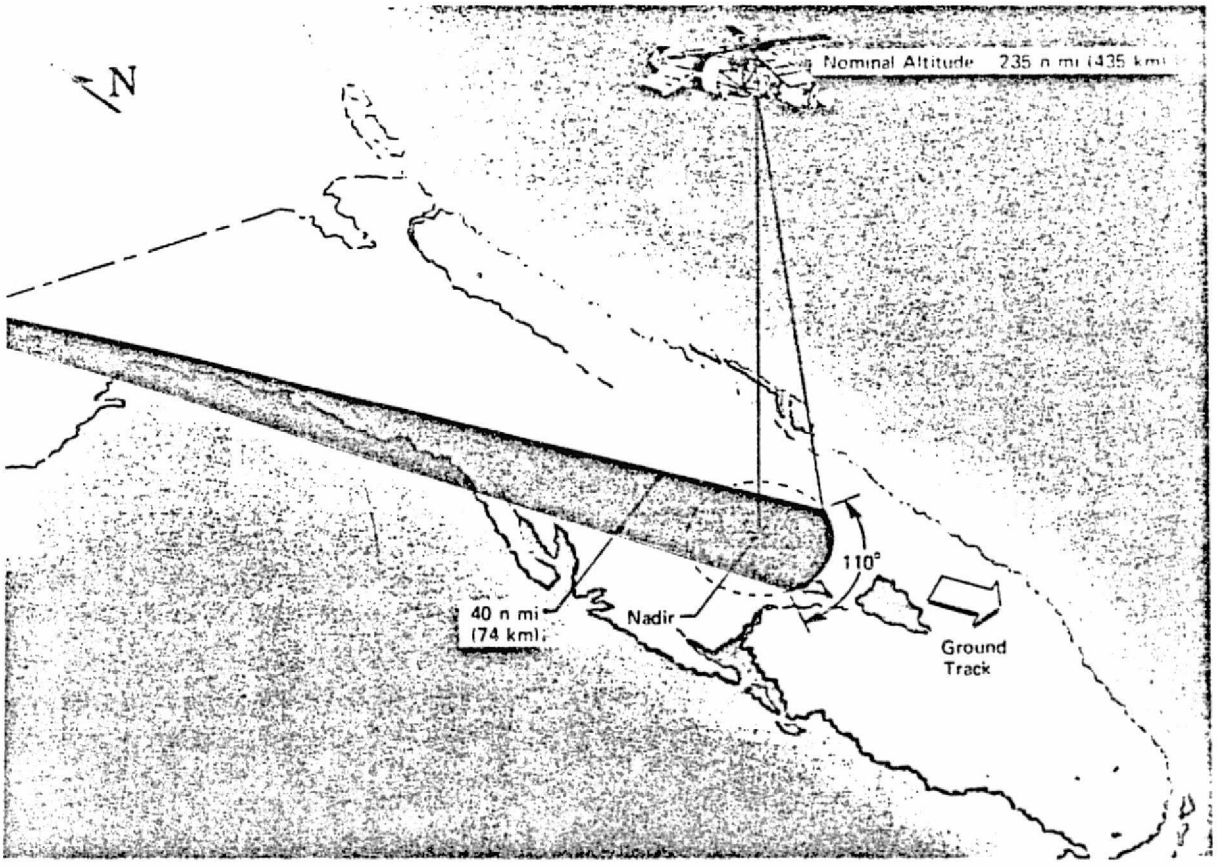
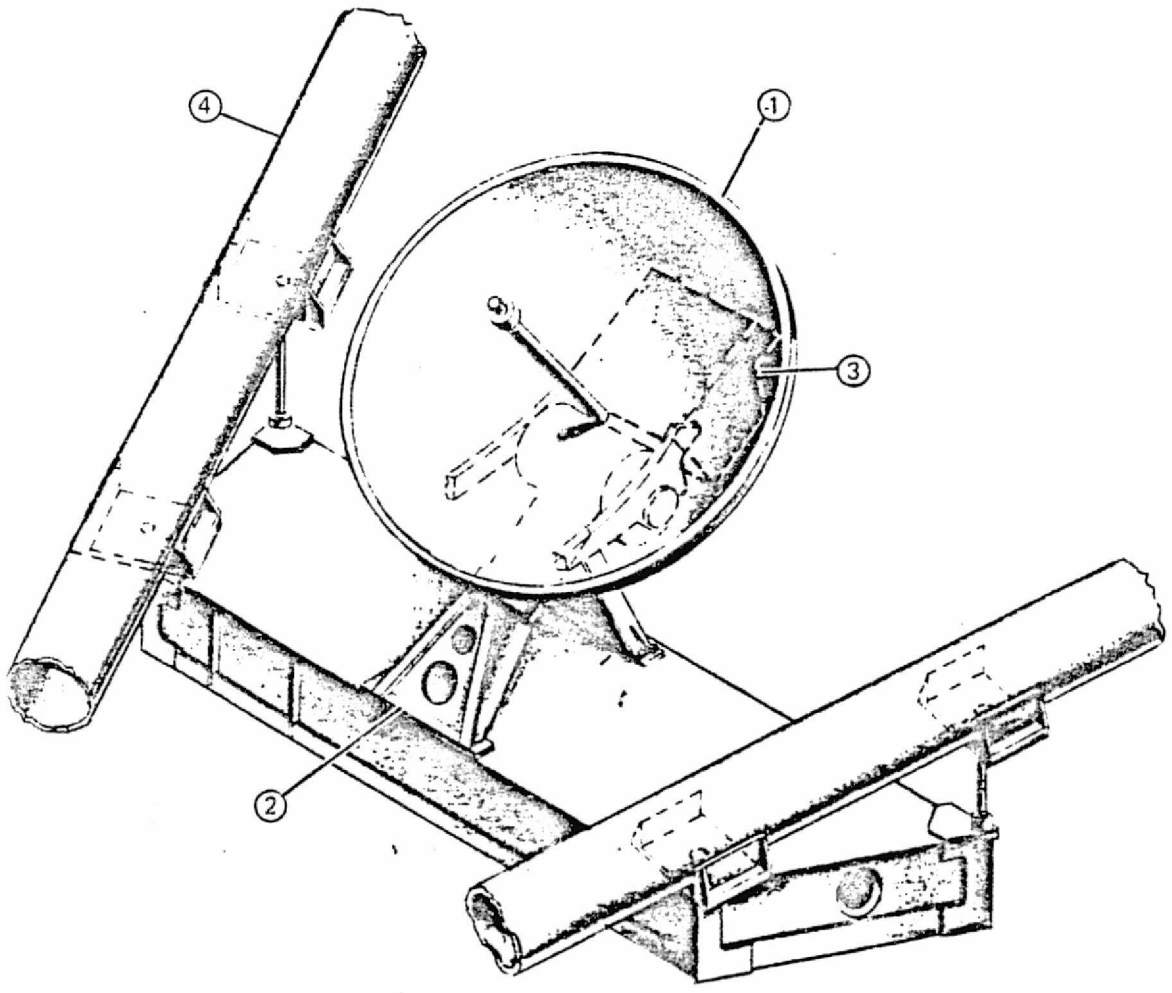


Figure 11 The Ground Coverage of the Multi-Spectral Scanner



1. Parabolic Antenna
2. Electronics Assembly
3. Gimbal Assembly
4. Apollo Telescope Mount Deployment Assembly Truss

Figure 12 Microwave Radiometer Scatterometer and Altimeter

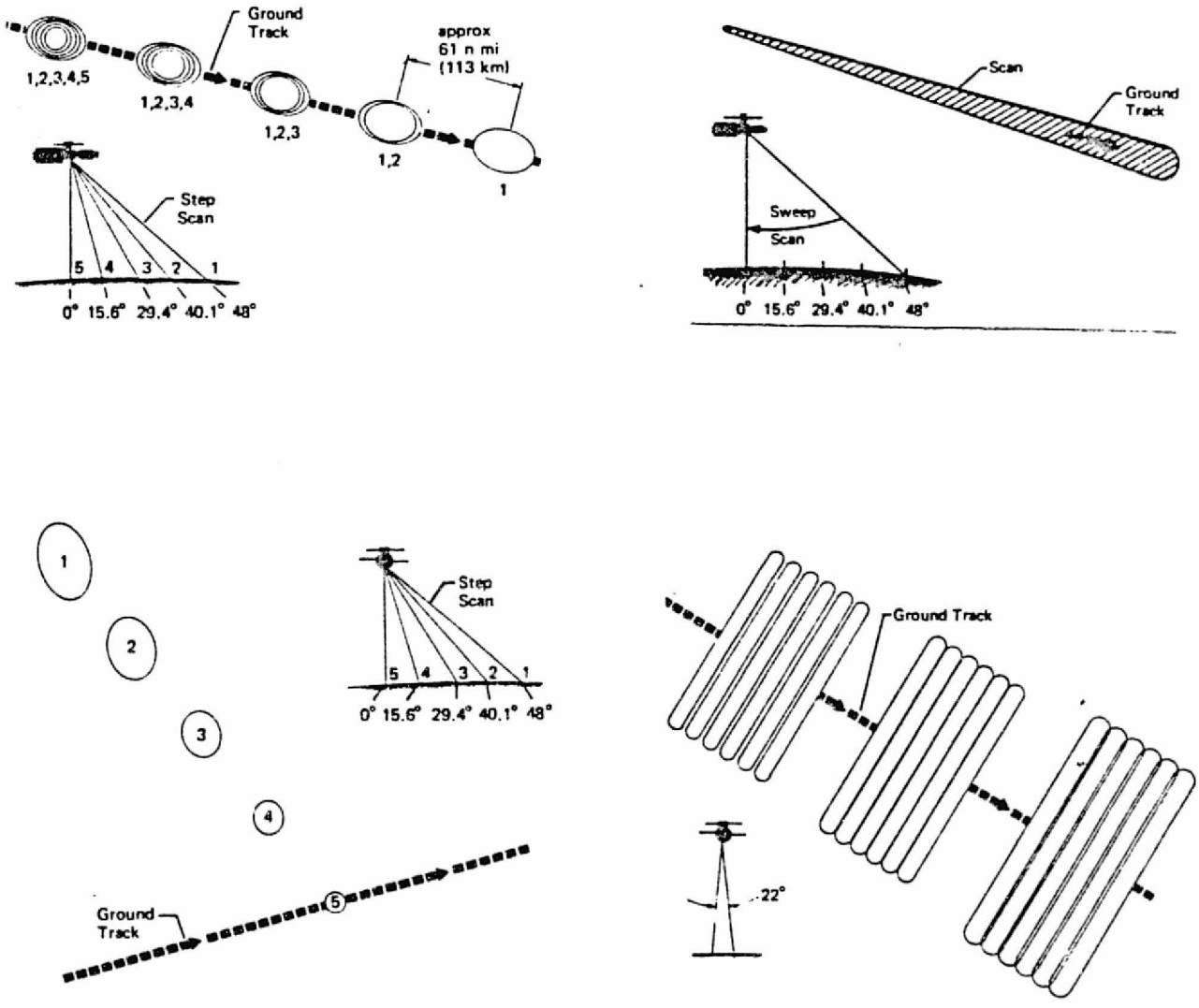
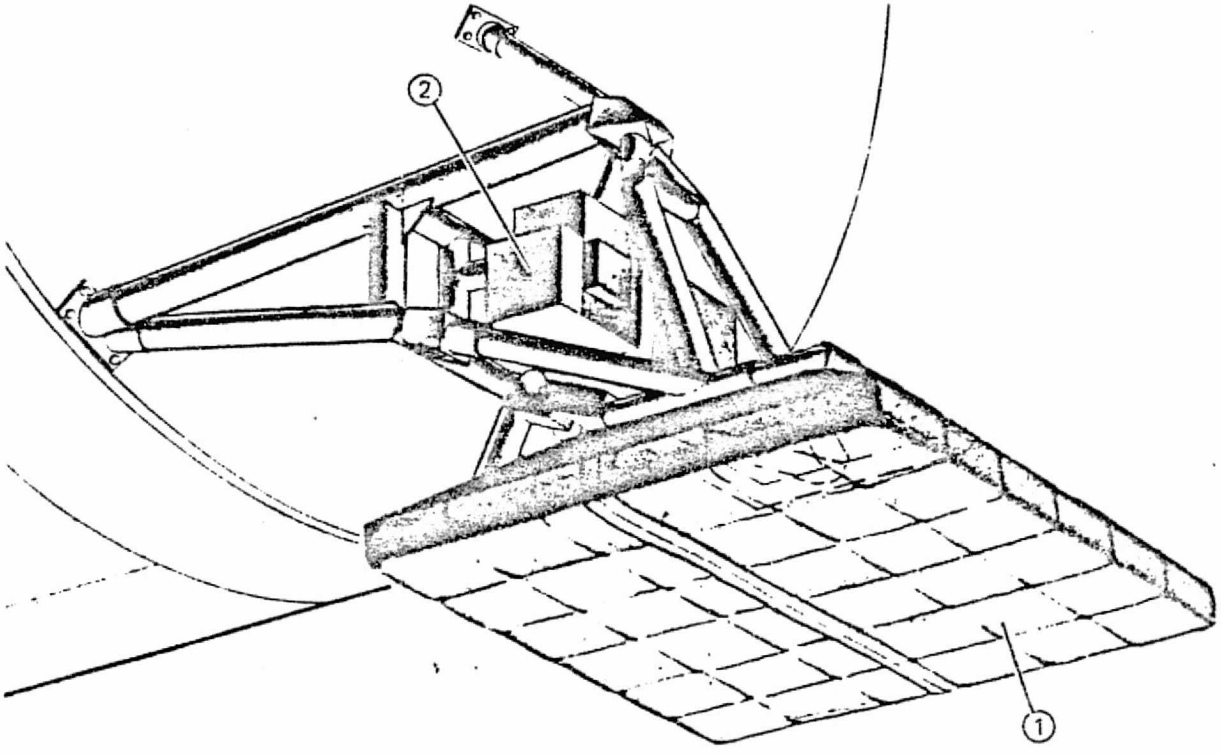


Figure 13 The Scanning Modes of Microwave Radiometer, Scatterometer and Altimeter



1. Antenna
2. Electronics Assembly

Figure 14 L-Band Radiometer

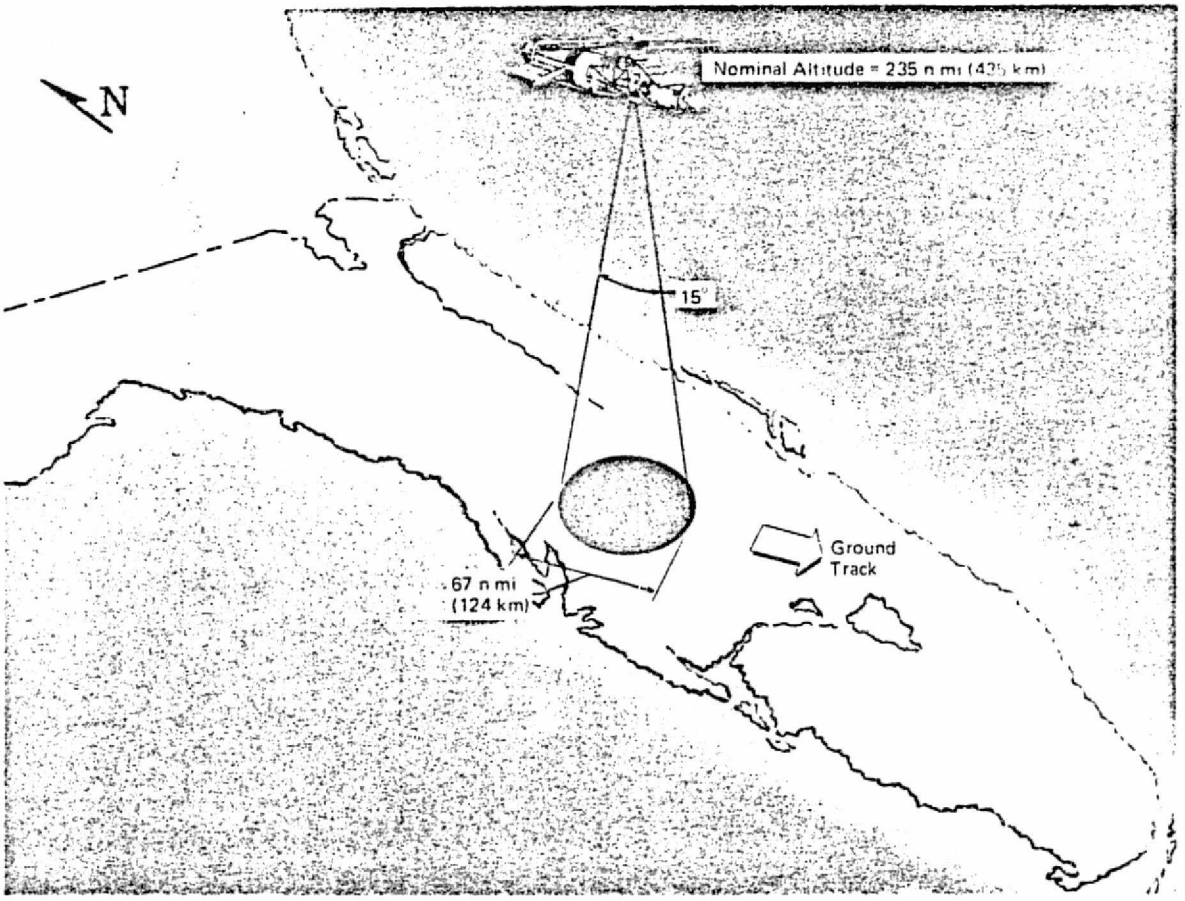


Figure 15 The Ground Coverage of the L-Band Radiometer

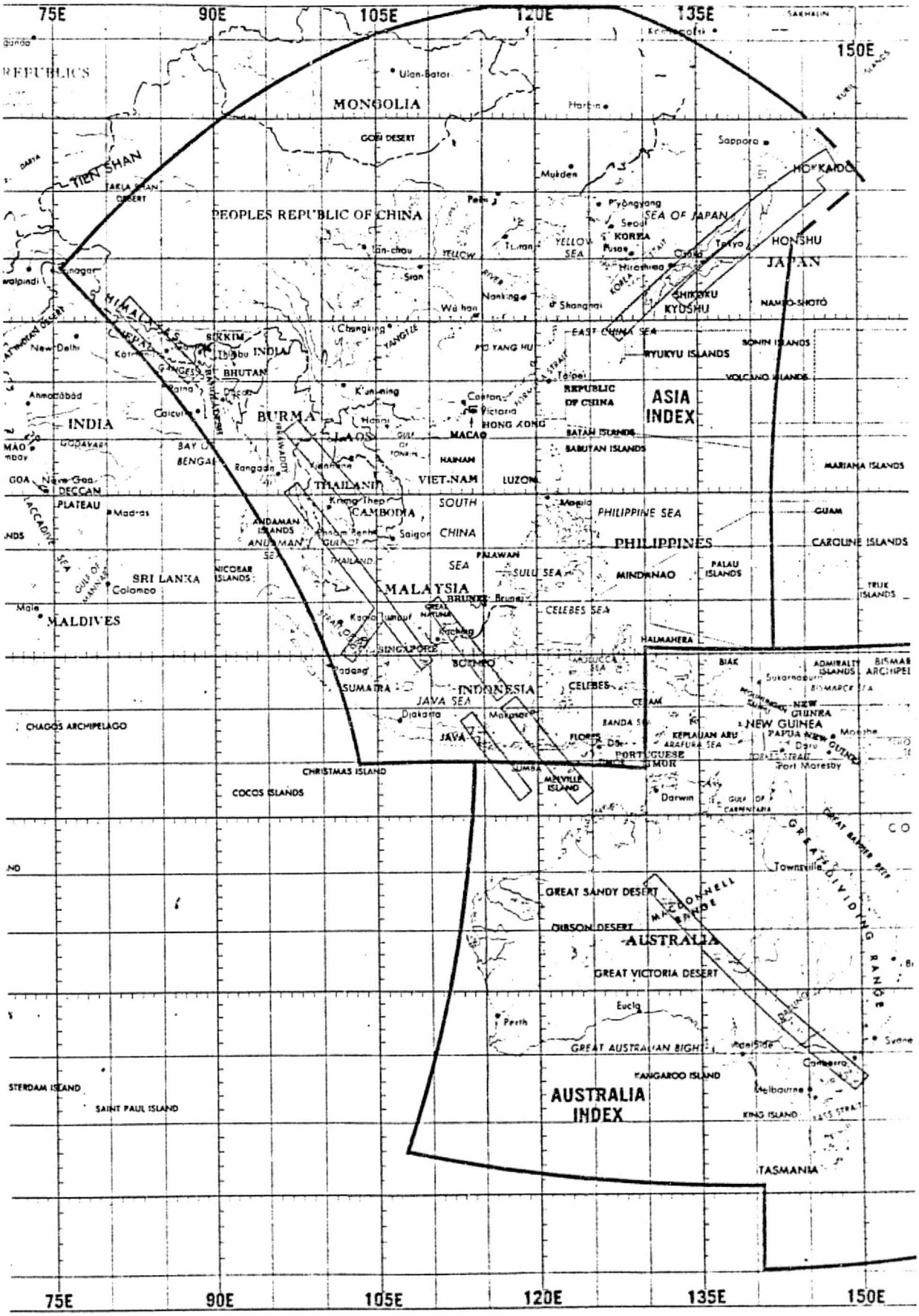


Figure 16 Skylab Ground Tracks of Thailand

Sites	Skylab Mission	Acquisition Date	Film Roll No.	Frame No.
Changwat Chiangmai	SL-3	August 12, 1973	84	094
Changwat Nakhon-Ratchasima	SL-3	August 12, 1973	84	105
Changwat Phetburi	SL-4	December 9, 1973	91	208

2. Maps: series L7017, scale 1:50,000, sheet no 4746-I,II, 4846-III,IV, 4934-I, 4935-II, 5438-IV and 5439-III.

3. Multispectral Viewer/Projector with projection on to a screen.

4. 35 mm field cameras.

5. Procedures

5.1 Photo interpretation

The 9 inch color transparencies were blown up from a scale of 1:475,000 to 1:50,000 onto a screen by using the multispectral viewer and 1:50,000 maps as base maps. All the visible, such as urban areas, roads, tracks, water ways and agricultural lands, etc. were delineated on the overlay sheets and maps showing interpretation results were prepared.

After comparing the overlays with 1:50,000 maps, sampling plots of either coincident ones or different ones were located on the overlays for ground checking.

5.2 Ground Observation

Almost all of the sampling plots of Chiangmai, Phetburi and Nakhon-Ratchasima test sites were ground-checked in the field by using 1:50,000 maps as reference. Field photography was made with 35 mm cameras and ground information was recorded simultaneously. Consequently, the interpretation maps of the three test sites were verified. Work diagram is shown in Fig. 17.

6. Conclusions

The high resolution color photographs of Skylab earth terrain camera show general features as listed below.

6.1 Chiangmai and Nakhon Ratchasima

The photographs were taken by Skylab mission 3, film roll no. 84. (Fig. 18, 19)

1. Vegetation areas appear in green, dense and scrub forest can be distinguished by dark and light shades.

2. Dark green is surface water.

3. Rivers, canals and irrigation canals appear in white.

4. In addition to item 3, white also signifies roads, tracks, railway and built-up area, such as airport.

5. Urban areas are in light green with white dispersive dots. Dark green denotes riverside villages.

6. Agricultural land and bare ground are shown in light brown.

6.2 Phetburi

Skylab mission 4, film roll no. 91 displays the following characteristics: (Fig. 20).

1. Forest can be differentated by light blue to dark blue shades.

2. Reservoirs, rivers and canals are in dark blue.

3. Roads, tracks, railways and irrigation canals appear in white color.

4. Constructions and urban areas are shown in light blue with white dispersive dots.

5. Agricultural areas are specified by light brownish purple; the bare soil prepared for planting is in white.

Evidently, as a result of comparison of the interpretation maps and base maps, most of the built up areas constructed sometime ago (over 6 years) coincide with the maps except those which were recently built and not located on the maps. Nevertheless some small tracks of less than 3 meters wide, small villages and built-up areas cannot be identified from Skylab photographs. Table 5 to 7 are the results in details.

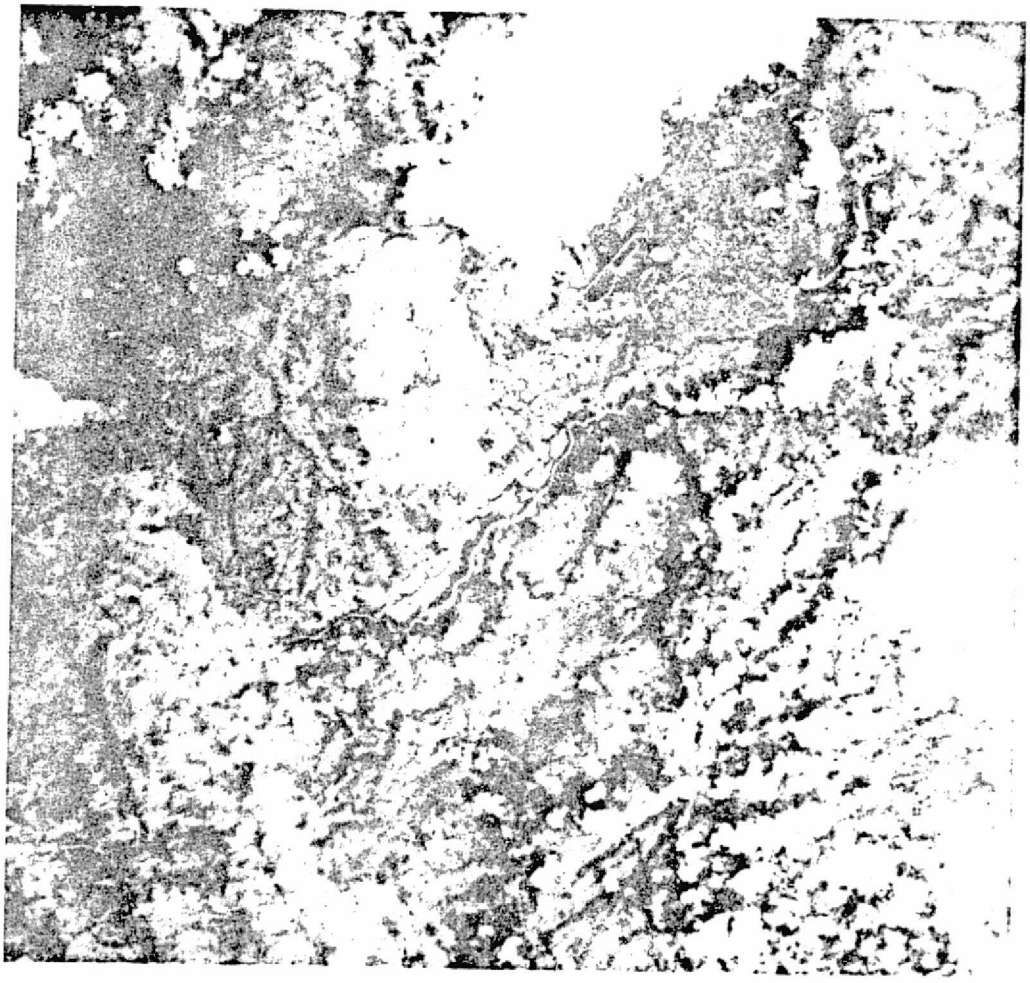


Figure 18 Skylab Photograph of Chiangmai

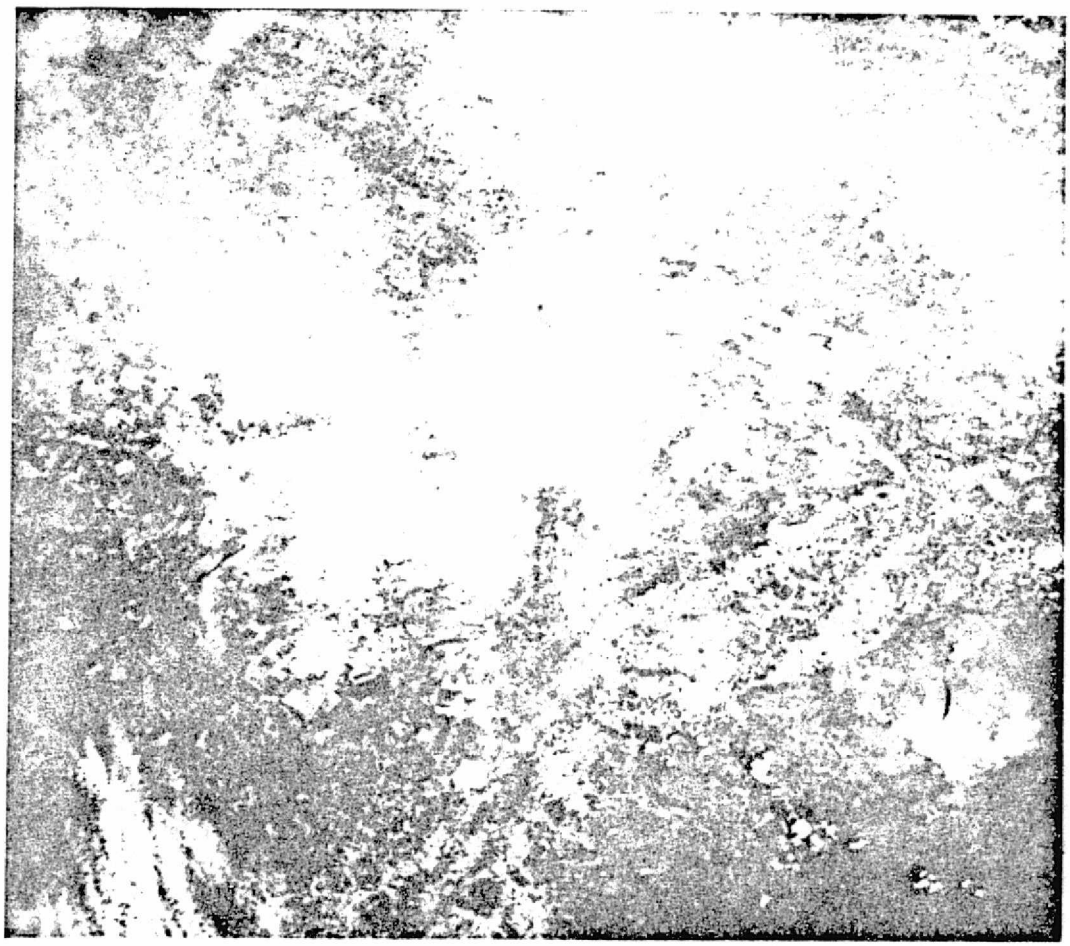


Figure 19 Skylab Photograph of Nakhon Ratchasima

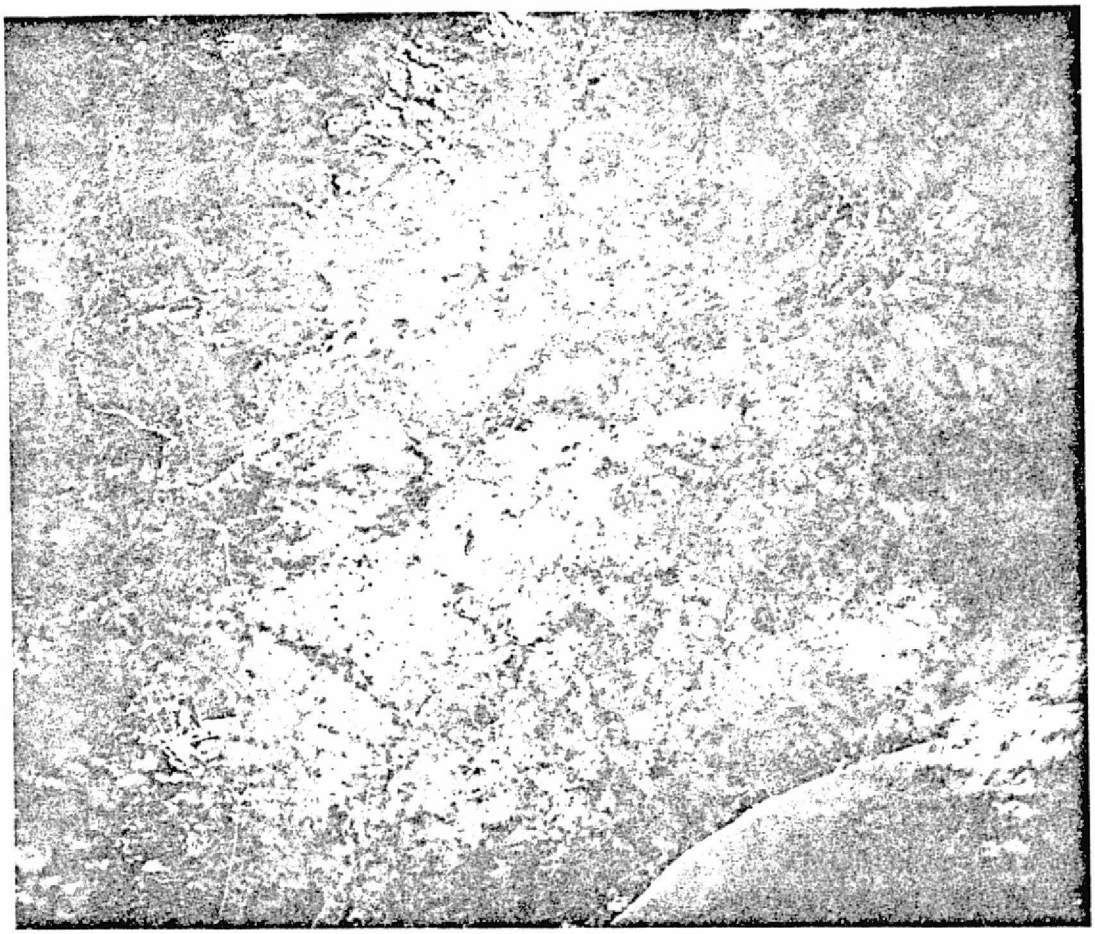


Figure 20 Skylab Photograph of Phetburi

Table 5 Comparison of Ground Information of Chiangmai Test Site

Sampling plot no.	Base map	Interpretation map	Ground truth
1	Crossroad	Crossroad	Crossroad
2	Nonexistent	Built-up area	Hospital
3	Nonexistent	Built-up area	Campus
4	School	Built-up area	School
5	School	Built-up area	School
6	Airport	Airport	Airport
7	Nonexistent	Built-up area	Housing area
8	Nonexistent	Built-up area	Buildings and open land
9	Rice field	Agricultural area	Old paddy field
10,11	Villages	Agricultural area	Villages and agricultural area
12	Rice field	Agricultural area	Rice field
13	Nonexistent	Agricultural area	Rice field, scrub and orchad
14,15	Villages	Agricultural area	Villages and agricultural area
16	Village and rice field	Agricultural area	Village and rice field
17	Rice field	Agricultural area	Rice field
18	Village	Agricultural area	Village and agricultural area
19	Nonexistent	Built-up area	Urban area
20	Canal	Track/Canal	Track alongside of canal
21	Rice field	Agricultural area	Rice field and orchard
22	Railroad	Crossroad	Track across railroad

Table 6 Comparison of Ground Information of Nakhon Ratchasima Test Site

Sampling plot no.	Base map	Interpretation map	Ground truth
1,2	Scrub forest	Agricultural area	Cassava
3	Reservoir	Vegetation	Reservoir covered with vegetation
4	- Deleted because the area was unaccessible		
5,6,7 8,9	Urban area	Urban area	Urban area
10	Rice field	Agricultural area	Rice field
11	Rice field and scrub forest	Agricultural area	Cassava and scrub
12	Rice field	Agricultural area	Rice field
13	Reservoir	Agricultural area	Rice field in flooded low land
14	Rice field	Agricultural area	Rice field
15	- Deleted because the area was unaccessible		
16	Scrub forest	Agricultural area	Rice field and scrub forest
17,18,19 20,21,22, 23,24,25, 26,27,28	Scrub forest	Agricultural area	Cassava
29	Scrub forest	Agricultural area	Cassava
30	- Deleted because the area was unaccessible		
31	Grating ground track	Agricultural area	Cassava
32,33,34	- Deleted because the area was unaccessible		
35	Track	Track/Canal	Track
36	Nonexistent	Track/Canal	Track alongside of canal
37	Scrub forest	Agricultural area	Cassava
38	Scrub forest	Agricultural area	Open land
39	Nonexistent	Bare ground	Dry dish
40	Nonexistent	Track/Canal	Track
41,42	Scrub forest	Agricultural area	Cassava
43	Nonexistent	Grating ground track	Scrub with grating ground track
44	Field	Agricultural area	Cassava
45,46	Scrub forest	Agricultural area	Cassava
47	Village	Agricultural area	Rice field and orchard around riverside village
48	Scrub forest	Agricultural area	Bare ground prepared for planting

Table 7 Comparison of Ground Information of Phetburi Test Site

Sampling plot no.	Base map	Interpretation map	Ground truth
1	Village	Built-up area	Urban area
2	Track	Track/Irrigation canal	Track
3	Nonexistent	Track/Irrigation canal	Irrigation canal
4	Village	Agricultural area	Village and agricultural area
5	Track	Track/Irrigation canal	Track
6	- Deleted because the area was unaccessible		
7	Nonexistent	Track/Irrigation canal	Track
8	- Deleted because the area was unaccessible		
9	Village	Dense vegetation	Village with dense trees
10	Canal across Irrigation canal along side of a road	Canal across a road	Canal across irrigation canal along side of a road
11	Track	Track/Irrigation canal	Track along side of irrigation canal
12	Canal	Track/Irrigation canal	Irrigation canal
13	Irrigation canal	Track/Irrigation canal	Track along side of irrigation canal
14	Nonexistent	Track/Irrigation canal	Irrigation canal
15	Nonexistent	Track/Irrigation canal	Irrigation canal
16	Nonexistent	Track/Irrigation canal	Irrigation canal
17	Track	Track/Irrigation canal	Track
18	Agricultural area	Bare ground	Factory
19	Track	Discontinuous track	Track partly covered with trees
20	Track	Track/Irrigation canal	Track
21	Village	Agricultural area	Village and rice field
22	Nonexistent	Canal	Canal
23	Village	Agricultural area	Village and agricultural area
24	- Deleted because the area was unaccessible		
25	Road across canal	Track/Canal crossing	Road across canal
26	Nonexistent	Track/Irrigation canal	Irrigation canal
27	Village	Agricultural area	Village and agricultural area
28	Nonexistent	Track/Irrigation canal	Canal along side irrigation canal
29	Nonexistent	Track/Irrigation canal	Irrigation canal
30	Village	Mixed of agricultural and bare ground	Urban and agricultural area
31	- Deleted because the area was unaccessible		
32	Tributary (not circular)	Circular shape of Tributary	Circular shape of Tributary
33	Track	Track/Irrigation canal	Track
34	Road along side of Irrigation canal	Track/Irrigation canal	Road along side of Irrigation canal

Sampling plot no.	Base map	Interpretation map	Ground truth
35	Runway	Wide track	Wide and smooth track
36	Agricultural area	Agricultural area	Sugar cane
37	Agricultural area	Dense vegetation	Coconut plantation
38	Scrub forest	Agricultural area	Sugar cane and truck crop
39	Scrub forest	Agricultural area	Sugar cane
40	Scrub forest	Agricultural area	Sugar cane, cassava and truck crop
41,42,43	Scrub forest	Agricultural area	Sugar cane, cassava pine-apple and banana plantation

APPENDIX A

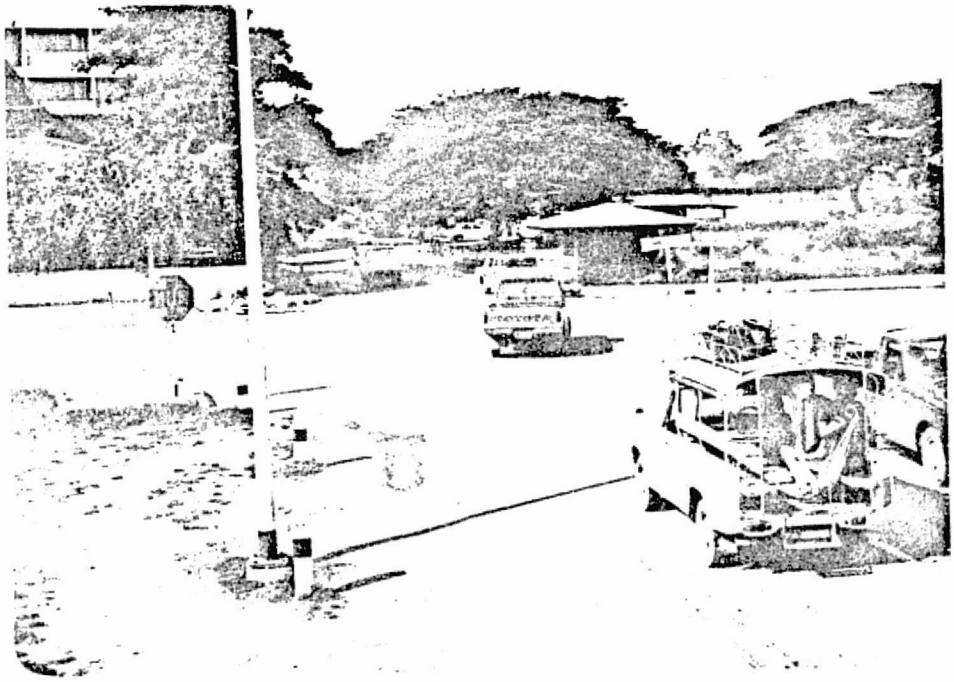
Data Sheet of Ground Information

GROUND TRUTH INFORMATION

LOCATION: ..Ban Chang Phuak..... AMPHOE: ..Muang.... CHANGWAT ..Chiangmai.....

DATE: ..10 Jun 75..... SAMPLING PLOT NO.: ..1.....

FIELD PHOTOGRAPHY



LAND USE CATEGORY: LEVEL I ....Built-up Land.....

LEVEL II ...Transportation.....

REMARK: .....cross-road.....

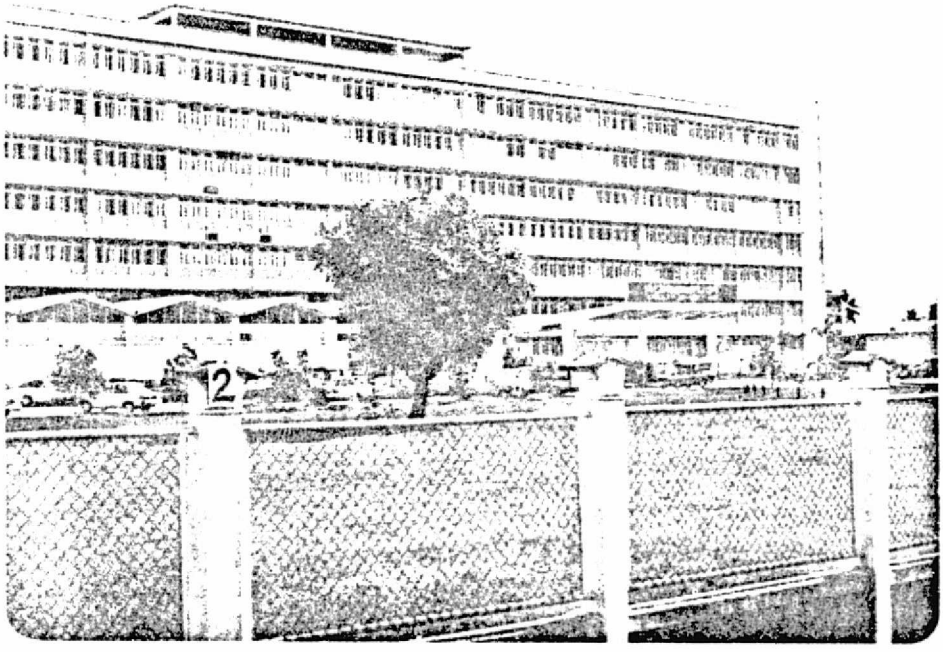
.....

GROUND TRUTH INFORMATION

LOCATION: ...Ban Suan Dok..... AMPHOE: ..Muang... CHANGWAT ..Chiangmai.....

DATE: .....10 Jan 75..... SAMPLING PLOT NO.: ...2.....

FIELD PHOTOGRAPHY



LAND USE CATEGORY: LEVEL I ...Built-up Land.....

LEVEL II ..Institutional.....

REMARK: ....Faculty of Medicine, Chiangmai University.....

.....

GROUND TRUTH INFORMATION

LOCATION: ...Ban Pa Mak..... AMPHOE: .Hang Dong. CHANGWAT ...Chiangmai.....

DATE: 11 Jun 75 ..... SAMPLING PLOT NO.: 16 .....

FIELD PHOTOGRAPHY

LAND USE CATEGORY: LEVEL I .Urban + Agricultural Land.....

LEVEL II Residential + Paddy field + Irrigation canal

REMARK: .....

.....

GROUND TRUTH INFORMATION

LOCATION: ...Ban Thawai..... AMPHOE: .Hang Dong. CHANGWAT ...Chiangmai.....

DATE: .....11.Jun.75..... SAMPLING PLOT NO.: ...17.....

FIELD PHOTOGRAPHY

LAND USE CATEGORY: LEVEL I ..Agricultural Land.....

LEVEL II .Paddy field.....

REMARK: .....

.....

GROUND TRUTH INFORMATION

LOCATION: ...Wat Pang Yoi..... AMPHOE: ..Saraphi.. CHANGWAT ....Chiangmai.....

DATE: .....12 Jun 75..... SAMPLING PLOT NO.: ...21.....

FIELD PHOTOGRAPHY

LAND USE CATEGORY: LEVEL I ...Agricultural Land.....

LEVEL II ..Paddy field + Perenial crop.....

REMARK: .....

.....

GROUND TRUTH INFORMATION

LOCATION: ...Ban Ang Hin..... AMPHOE: Pak Thong Chai.. CHANGWAT Nakhon Ratchasima....

DATE: .....24 Jun 75..... SAMPLING PLOT NO.: ..2.....

FIELD PHOTOGRAPHY

LAND USE CATEGORY: LEVEL I ..Agricultural Land.....

LEVEL II .Field crop (Cassava).....

REMARK: .....

.....

GROUND TRUTH INFORMATION

LOCATION: ...Huai Yang..... AMPHOE Pak Thong Chai CHANGWAT Nakhon Ratchasima....

DATE: .....24 Jun 75..... SAMPLING PLOT NO.: 3.....

FIELD PHOTOGRAPHY

LAND USE CATEGORY: LEVEL I ...Water.....

LEVEL II ..Reservoir.....

REMARK: ..almost dry, covered with water vegetation.....

.....

GROUND TRUTH INFORMATION

LOCATION: ..Ban Si Phatthana.... AMPHOE: ..Muang.... CHANGWAT ..Nakhon Ratchasima...

DATE: .....24 Jun 75..... SAMPLING PLOT NO.: ...11.....

FIELD PHOTOGRAPHY

LAND USE CATEGORY: LEVEL I ..Forest Land.....

LEVEL II ..Cut Forest (Deciduous).....

REMARK: ..Cut forest was replaced by cassava.....

.....

GROUND TRUTH INFORMATION

LOCATION: Ban Map Makha ..... AMPHOE: Muang .... CHANGWAT Nakhon Ratchasima ....

DATE: 26 Jun 75 ..... SAMPLING PLOT NO.: 36 .....

FIELD PHOTOGRAPHY

LAND USE CATEGORY: LEVEL I ....Built-up Land.....

LEVEL II ....Institutional.....

REMARK: Canal and levee of the same width (about 10 meters)

Boundary of Training Center for Eastern Technical College

GROUND TRUTH INFORMATION

LOCATION: ..Wat Sa-Bua..... AMPHOE: ..Muang.... CHANGWAT ..Phetburi.....

DATE: .....17 Jun 75..... SAMPLING PLOT NO.: ...1.....

FIELD PHOTOGRAPHY

LAND USE CATEGORY: LEVEL I ...Urban Land.....

LEVEL II ...Residential.....

REMARK: .....

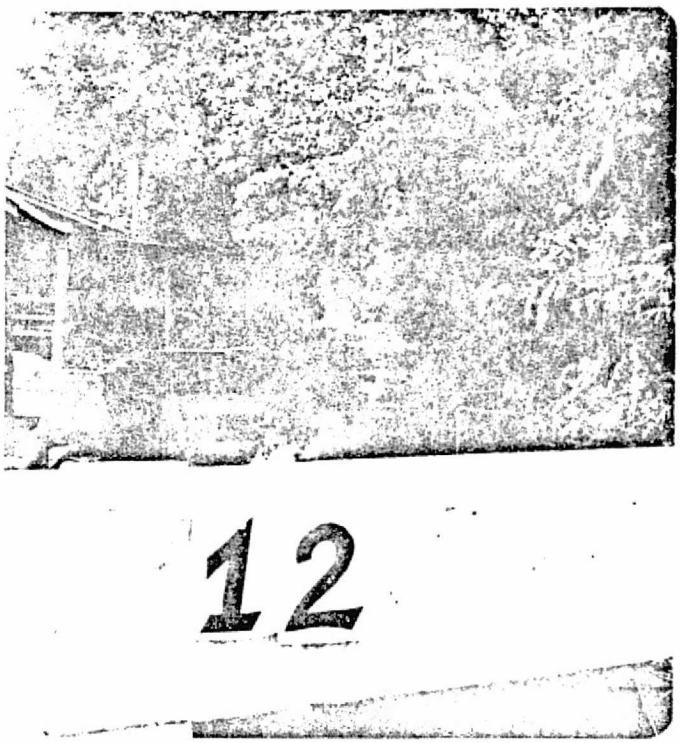
.....

GROUND TRUTH INFORMATION

LOCATION: Ban Tha Raeng Ok ..... AMPHOE: Ban Laem ... CHANGWAT ..Phetburi.....

DATE: ....17 Jun 75..... SAMPLING PLOT NO.: ....12.....

FIELD PHOTOGRAPHY



LAND USE CATEGORY: LEVEL I ....Water.....

LEVEL II ....Canal.....

REMARK: .....

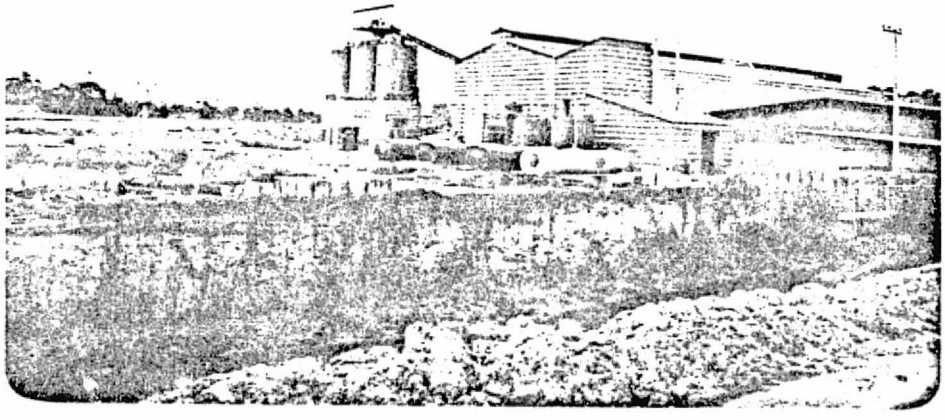
.....

GROUND TRUTH INFORMATION

LOCATION: ....Ban Lahan..... AMPHOE: .Ban Lat... CHANGWAT ..Phetburi.....

DATE: 17 Jun 75 ..... SAMPLING PLOT NO.: 18/2 .....

FIELD PHOTOGRAPHY



LAND USE CATEGORY: LEVEL I ..Built-up Land.....

LEVEL II ..Industrial.....

REMARK: ...Thai Fluorite Processing Company.....

.....

GROUND TRUTH INFORMATION

LOCATION: ..Wat Khao Damrong.... AMPHOE: Ban Lat.... CHANGWAT ..Phetburi.....

DATE: .....17 Jun 75..... SAMPLING PLOT NO.: ...19.....

FIELD PHOTOGRAPHY

LAND USE CATEGORY: LEVEL I ..Built-up Land.....

LEVEL II ..Transportation.....

REMARK:- ...loose surface track, 4 meters wide.....

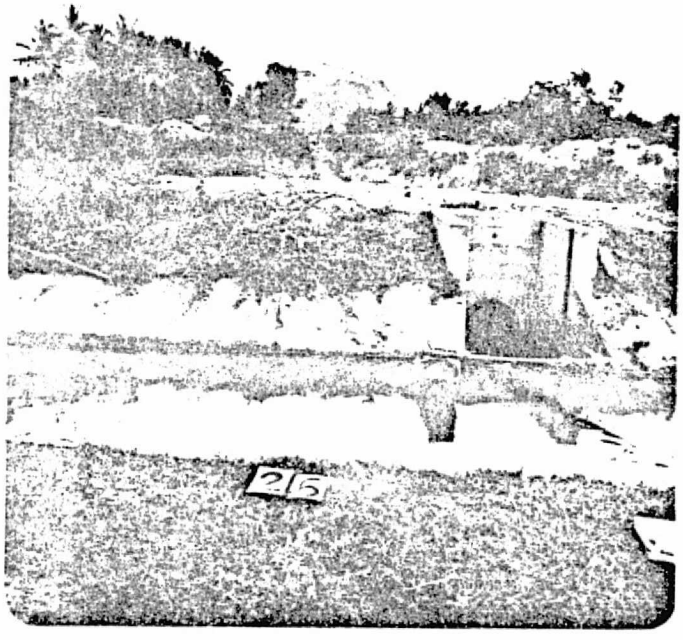
.....

GROUND TRUTH INFORMATION

LOCATION: Ban Don AMPHOE: Cha-am CHANGWAT Phetburi

DATE: 18 Jun 75 SAMPLING PLOT NO.: 26

FIELD PHOTOGRAPHY



LAND USE CATEGORY: LEVEL I Water

LEVEL II Irrigation canal

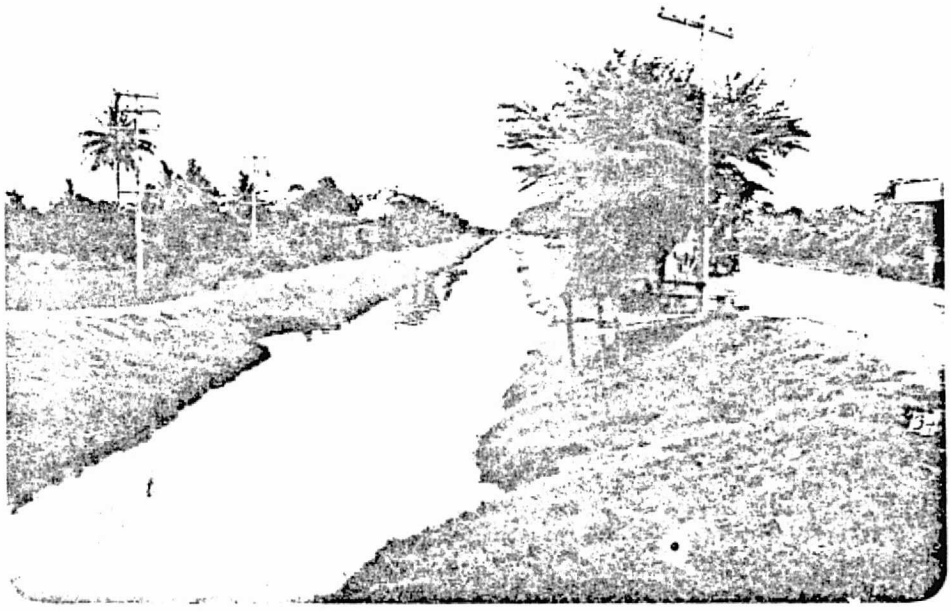
REMARK: about 2 meters wide

GROUND TRUTH INFORMATION

LOCATION: ..Ban Pong Ngu Luam... AMPHOE: ..Tha Yang. CHANGWAT ...Phetburi.....

DATE: .....18 Jun 75..... SAMPLING PLOT NO.: ...34.....

FIELD PHOTOGRAPHY



LAND USE CATEGORY: LEVEL I ..Built-up Land + Water.....

LEVEL II .Transportation + Irrigation canal.

REMARK: ....Asphalt road and irrigation canal.....

.....

GROUND TRUTH INFORMATION

LOCATION: Sanam Bin Lahan Bon.. AMPHOE: Tha Yang... CHANGWAT ..Phetburi.....

DATE: .....18 Jun 75..... SAMPLING PLOT NO.: ....35.....

FIELD PHOTOGRAPHY

LAND USE CATEGORY: LEVEL I ..Built-up Land.....

LEVEL II .Transportation.....

REMARK: ..A large smooth track, used as a runway.....

.....

GROUND TRUTH INFORMATION

LOCATION: Self Settlement (2) AMPHOE: Cha-am CHANGWAT Phetburi

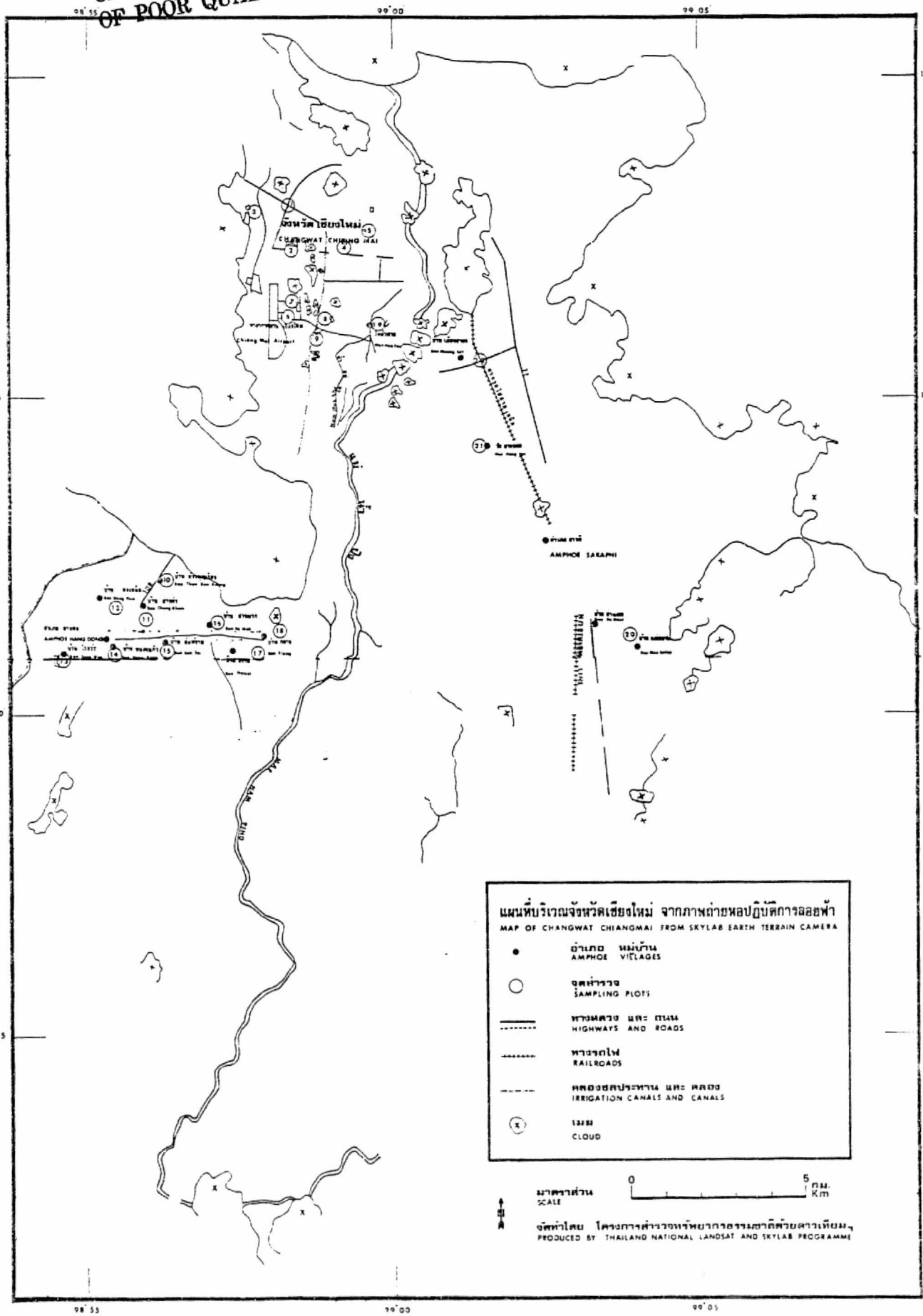
DATE: 19 Jun 75 SAMPLING PLOT NO.: 38

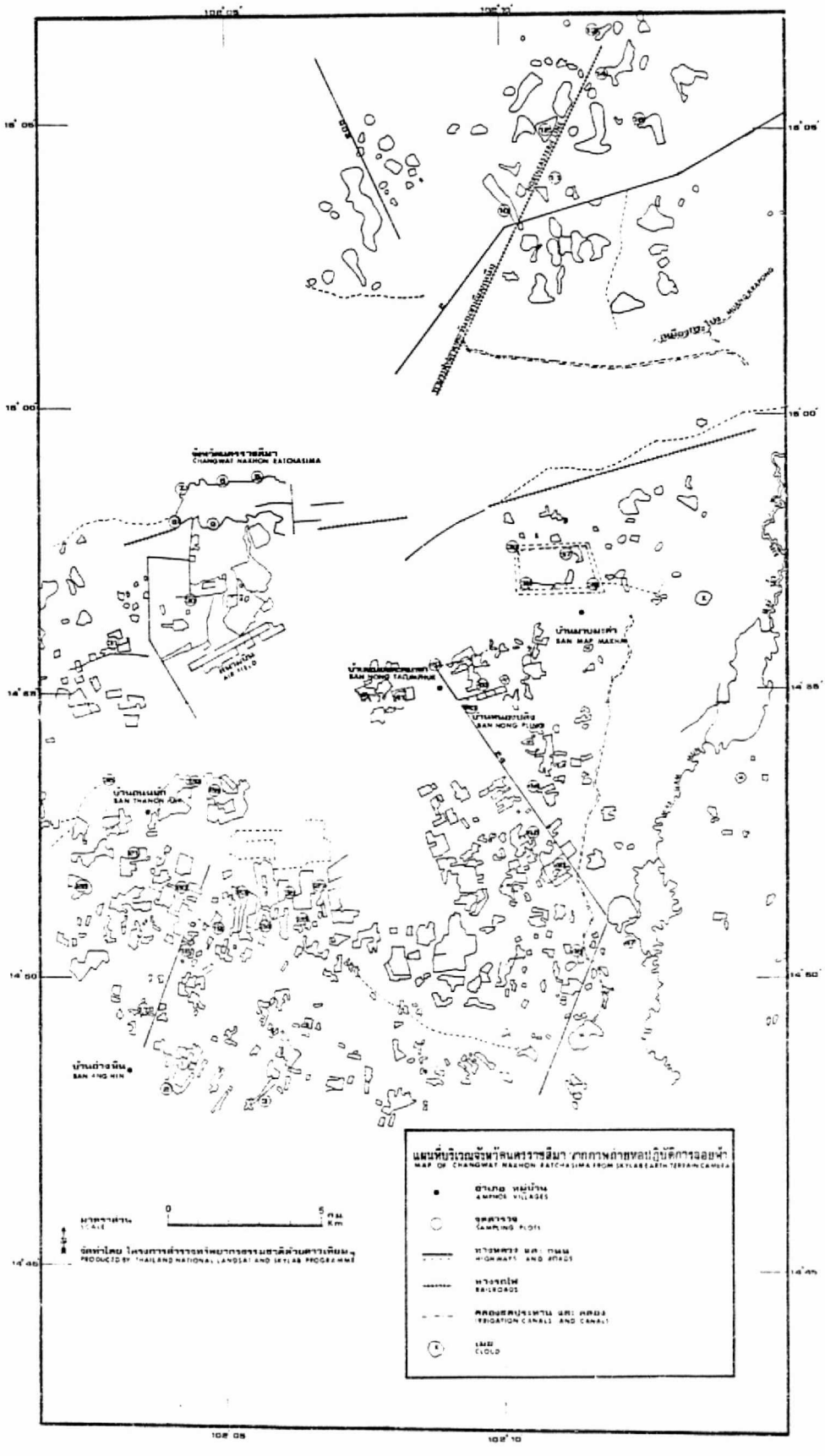
FIELD PHOTOGRAPHY

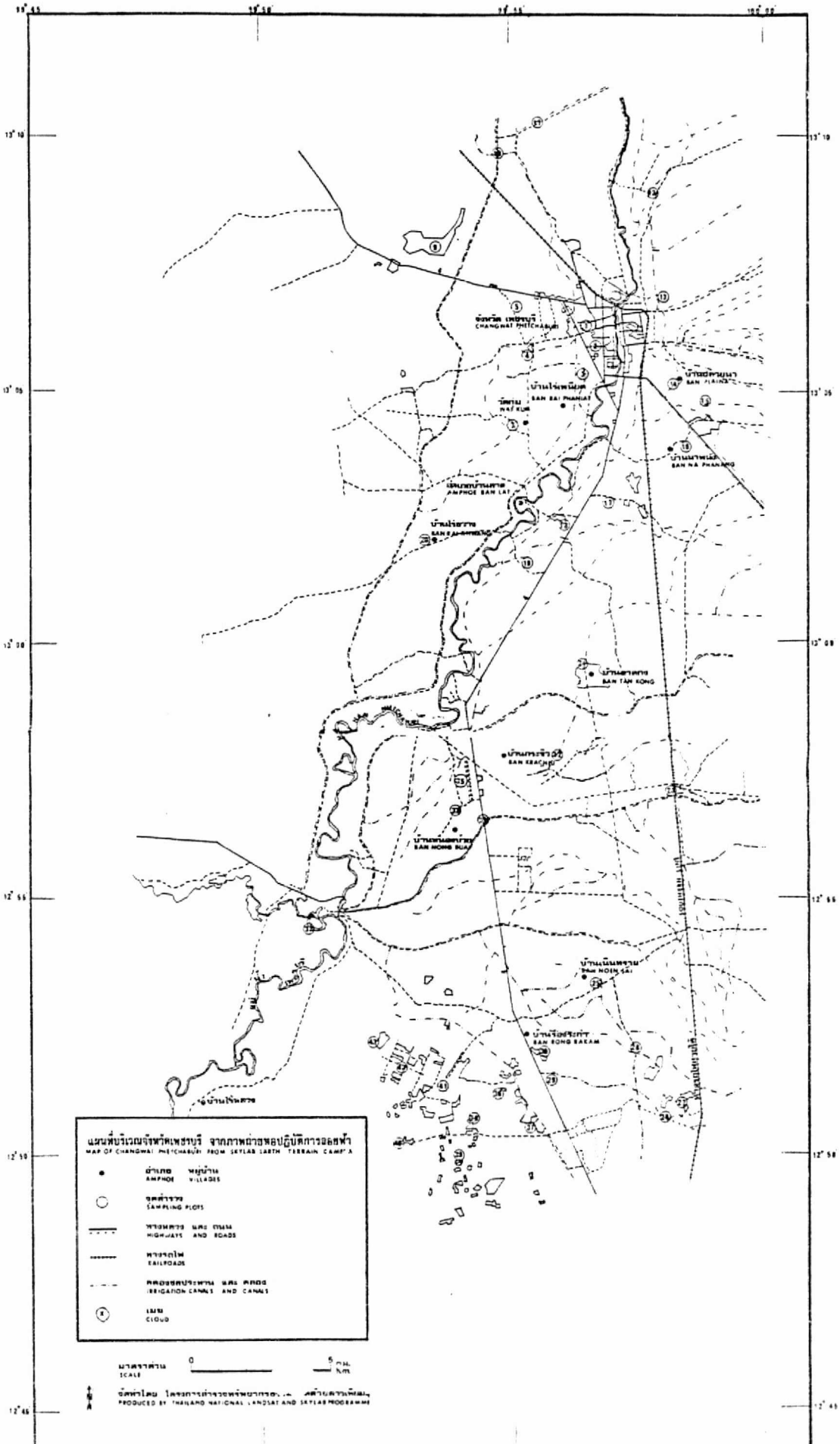
LAND USE CATEGORY: LEVEL I Agricultural Land

LEVEL II Field crop + Horticultural crop

REMARK: sugar cane and chinese radish in the same field







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