MAP - 6A

RELIEF MAP
OF
SOUTHERN JAPAN

Mercator projection

Scale 1:1,000,000 at Latitude 35°

Elevations in feet

PREPARED AND REPRODUCED IN THE
UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY
FOR THE WAR DEPARTMENT
OFFICE OF THE ASSISTANT CHIEF OF AIR STAFF, INTELLIGENCE
FEBRUARY 1944

GLOSSARY

Japanese	English
-gata	lagoon, inlet
-jima	island
-kaikyō	strait
-ko	lake
-misaki	point, cape
-nada	sea, open bay
-rettō	island chain
-saki	point, cape
-san	mountain
-shima	island
-suidō	channel, strait
-wan	bay
-zaki	point, cape

AAF AERONAUTICAL CHART

LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS 7° AND 20° SCALE 1:1,000,000

MAP - 7

AERONAUTICAL SYMBOLS

- AIRPORTS UNCLASSIFIED — 205
- MILITARY FIELD — 205
- JOINT MILITARY-CIVIL AIRPORT — 205
- COMMERCIAL OR MUNICIPAL AIRPORT (NUMERALS INDICATE HEIGHT IN FEET ABOVE SEA LEVEL) — 205
- FLIGHT STRIP (LANDING AREA ADJACENT TO HIGHWAY) (SYMBOL INDICATES DIRECTION OF RUNWAY) — 205
- EMERGENCY LANDING FIELD — 205
- SEAPLANE BASE
- SEAPLANE ANCHORAGE (WITH REFUELING & LIMITED FACILITIES)
- PROTECTED ANCHORAGE (NO FACILITIES)
- ROTATING BEACON (WITH FLASHING CODE BEACON)
- ROTATING BEACON (WITH COURSE LIGHTS AND CODE) — 27
- FLASHING CODE BEACON
- FLASHING BEACON
- OBSTRUCTION (NUMERALS INDICATE HEIGHT IN FEET ABOVE GROUND) — 205
- MOORING MAST
- NIGHT LIGHTING FACILITIES — LF
- MARINE NAVIGATION LIGHT (WITH CHARACTERISTIC) — Gp Fl
- LINES OF EQUAL MAGNETIC VARIATION — 22° W
- CIVIL AIRWAY (WITH FLIGHT LEVELS INDICATED) — (traffic controlled) (traffic uncontrolled) 8000 250 (Numerals give mileage along axis of airway)
- AIR NAVIGATION HAZARDS (UNITED STATES ONLY) — DANGER AREA, CAUTION AREA, PROHIBITED AREA
- AIR DEFENSE ZONE OR VITAL DEFENSE AREA (UNITED STATES ONLY)
- RADIO FAN MARKER — WINSTON
- RADIO MARKER BEACON (WITH VOICE) — 379 and 209 NEW FLORENCE RADIO 278
- NON-DIRECTIONAL RADIO BEACON (TYPE H) — OTTOWA 278 YJ
- RADIO RANGE — N, A, 275°, 95°, (BEARINGS ARE MAGNETIC AT THE STATION), FINAL APPROACH LEG
- RADIO RANGE NOTE (AT NEAT LINE) — To Big Springs 326 BZ
- RADIO RANGE (WITHOUT VOICE) — 206 AP
- RADIO RANGE (WITH VOICE) — 391 LN LEBO RADIO 278
- RADIO RANGE (SIMULTANEOUS) — WHITEHALL RADIO 284 WW
- AIRPORT CONTROL TOWER — BIGGS FIELD TOWER 396

- RADIO DIRECTION FINDER STATION — RC ALGOA KFOB
- RADIOBEACON — Rbn HAFUN HJA 294.5 CK
- RADIO COMMUNICATION STATION — Dante ISP
- RADIO COMMUNICATION STATION (WITH RADIOBEACON FACILITY) — Rbn Geneva WJY
- RADIO COMMUNICATION STATION (WITH DIRECTION FINDER FACILITY) — RC Chicago WOR
- RADIO BROADCASTING STATION — KFBB 1280

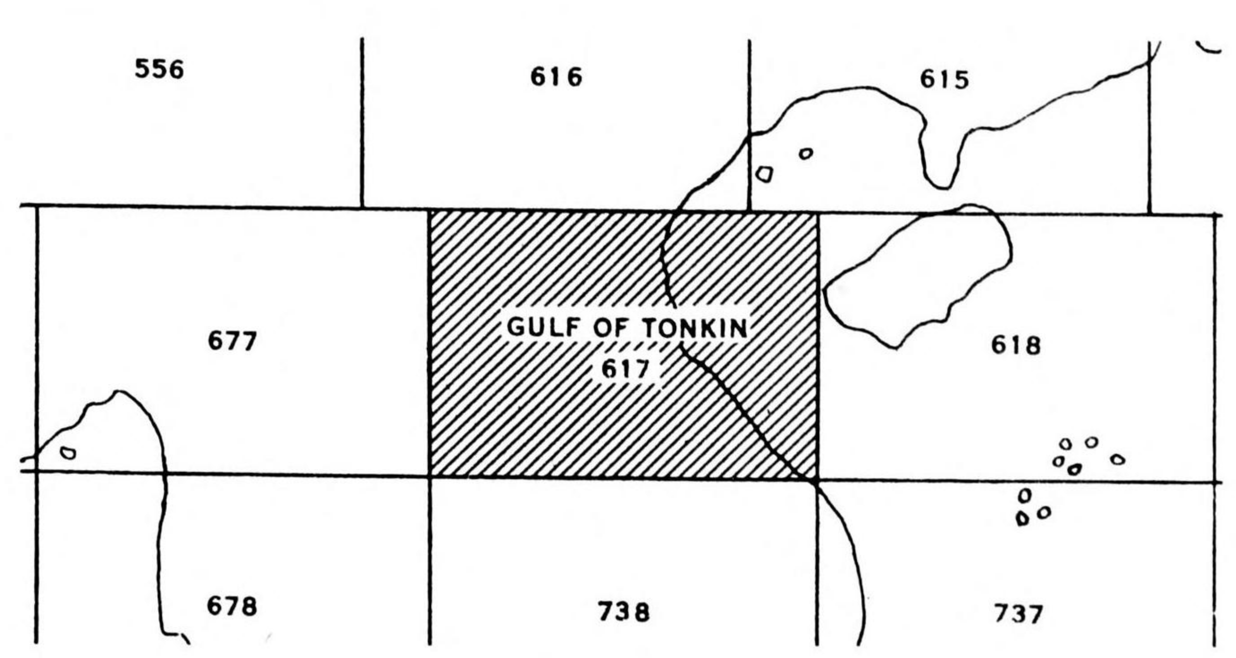
Radio facilities information is supplemented by current data sheet.

CULTURAL AND MISCELLANEOUS SYMBOLS

- RAILROADS (SINGLE TRACK) — Crossties 5 mi. apart
- RAILROADS (DOUBLE TRACK)
- RAILROAD OVERPASS
- RAILROAD UNDERPASS
- RAILROAD SIDING
- RAILROADS (ABANDONED)
- TUNNELS (RAILROAD OR HIGHWAY)
- BRIDGES (RAILROAD)
- BRIDGES (HIGHWAY)
- STATE & INTERNATIONAL BOUNDARIES
- POWER TRANSMISSION LINES — Poles 8 miles apart
- DAMS
- PIPELINE
- SPOT ELEVATIONS (IN FEET) — 5248
- HIGHEST ELEVATION ON CHART — 5390
- FORT
- LOOKOUT TOWER
- LOCATED OBJECTS (WITH EXPLANATORY NOTE)
- MOUNTAIN PASS
- MINES & QUARRIES

TOPOGRAPHIC FEATURES

- CONTOURS — 2000
- APPROXIMATE CONTOURS — 2000
- DEPRESSION CONTOURS — 200
- HACHURES (ELEVATION IN FEET) — 5248
- BLUFFS, CLIFFS & ESCARPMENTS
- SAND AREAS
- SAND DUNE AREAS
- SAND RIDGES
- LAVA FLOWS
- UNUSUAL LAND FEATURES



HYDROGRAPHIC FEATURES

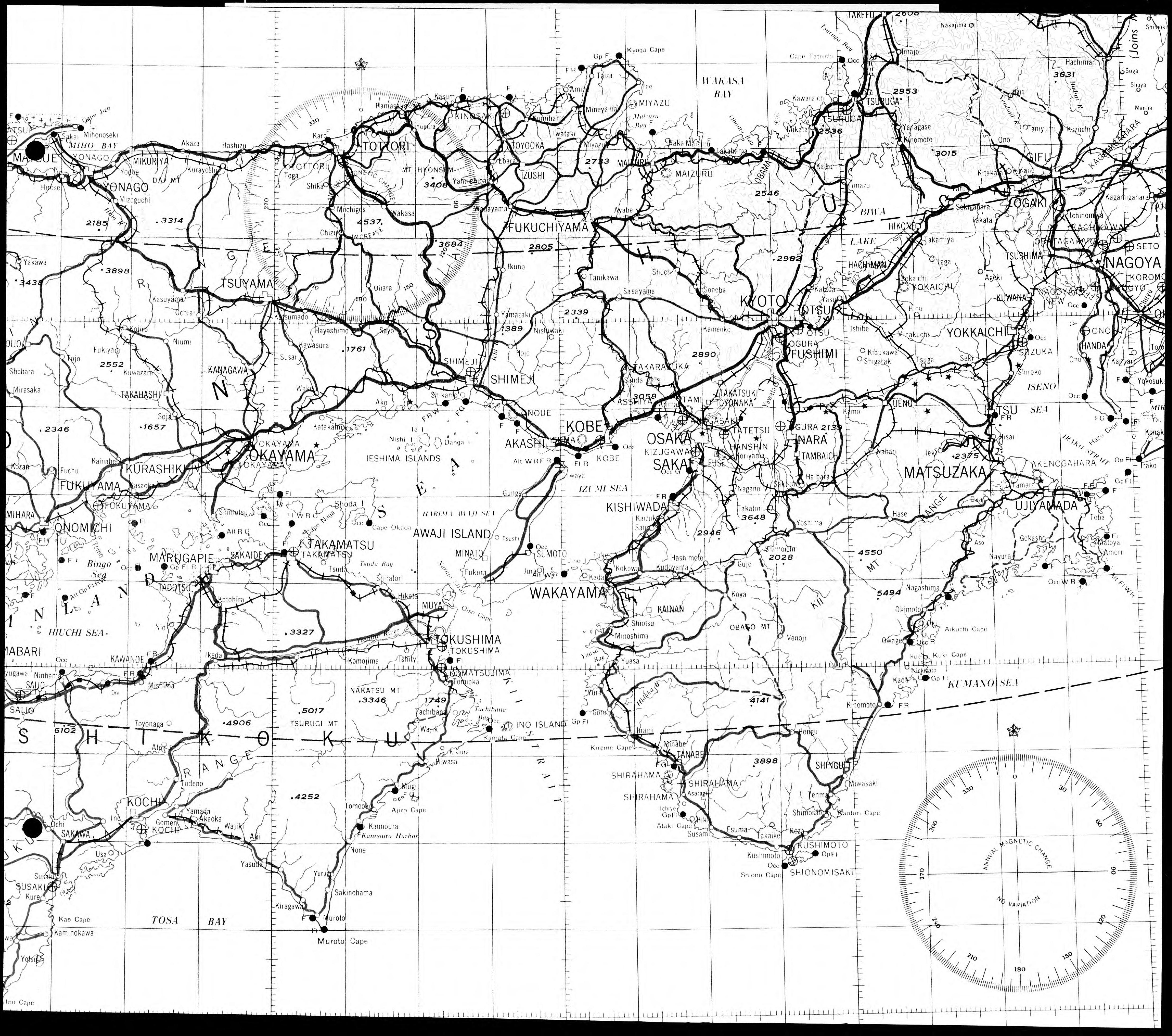
- STREAMS, RIVERS, LAKES & COASTLINES
- ONE FATHOM LINE (6 FEET BELOW LOW WATER LEVEL)
- STREAMS, RIVERS, LAKES & COASTLINES (UNSURVEYED)
- STREAMS & RIVERS (INTERMITTENT)
- RAPIDS & FALLS
- CANALS
- SPRINGS
- WELLS & WATER HOLES
- INTERMITTENT LAKES
- SWAMPS & MARSHES
- GLACIERS
- CHARTED ROCKS
- TIDAL FLATS
- REEFS, SHOALS, BANKS, ETC. (AREA BETWEEN HIGH AND LOW WATER LEVEL)
- MUD FLATS — Land

CITIES AND TOWNS

- LARGE CITIES — ST. LOUIS
- CITIES — ELMIRA
- SMALL CITIES — QUINCY
- TOWNS — Corville
- VILLAGES & STATIONS — Arcola

HIGHWAYS AND ROADS

- MAIN ROADS
- SECONDARY ROADS
- TRAILS
- U. S. ROAD MARKERS — 51
- NATIONAL, STATE OR PROVINCIAL MARKERS — 30



MATSUE
MIHONOSEKI
MIHO BAY
YONAGO
MIKURIYA
KURAYOSHI
TOTTORI
MT HYONSEN
KINOSAKI
TOYOOKA
IZUSHI
MIYAZU
MAIZURU
WAKASA BAY
TSURUGA
OBAMA
GIFU
OGAKI
NAGOYA
FUKUCHIYAMA
LAKE BIWA
HIKONE
KYOTO
OTSU
FUSHIMI
YOKKAICHI
SUZUKA
TSUYAMA
ANNUAL MAGNETIC CHANGE
INCREASE
TAKAHASHI
KANAGAWA
SHIMEJI
HIMEJI
KOBE
OSAKA
SAKAI
NARA
TAKATSUKI
TOYONAKA
AMAGASAKI
ASHIYA
ISENO SEA
TSU
MATSUZAKA
UJIYAMADA
KURASHIKI
OKAYAMA
FUKUYAMA
ONOMICHI
MIHARA
IESHIMA ISLANDS
HARIMA SEA
AKASHI
IZUMI SEA
KISHIWADA
AWAJI ISLAND
TAKAMATSU
MARUGAME
SAKAIDE
TADOTSU
SUMOTO
WAKAYAMA
KAINAN
OBAGO MT
KII
Bingo Sea
HIUCHI SEA
TOKUSHIMA
KOMATSUSHIMA
NAKATSU MT
TSURUGI MT
KII STRAIT
INO ISLAND
KUMANO SEA
SHINGU
TANABE
SHIRAHAMA
KUSHIMOTO
SHIONOMISAKI
Shiono Cape
SAIJO
KAWANOE
SHIKOKU RANGE
KOCHI
SAKAWA
SUSAKI
TOSA BAY
Muroto Cape
Kaminokawa
Ino Cape
ANNUAL MAGNETIC CHANGE
NO VARIATION

HORAGE
(S & LIMITED FACILITIES)

E
(FACILITIES) NAME

CON
(CODE BEACON)

CON
(GHTS) 27

E BEACON

CON

S INDICATE HEIGHT ABOVE GROUND IN FEET) 205

(ATTACH TO TOP OF FIELD SYMBOL)

G FACILITIES LF

ATION LIGHT
(RISTIC) Occ

L MAGNETIC DECLINATION 22° W

AMBER 4 (airway traffic controlled)

LIMITS)

Miles from Houston 250
(Numerals give mileage along axis of airway)

RVATION

AIRSPACE RESERVATION
Danger zone

WINSTON

N

359 H
KNOXVILLE
RADIO 278

N

379 and 209 I
NEW FLORENCE
RADIO 278

To Big Springs

OTE

326 BZ

206 AP.
A N
N A
275° 95°
297° 117°
205° 25°

STING STATION

SALEM KFBB ○ RS

OL TOWER

BIGGS FIELD
TOWER 396

391 LN
LEBO RADIO 278

WHITEHALL RADIO
284 WW
Weather 20m 43m 48m

N FINDER STATION

ALGOA KFOB ○ RC

EACON

278
Operates 0m-10m & 30m-40m each hour ○ Rbn

ON STATION

Dante ISP

ONAL STATION WITH RADIOBEACON

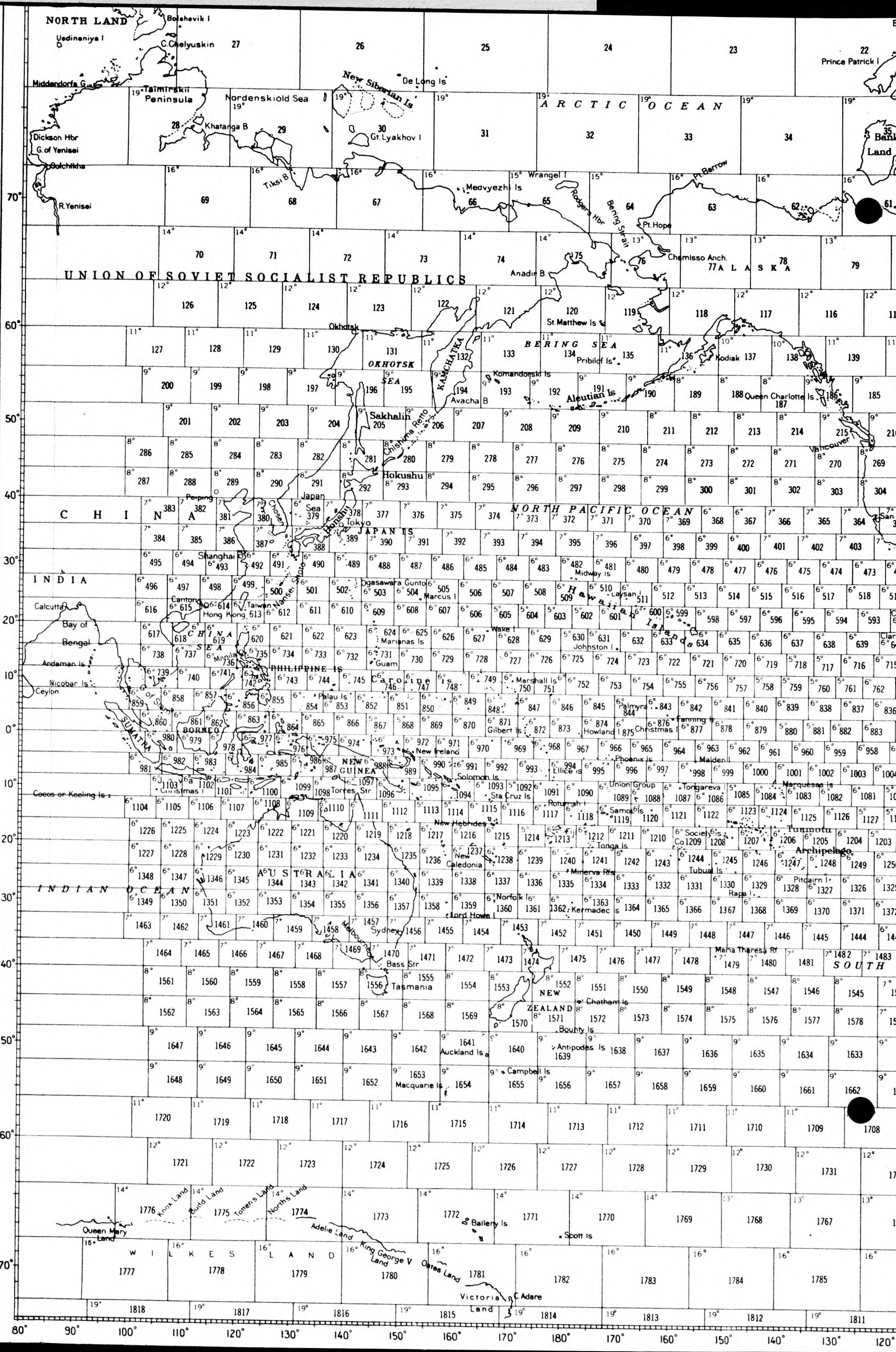
Rbn
Geneva WJY

ONAL STATION WITH DIRECTION FINDER FACILITY

RC
Chicago WOR

OF INTERSECTION

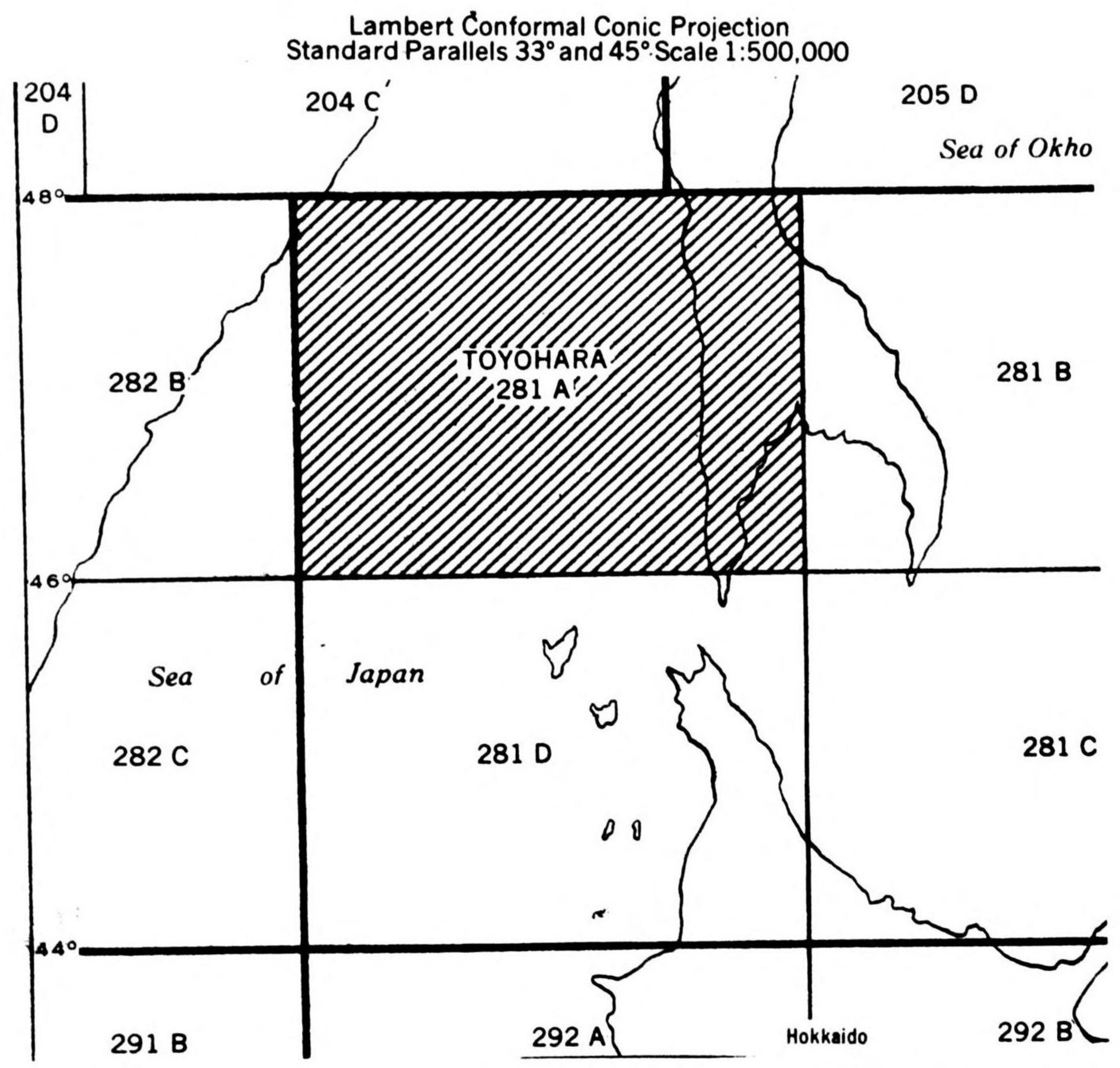
CONTROL ZONE
OF INTERSECTION
NOTE



AAF AERONAUTICAL CHART

Scale 1:500,000-1 Inch – 7.89 Miles

MAP - 8



CULTURAL AND MISCELLANEOUS SYMBOLS

(BLACK)

- Poles 4 Miles Apart — POWER TRANSMISSION LINES
- DAMS
- LOCATED OBJECTS (WITH EXPLANATORY NOTE) — ● OR ■
- SPOT ELEVATIONS (ELEVATION IN FEET) — •5248
- HIGHEST KNOWN ELEVATION ON CHART (NOT NECESSARILY A SPOT ELEVATION) — •11358
- MINES & QUARRIES
- MOUNTAIN PASSES
- LOOKOUT TOWER
- FORT
- Pipeline — PIPELINE
- OIL FIELDS
- RACE TRACK
- STATE & INTERNATIONAL BOUNDARIES
- RAILROADS (SINGLE TRACK) (Crossties 2.5 mi. apart)
- RAILROADS (DOUBLE TRACK)
- Siding — RAILROAD SIDING
- RAILROADS (ABANDONED)
- RAILROAD OVERPASS
- RAILROAD UNDERPASS
- BRIDGES (HIGHWAY)
- BRIDGES (RAILROAD)
- TUNNELS (RAILROAD OR HIGHWAY)

TOPOGRAPHIC FEATURES

(BROWN)

- HACHURES (ELEVATION IN FEET) — 5350
- SAND AREAS
- SAND DUNE AREAS
- SAND RIDGES
- UNUSUAL LAND FEATURES (LABEL ROCK, LIGHT, DARK AREAS, ETC.)
- CONTOURS — 3000
- APPROXIMATE CONTOURS — 3000
- DEPRESSION CONTOURS — 300
- LAVA FLOWS
- BLUFFS, CLIFFS & ESCARPMENTS

GLOSSARY

—bana — point
—bukujō — stock farm
—dake — mountain
—dantai — community
—fuji — mountain
—gawa — river
—gun — county
—guntō — archipelago
—hama — beach
—hana — point
—hanto — peninsula
—iwa — rock
—jima — island
—kaikyo — strait
—kawa — river
—ken — prefecture
—kō — harbor
—ko — lake
—mine — mountain
—misaki — cape
—mori — forest
—nada — sea
—nōjō — farms
—numa — lake or pond
—rettō — island chain
—saki — cape
—san — mountain
—sawa — swamp, stream
—se — shoals, rapids
—seto — strait
—shima — island
—shotō — island group
—suidō — channel
—take — mountain
—taki — waterfall
—tō — island
—tōge — mountain pass
—umi — bay, gulf
—ura — inlet, creek
—wan — bay
—yama — mountain
—zaki — cape
—zan — mountain
—zawa — swamp, stream

HYDROGRAPHIC FEATURES

(LIGHT BLUE)

- STREAMS, RIVERS
- STREAMS, RIVERS
- STREAMS & RIVERS (INTERMITTENT)
- STREAMS, RIVERS, LAKES, & COASTLINES (UNSURVEYED)
- Rapids / Falls — RAPIDS & FALLS (DESIGNATED AS RAPIDS OR FALLS)
- CANAL — CANALS
- ONE FATHOM LINE (6 FEET BELOW LOW WATER LEVEL)
- CHARTED ROCKS
- SPRINGS
- WELLS & WATER HOLES
- LAKES & COASTLINES
- INTERMITTENT LAKES
- GLACIERS (FORM LINES SHOWING FLOW)
- SWAMPS & MARSHES
- REEFS AND SHOALS (AREA BETWEEN HIGH AND LOW WATER LEVEL) (BROWN)
- TIDAL FLATS
- MUD FLATS

CITIES AND TOWNS

(HALFTONE BLACK)

- LARGE CITIES (100,000 & Over)
- CITIES (25,000 To 100,000)
- SMALL CITIES (5,000 To 25,000)
- TOWNS (1,000 To 5,000)
- VILLAGES & STATIONS (0 To 1,000)

HIGHWAYS AND ROADS

(HALFTONE BLACK)

- MAIN ROADS
- SECONDARY ROADS
- TRAILS
- 78 — U. S. ROAD MARKERS
- 50 — NATIONAL, STATE OR PROVINCIAL ROAD MARKERS

AERONAUTICAL SYMBOLS

(NUMERALS INDICATE HEIGHT IN FEET ABOVE SEA LEVEL)

- AIRPORTS UNCLASSIFIED — 205
- MILITARY FIELD — 205
- JOINT MILITARY-CIVIL AIRPORT — 205
- COMMERCIAL OR MUNICIPAL AIRPORT — 205
- FLIGHT STRIP (LANDING AREA ADJACENT TO HIGHWAY) (SYMBOL INDICATES DIRECTION OF RUNWAY) — 205
- EMERGENCY LANDING FIELD — 205
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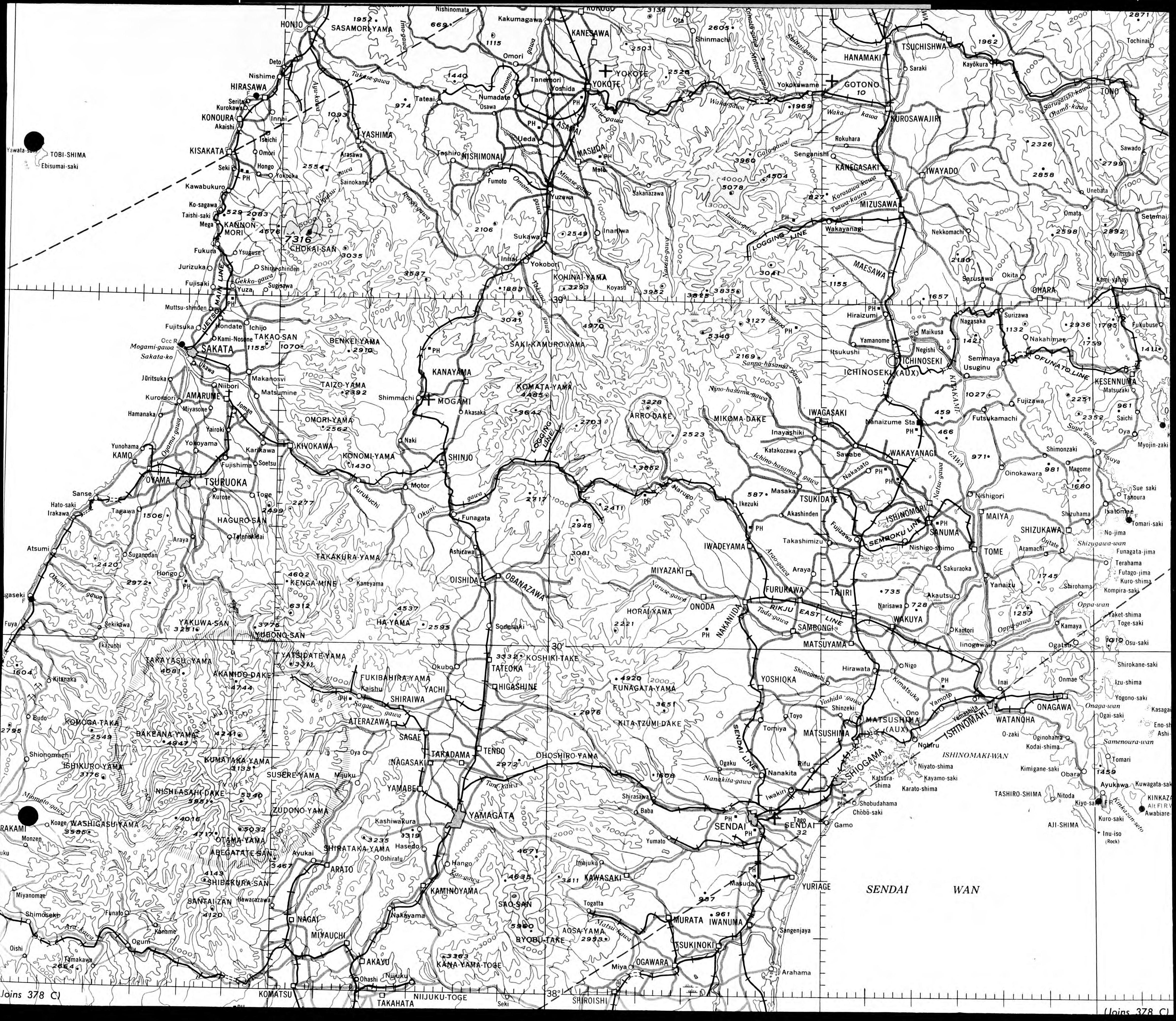
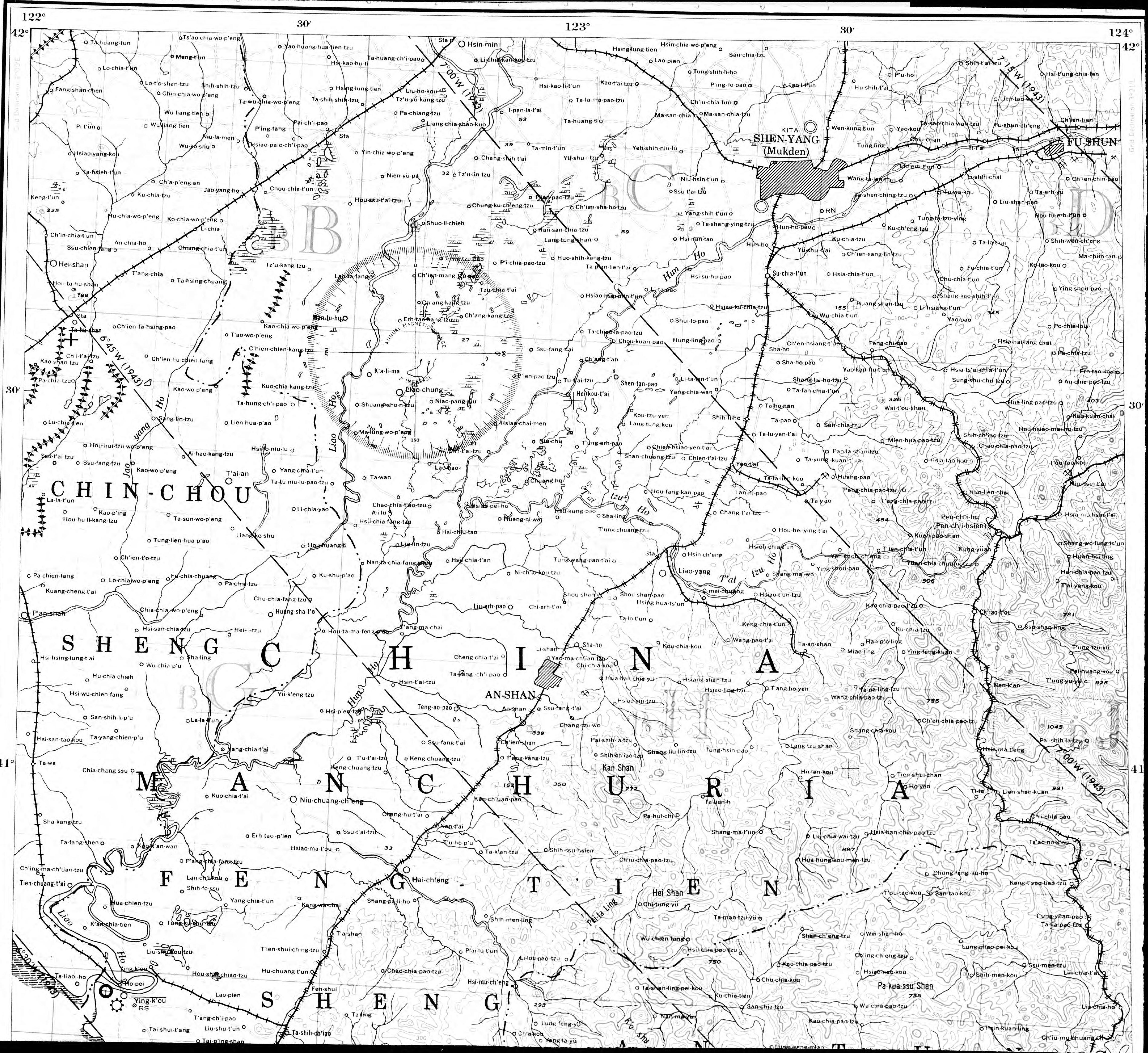
- SEAPLANE ANCHORAGE (WITH REFUELING & LIMITED FACILITIES)
- PROTECTED ANCHORAGE (NO FACILITIES)
- AIRPORT CONTROL TOWER — BIGGS FIELD TOWER
- RADIO DIRECTION FINDER STATION — RC — ALGOA KFOB
- RADIOBEACON — Rbn — HAFUN HJA 294.5
- RADIO COMMUNICATION STATION — Dante ISP
- RADIO COMMUNICATION STATION (WITH RADIOBEACON FACILITY) — Rbn — Geneva WJY
- RADIO COMMUNICATION STATION (WITH DIRECTION FINDER FACILITY) — RC — Chicago WOR
- RADIO BROADCASTING STATION — KFBB 1280
- ROTATING BEACON (WITH FLASHING CODE BEACON)
- ROTATING BEACON (WITH COURSE LIGHTS AND CODE) — 27
- FLASHING CODE BEACON
- FLASHING BEACON
- OBSTRUCTION (NUMERALS INDICATE HEIGHT IN FEET ABOVE GROUND) — 205
- MOORING MAST
- LIGHTSHIP
- NIGHT LIGHTING FACILITIES — LF
- MARINE NAVIGATION LIGHT (WITH CHARACTERISTIC) — Gp Fl
- LINES OF EQUAL MAGNETIC VARIATION — 22° W
- CIVIL AIRWAY (WITH FLIGHT LEVELS INDICATED) — (traffic controlled) (traffic uncontrolled) 8000 — 250 (Numerals give mileage along axis of airway)
- AIR NAVIGATION HAZARDS (UNITED STATES ONLY) — DANGER AREA — CAUTION AREA — PROHIBITED AREA
- AIR DEFENSE ZONE OR VITAL DEFENSE AREA (UNITED STATES ONLY)
- RADIO FAN MARKER — WINSTON
- RADIO MARKER BEACON (WITHOUT VOICE) — 359 H — KNOXVILLE RADIO 278
- RADIO MARKER BEACON (WITH VOICE) — 379 and 209 I — NEW FLORENCE RADIO 278
- NON-DIRECTIONAL RADIO BEACON (TYPE H) — OTTOWA 278 YJ
- RADIO RANGE — N A (BEARINGS ARE MAGNETIC AT THE STATION) 275° 95° 275° 95° A N
- RADIO RANGE NOTE (AT NEAT LINE) — To Big Springs 326 BZ
- RADIO RANGE (WITHOUT VOICE) — 206 AP
- RADIO RANGE (WITH VOICE) — 391 LN — LEBO RADIO 278
- RADIO RANGE (SIMULTANEOUS) — WHITEHALL RADIO 284 WW



HONJO
SASAMORI-YAMA
Nishinomata
Kakumagawa
KANESAWA
Ota
Shinmachi
HANAMAKI
TSUCHISHWA
Kayokura
Tochinai
Deto
Nishime
HIRASAWA
Omori
Takase-gawa
Tateai
Numadate
Osawa
Tanemori
Yoshida
YOKOTE
Yokokawame
GOTONO
TONO
Serita
Kurokawa
KONOURA
Akaishi
Innai
YASHIMA
ASAHAI
Ueda
Waka-gawa
KUROSAWAJIRI
Sarugaishi-kawa
Otamo-kawa
Yawata-saki
TOBI-SHIMA
Ebisumai-saki
KISAKATA
Tseichi
Omori
Arasawa
Tashiro
NISHIMONAI
MASUDA
Mato
Senganishi
Rokuhara
Gato-gawa
KANEGASAKI
IWAYADO
Sawado
Seki
Hongo
Yokooka
Sainokami
Fumoto
Yuzawa
Sakanazawa
Kawabukuro
Ko-sagawa
Taishi-saki
Mega
KANNON-MORI
CHOKAI-SAN
Korosawa-kawa
Tsawa-kawa
MIZUSAWA
Unebata
Omata
Setemai
Fukura
Ysuguse
Sukawa
Inarawa
Isawa-gawa
LOGGING LINE
Wakayanagi
Nekkomachi
Kuritsuba
Jurizuka
Shirase-shinden
Innai
Yokobori
MAESAWA
Okita
Fujisaki
Gekko-gawa
Yuza
Sugisawa
KOHINAI-YAMA
Koyasu
Sarusawa
Kami-yanagi
OHARA
Muttsu-shinden
JETSU MAIN LINE
Hondate
Ichijo
Fujitsuka
Kami-Nosone
TAKAO-SAN
BENKEI-YAMA
SAKI-KAMURO-YAMA
Sanno-hasama-gawa
Hiraizumi
Maikusa
Yamanome
Itsukushi
Negishi
ICHINOSEKI
ICHINOSEKI (AUX)
Nagasaka
Surizawa
Nakahimae
Semmaya
Usuginu
OFUNATO LINE
KESENNUMA
Fukubuse
Mogami-gawa
SAKATA
Sakata-ko
Ukawa
Makanosvi
Jūritsuka
Niibori
Kuromori
AMARUME
Matsumine
Hamanaka
Miyasone
TAIZO-YAMA
KANAYAMA
Shimmachi
MOGAMI
Akasaka
KOMATA-YAMA
ARRO-DAKE
Nino-hasama-gawa
MIKOMA-DAKE
IWAGASAKI
Nanaizume Sta
KITAKAMI
Fujizawa
Futsukamachi
Matsuzaki
Saichi
Oya
Myojin-zaki
Suya-gawa
Yunohama
KAMO
Oyama-gawa
Yokoyama
Yairoki
Joman
Karikawa
KIVOKAWA
OMORI-YAMA
KONOMI-YAMA
Naki
SHINJO
LOGGING LINE
Inayashiki
Katakozawa
Ichino-hasama-gawa
Sawabe
WAKAYANAGI
GAWA
Shimonzaki
Magome
Tsuya
Oinokawara
OYAMA
TSURUOKA
Fujishima
Soetsu
Furukuchi
Motor
Naruge
Masaka
TSUKIDATE
Nakasato
Nishigori
Sue saki
Tanoura
Isatomae
Tomari-saki
Sanse
Hato-saki
Irakawa
Tagawa
Kurose
Toge
HAGURO-SAN
Okuni-gawa
Funagata
Ikezuki
Akashinden
ISHINOMORI
SEMBOKU LINE
SANUMA
MAIYA
SHIZUKAWA
Shizuhama
No-jima
Araya
Tatenokidai
Ashizawa
IWADEYAMA
Takashimizu
Fujizawa
Nishigo-shimo
TOME
Atamachi
Oritate
Shizugawa-wan
Funagata-jima
Atsumi
Suganodan
TAKAKURA-YAMA
KENGA-MINE
Kaneyama
OISHIDA
OBANAZAWA
MIYAZAKI
Aran-gawa
Araya
Sakuraoka
Yanaizu
Terahama
Futago-jima
Kuro-shima
Shirohama
Kompira-saki
Hongo
Naruse-gawa
ONODA
FURUKAWA
TAJIRI
Akautsu
Narisawa
Oppa-wan
Fuya
Sekikawa
YAKUWA-SAN
YUBONO-SAN
HA-YAMA
Sodesaki
HORAI-YAMA
NAKANIIDA
RIKJU EAST LINE
Tada-gawa
SAMBONGI
WAKUYA
Kantori
Oppa-gawa
Kamaya
Yaket-shima
Toge-saki
Osu-saki
Ikazuchi
MATSUYAMA
Iinogawa
Ogatsu
TAKAYASU-YAMA
AKAMIDO-DAKE
YATSIDATE-YAMA
KOSHIKI-TAKE
TATEOKA
Okubo
FUKIBAHIRA-YAMA
YACHI
HIGASHINE
Kitanaka
Kaishu
SHIRAIWA
Sagae-gawa
FUNAGATA-YAMA
YOSHIOKA
Shimomachi
Hirawata
Nigo
Kimatsuka
Shirokane-saki
Inai
Onmae
Izu-shima
Yogono-saki
Budo
KOMOGA-TAKA
BAKEANA-YAMA
ATERAZAWA
SAGAE
KITA-IZUMI-DAKE
Toyo
Shinzeki
Yoshida-gawa
MATSUSHIMA (AUX)
Yamoto
Ono
WATANOHA
ONAGAWA
Onaga-wan
Ogai-saki
Kasagai
Eno-shima
Ashi
ISHIKURO-YAMA
KUMATAKA-YAMA
Oya
TAKADAMA
NAGASAKI
TENDO
OHOSHIRO-YAMA
Tomiya
MATSUSHIMA
SHIOGAMA
ISHINOMAKI
Yamashita
O-zaki
Oginohama
Kodai-shima
Samenoura-wan
Nobiru
ISHINOMAKI-WAN
Tomari
Kimigane-saki
Obara
Shionomachi
SUSERE-YAMA
Mijuku
YAMABE
Tani-gawa
Ogaku
SENDAI LINE
Nanakita
Rifu
Nanakita-gawa
Niyato-shima
Kayamo-saki
Katsura-shima
Karato-shima
NISHI-ASAHI-DAKE
ZUDONO-YAMA
Shirasawa
Iwakiri
Ayukawa
Kuwagata-saki
TASHIRO-SHIMA
Nitoda
Kiyo-saki
KINKAZAN
Awabiare
Kinkazan-seto
RAKAMI
Koage
WASHIGASU-YAMA
YAMAGATA
Baba
SENDAI
Tago
Shobudahama
Chobo-saki
Gamo
AJI-SHIMA
Kuro-saki
Inu-iso (Rock)
Monzen
OTAMA-YAMA
ABEGATATE-SAN
Kashiwakura
SHIRATAKA-YAMA
Hasedo
Oshirafu
Yumato
Ayukai
ARATO
Hango
Imajuku
KAWASAKI
Masuda
YURIAGE
SENDAI WAN
Miyanomae
SHIBAKURA-SAN
KAMINOYAMA
SAO-SAN
Funato
SANTAI-ZAN
Hawarazawa
Togatta
Matsu-kawa
MURATA
IWANUMA
Shimoseki
Kaname
NAGAI
Nakayama
AOSA-YAMA
BYOBU-TAKE
Sangenjaya
Arakawa
Ogum
MIYAUCHI
TSUKINOKI
Oishi
Tamakawa
KANA-YAMA-TOGE
AKAYU
Miya
OGAWARA
Arahama
Ohashi
Nijjuku
KOMATSU
TAKAHATA
NIIJUKU-TOGE
Seki
SHIROISHI
(Joins 378 C)



122°
30′
123°
30′
124°
42°
CHIN-CHOU
SHENG
CHINA
MANCHURIA
FENG-T'IEN
SHENG
KITA
SHEN-YANG
(Mukden)
FU-SHUN
AN-SHAN
Hsin-min
Liao-chung
Liao-yang
Pen-ch'i-hu
(Pen-ch'i-hsien)
Niu-chuang-ch'eng
Hai-ch'eng
Ying-k'ou
P'an-shan
Hei-shan
Kan Shan
Hei Shan
Pa-kua-ssu Shan
Hun Ho
T'ai tzu Ho
Liao Ho
Hun Ho
7°00′W (1943)
7°15′W (1943)
6°45′W (1943)
ANNUAL MAGNETIC CHANGE
41°
Sta
Ta-huang-tun
Meng-t'un
Lo-chia-t'un
Fang-shan-chen
Chin-chia-wo-p'eng
Wu-liang-tien
Hsiao-yang-kou
Keng-t'un
Ch'in-chia-t'un
Ssu-chien-fang
Kao-shan-tzu
Pa-chia-tzu
Lu-chia-tien
Hou-hui-tzu-wo-p'eng
Ssu-fang-tzu
Kao-wo-p'eng
La-la-t'un
Kao-p'ing
Tung-lien-hua-p'ao
Pa-chien-fang
Kuang-cheng-t'ai
Hsi-hsing-lung-t'ai
Hu-chia-chieh
San-shih-li-p'u
Ta-yang-chien-p'u
Chia-cheng-ssu
Sha-kang-tzu
Ta-fang-shen
Ch'ing-ma-ch'uan-tzu
Tien-chuang-t'ai
Ta-liao-ho
Ta-shih-ch'iao
Tung-lin-ho
Sha-ho
Shang-ma-t'un
Wu-chien-fang
Ta-shan-ling-pei-kou
Chu-chia-tien
Lung-feng-yü
Hsi-mu-ch'eng
Ch'a-kou
Chung-fang-liu-ho
Kang-t'ang-tun-tzu
Lin-chia-t'ai
Lin-chia-ho

MANCHURIA 1:500,000

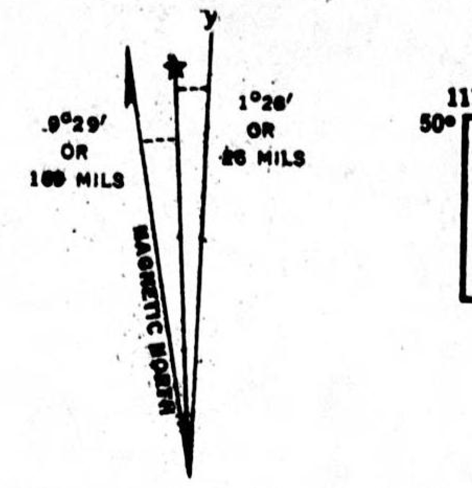
A. M. S. L401
First Edition 1943

Polyconic Projection
Contour Interval 100 Meters

FIFTY THOUSAND YARD WORLD POLYCONIC GRID, BAND IIIn, ZONE "D"
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

NOTE: OFFICERS USING THIS MAP WILL MARK HEREON CORRECTIONS AND ADDITIONS WHICH COME TO THEIR ATTENTION AND MAIL DIRECT TO THE CHIEF OF ENGINEERS, WASHINGTON, D. C.

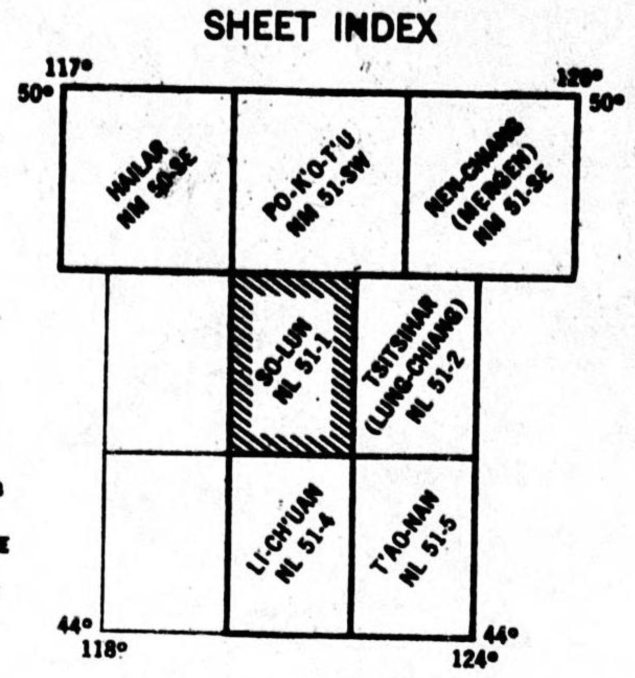
HEIGHTS IN METERS



APPROXIMATE MEAN DECLINATION 1943
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 4' INCREASE

Do not use diagram except to obtain numerical values of angles

SHEET INDEX



SO-LUN

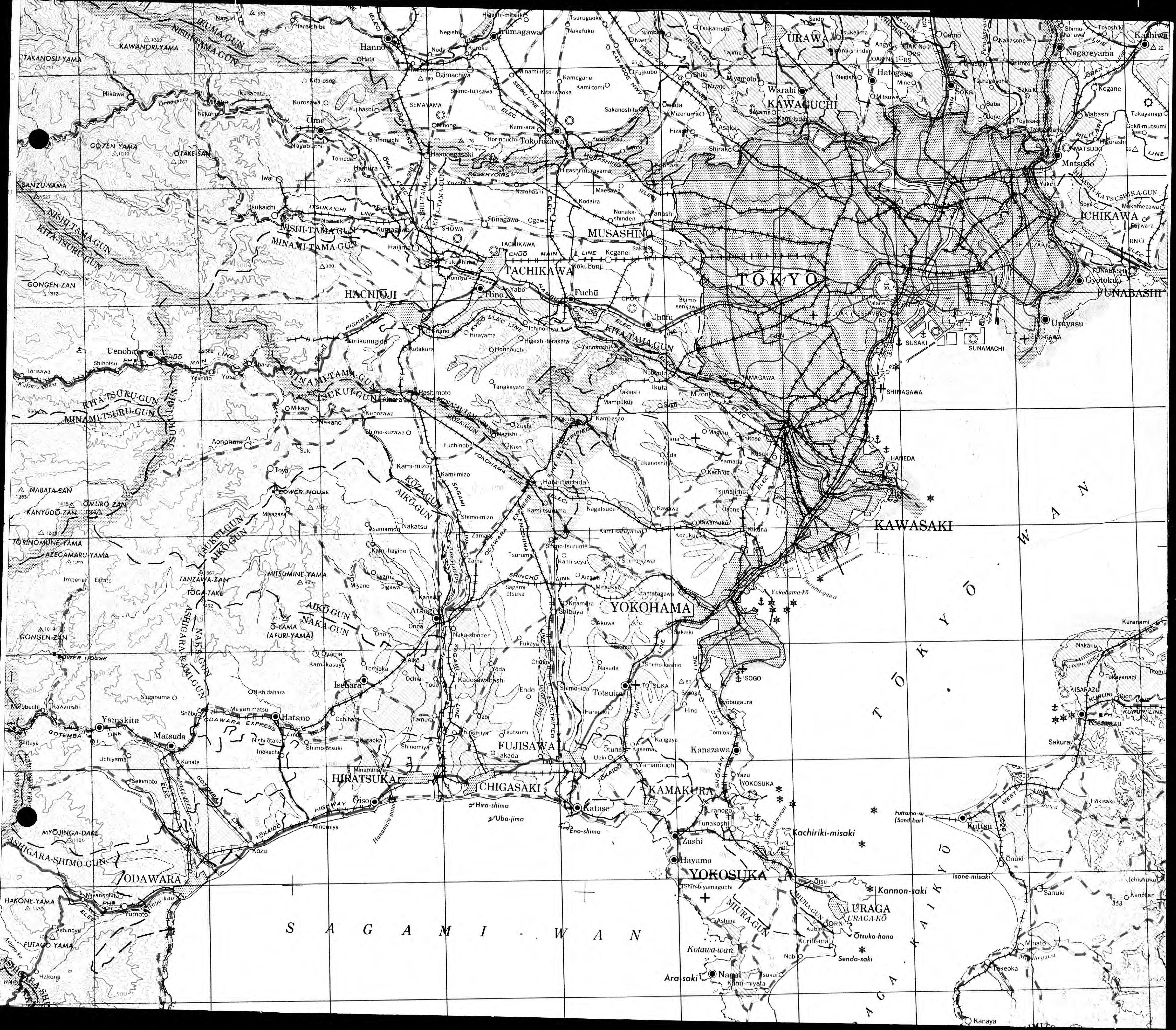
LEGEND

Population over 100,000 .... REDON
Population 25,000 to 100,000 .... REDONDIN
Population 10,000 to 25,000 .... Redondinha
Population 5,000 to 10,000 .... Redondinha
Population 1,000 to 5,000 .... Redondinha
Population less than 1,000 .... Redondinha
Roads: 1st class
Roads: 2nd class
Roads: 3rd class
Roads: 4th class
Trails
Railroads: Broad Gauge .... Single .... Double
Railroads: Narrow Gauge
Railroads: Standard Gauge .... Single .... Double
Railroads: Electric
Transmission Line
Telegraph and Telephone Lines .... T T T T T T
Boundaries: International
Boundaries: International Indefinite
Boundaries: Intercolonial
Boundaries: State, Province or Colony
Lines of Equal Magnetic Declination .... 4°E
Lighting Facilities at Field .... LF
Radio Station, Radio Beacon, Radio Direction Finder Station (with descriptive notes)
Located Object (with descriptive notes)
Spot Elevations (Natural Features) .... + 197
Spot Elevations (Cultural Features) 1955

	Field	Anchorage
Government, Army, Navy		
Municipal or Commercial		
Auxiliary or Emergency		
Unclassified		

GLOSSARY

Ho .... river
Lei-chih .... site of military wall
Shan .... mountain
Shan-mo .... range
Sheng .... province administrative division



TŌKYŌ
YOKOHAMA
KAWASAKI
YOKOSUKA
KAMAKURA
FUJISAWA
CHIGASAKI
HIRATSUKA
ODAWARA
HACHIOJI
TACHIKAWA
MUSASHINO
URAWA
KAWAGUCHI
ICHIKAWA
FUNABASHI
URAGA
S A G A M I - W A N
T Ō K Y Ō - W A N
Hannō
Ōme
Tokorozawa
Fuchū
Chōfu
Hino
Atsugi
Isehara
Hatano
Matsuda
Yamakita
Ōiso
Kōzu
Katase
Zushi
Hayama
Totsuka
Kanazawa
Kisarazu
Futtsu
Matsudo
Nagareyama
Urayasu
Gyōtoku
Sōka
Warabi
Hatogaya
Irumagawa
HANEDA
SHINAGAWA
SUSAKI
SUNAMACHI
Enoshima
Hira-shima
Uba-jima
Kannon-saki
Kachiriki-misaki
Futtsu-su (Sand bar)
Ara-saki
Kotawa-wan
Ōtsuka-hana
Senda-saki
URAGA-KŌ
Yokohama-kō
HAKONE-YAMA
FUTAGO-YAMA
MYŌJINGA-DAKE
ŌYAMA (AFURI-YAMA)
TANZAWA-ZAN
TŌGA-TAKE
MITSUMINE-YAMA
GONGEN-ZAN
TORINOMUNE-YAMA
AZEGAMARU-YAMA
NABATA-SAN
KANYŪDŌ-ZAN
ŌMURO-ZAN
GOZEN-YAMA
ŌTAKE-SAN
SANZU-YAMA
TAKANOSU-YAMA
KAWANORI-YAMA
NISHI-TAMA-GUN
MINAMI-TAMA-GUN
KITA-TAMA-GUN
KITA-TSURU-GUN
MINAMI-TSURU-GUN
TSUKUI-GUN
KŌZA-GUN
AIKŌ-GUN
NAKA-GUN
ASHIGARA-KAMI-GUN
ASHIGARA-SHIMO-GUN
MIURA-GUN
IRUMA-GUN
CHŪŌ MAIN LINE
TŌKAIDŌ
YOKOHAMA LINE
ODAWARA EXPRESS
GOTEMBA LINE
SAGAMI LINE
NAMBU LINE
MUSASHINO LINE
ŌME ELEC
ITSUKAICHI LINE
HIGHWAY
POWER HOUSE
RESERVOIRS

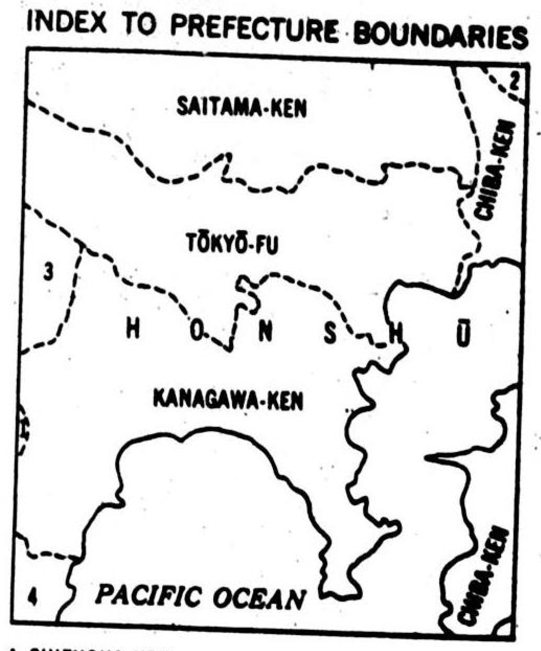
CENTRAL JAPAN 1:250,000

A. M. S. L571
First Edition (A M S 1) 1944

TŌKYŌ, CENTRAL JAPAN

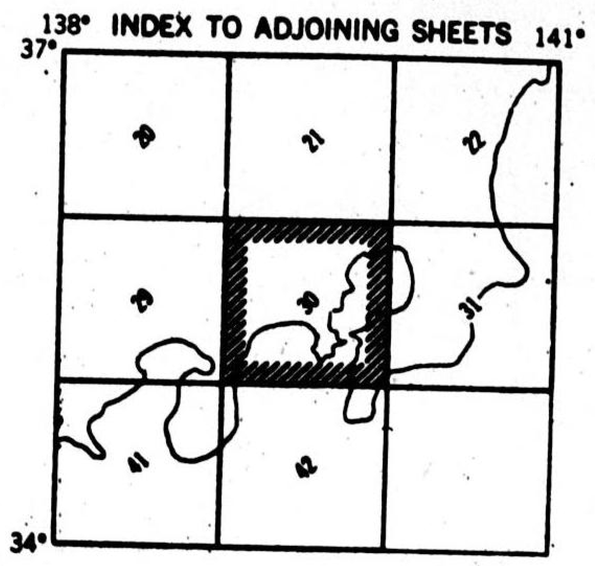
N3500-E13900/100

INDEX TO PREFECTURE BOUNDARIES

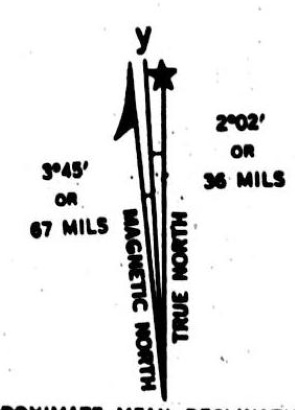


1 SHIZUOKA-KEN
2 IBARAKI-KEN
3 YAMANASHI-KEN
4 SHIZUOKA-KEN

INDEX TO ADJOINING SHEETS



Prepared under the direction of the Chief of Engineers, U. S. Army, by the Army Map Service (IN), U. S. Army Washington, D. C., 1944.
Compiled from the following sources:
Japan, 1:50,000, Japanese Imperial Land Survey, 1906–1938;
Japan, 1:200,000, Imperial Land Survey, Tōkyō, 1934; Yakosuka, 1935;
United States H. O. Chart 2734.
All place names transcribed according to the Modified Hepburn (Romaji) System.



APPROXIMATE MEAN DECLINATION 1943
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 3' INCREASE.

Use diagram only to obtain numerical values. To determine magnetic north line, connect the pivot point "P" on the south edge of the map with the value of the angle between GRID NORTH and MAGNETIC NORTH, as plotted on the degree scale at the north edge of the map.

LEGEND

Cities over 100,000 Population
" 20,000-100,000 "
" 5,000-20,000 "
Towns 1,000-5,000 "
Villages 1-1,000 "

Width
Primary Highways 24 ft. or more
Improved Roads 18 ft. to 24 ft.
Unimproved Roads 6 ft. to 18 ft.
Trails under 6 ft.
Boundary: Ken (Prefecture)
Boundary: Gun (County), Shi
Lighthouses or Lights
Rice
Radio Broadcasting Stations RS
Other Radio Stations RN

Railroads: Standard Gauge 3'6"
Double Track
Single Track, Station
Railroads: Narrow Gauge and Light
Single or Double Track
Topographic Control Points
Triangulation Points
Elevations × 155
Inaccessible Coast

Aeronautical Information (Field / Anchorage)
Government, Army, Navy
Municipal or Commercial
Auxiliary or Emergency
Unclassified

Road classification is not based on reconnaissance. Reliability uncertain.

GLOSSARY

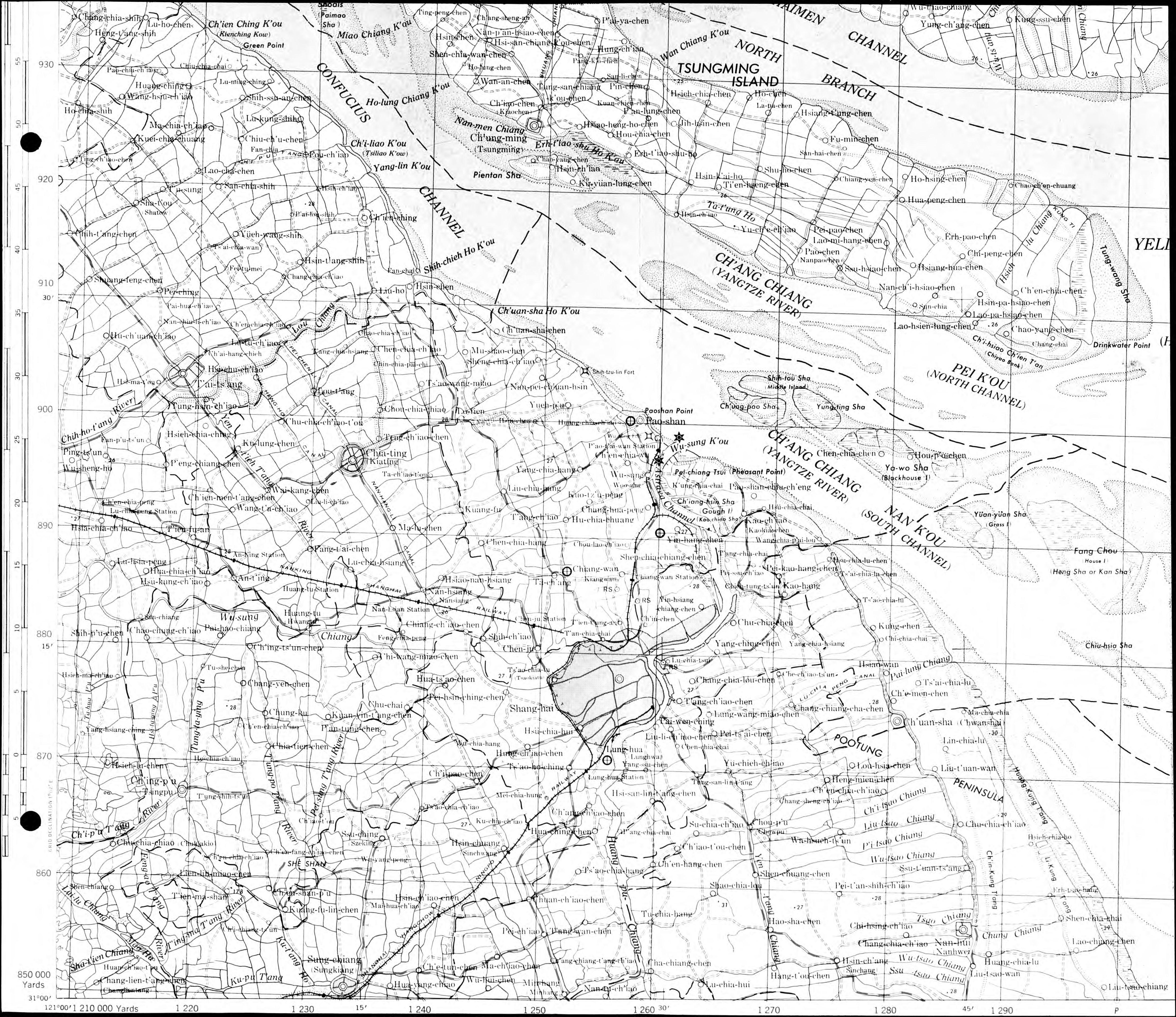
- -bana .... point
- -dake .... mountain
- -daki .... waterfall
- -fuji .... mountain
- -gawa .... river
- -gun .... county
- -guntō .... archipelago
- -hama .... beach
- -hana .... point
- -iwa .... rock
- -jima .... island
- -kai .... bay, gulf, sea
- -kaikyō .... strait
- -kawa .... river
- -ken .... prefecture
- -ko .... lake
- -kō .... harbor
- -mine .... mountain
- -misaki .... cape
- -mori .... forest, mountain
- -nada .... sea
- -numa .... lake, pond
- -rettō .... island chain
- -saki .... cape
- -sammyaku .... mountain range
- -san .... mountain
- -sawa .... swamp, stream
- -se .... shoals, rapids
- -seto .... strait
- -shima .... island
- -shotō .... island group
- -suidō .... channel
- -take .... mountain
- -taki .... waterfall
- -tō .... island
- -tōge .... mountain pass
- -umi .... bay, gulf
- -ura .... inlet, beach
- -wan .... bay
- -yama .... mountain
- -zaki .... cape
- -zan .... mountain
- -zawa .... swamp, stream

CONTOUR INTERVAL 100 METERS

POLYCONIC PROJECTION

TEN THOUSAND YARD WORLD POLYCONIC GRID BAND IIIN., ZONE "A"
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

HEIGHTS IN METERS



TSUNGMING ISLAND
NORTH BRANCH CHANNEL
CONFUCIUS CHANNEL
CH'ANG CHIANG (YANGTZE RIVER)
PEI K'OU (NORTH CHANNEL)
NAN K'OU (SOUTH CHANNEL)
POOTUNG PENINSULA
Ch'ung-ming (Tsungming)
Nan-men Chiang
Pientan Sha
Ch'ien Ching K'ou (Kienching Kow)
Green Point
Miao Chiang K'ou
Ho-lung Chiang K'ou
Ch'i-liao K'ou (Tsiliao K'ow)
Yang-lin K'ou
Wan Chiang K'ou
Shih-chieh Ho K'ou
Ch'uan-sha Ho K'ou
Shih-t'ou Sha
Middle Island
Ch'ung-pao Sha
Yung-ting Sha
Paoshan Point
Pao-shan
Wu-sung K'ou
Pei-chiang Tsui (Pheasant Point)
Ya-wo Sha (Blockhouse I)
Yüan-yüan Sha (Grass I)
Fang Chou House I (Heng Sha or Kan Sha)
Ch'i-hsiao Ch'ien T'an (Chiyao Bank)
Drinkwater Point
Chiu-hsia Sha
Tung-wang Sha
T'ai-ts'ang
Chia-ting (Kiating)
Shang-hai
Lung-hua (Lunghwa)
Chiang-wan (Kiangwan)
Ch'uan-sha (Chwansha)
Ch'ing-p'u (Tsingpu)
Sung-chiang (Sungkiang)
SHE SHAN
Liu Chiang
Wu-sung Chiang
Huang-p'u Chiang
Chih-ho-t'ang River
Nan-hui (Nanhwei)
NANKING SHANGHAI RAILWAY
SHANGHAI HANGCHOW NINGPO RAILWAY
930
920
910
900
890
880
870
860
850 000 Yards
31°00'
121°00'
1 210 000 Yards
1 220
1 230
1 240
1 250
1 260
1 270
1 280
1 290

CHINA PROPER, S.E. 1:250,000

MAP - 11

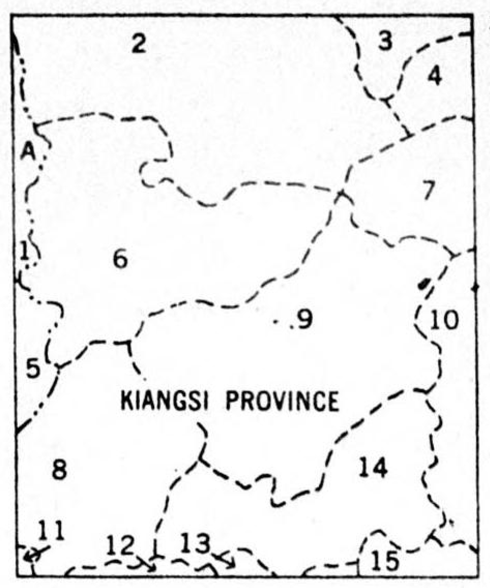
A. M. S. L581

First Edition (A M S 1) 1944

SHANG-KAO, CHINA

N2800-E11400/100

INDEX TO BOUNDARIES

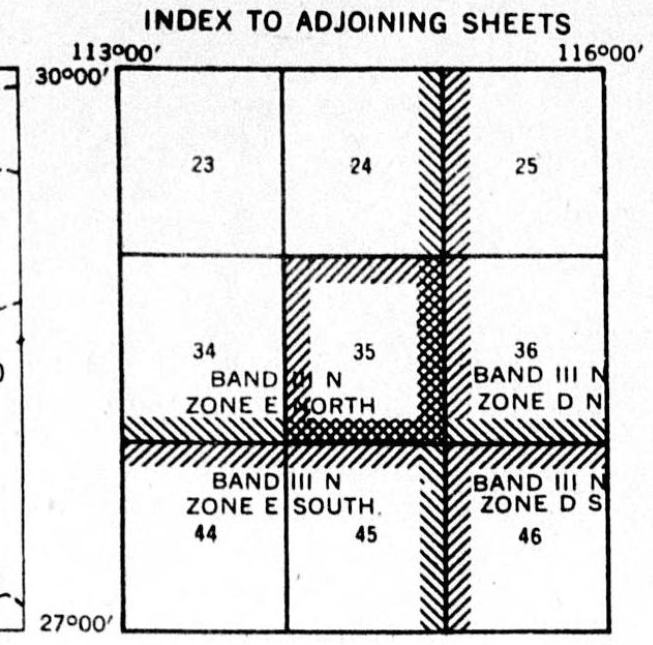


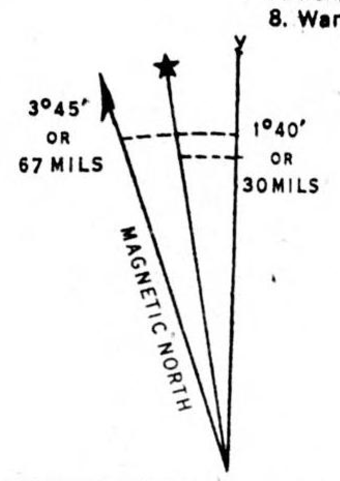
A. HUNAN PROVINCE

HSIENS

1. P'ing-chiang
2. Hsiu-shui
3. Wu-ning
4. Ching-an
5. Liu-yang
6. T'ung-ku
7. Feng-hsin
8. Wan-tsai
9. I-feng
10. Kao-an
11. I-ch'un
12. Chin
13. Fen-i
14. Shang-kao
15. Hsin-yu

INDEX TO ADJOINING SHEETS





APPROXIMATE MEAN DECLINATION 1944
FOR CENTER OF SHEET
NO ANNUAL MAGNETIC CHANGE

Use diagram only to obtain numerical values. To determine magnetic north line, connect the pivot point "P" on the south edge of the map with the value of the angle between GRID NORTH and MAGNETIC NORTH, as plotted on the degree scale at the north edge of the map.

POLYCONIC PROJECTION

TEN THOUSAND YARD WORLD POLYCONIC GRID. BAND IIIN. ZONE "E"
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

To convert grid coordinates from Zone "E" North to Zone "E" South add 2,904,667.2 yards to the northings.

NOTE: OFFICERS USING THIS MAP WILL MARK HEREON CORRECTIONS AND ADDITIONS WHICH COME TO THEIR ATTENTION AND MAIL DIRECT TO THE CHIEF OF ENGINEERS, WASHINGTON, D. C.

The data upon which this map is based is unreliable both as to position and detail

Spot elevations are from 100 to 400 meters too high; use with caution.

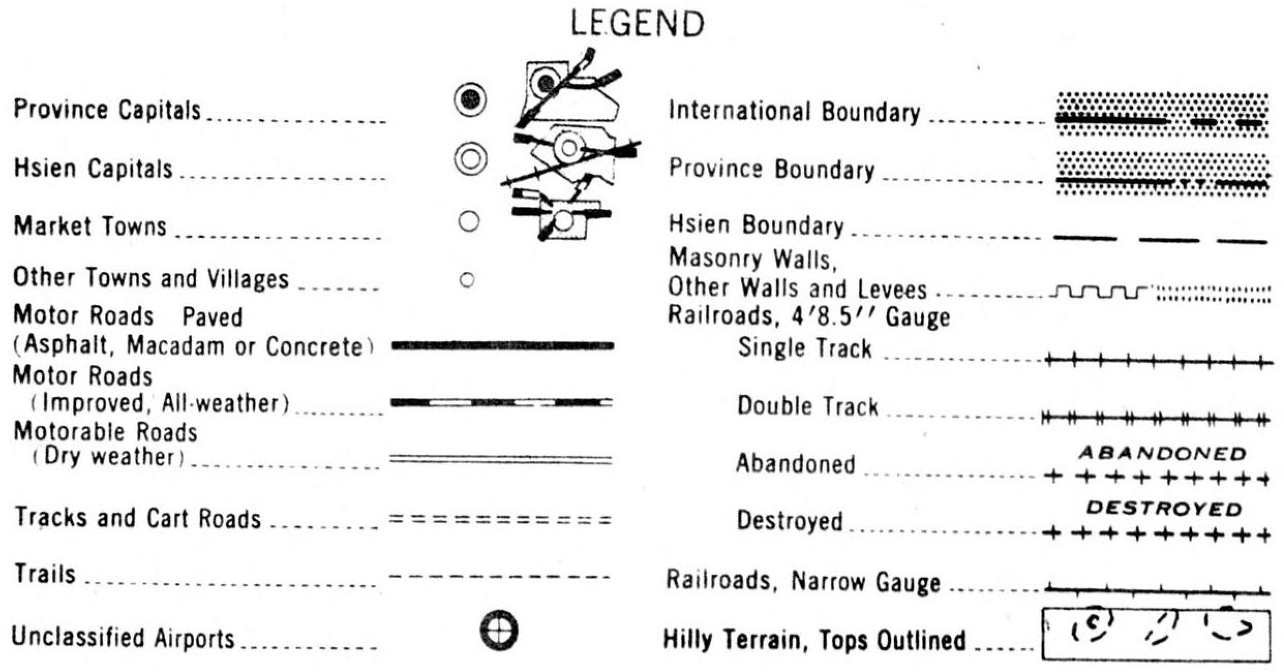
Road classification is NOT based on reconnaissance.

HEIGHTS IN METERS

Prepared under the direction of the Chief of Engineers, U. S. Army, by the Army Map Service (LU), U. S. Army, Washington, D. C., 1944.
Compiled from Chinese General Staff Land Survey Maps, 1:100,000, (1930-32).
Road classification based on Asia Transportation Map, 1:2,000,000 A.M.S. 1943.

Chinese place names are transliterated according to the modified Wade-Giles System

LEGEND



GLOSSARY

Ao	pass, hill, mountain, ravine
Chang	mountain
Ch'i	stream, river, lake
Chiang	river, harbor, port, bay, lagoon, inlet
Chiao	cape, rock
Ch'iao	bridge
Chien	mountain, hill, stream
Ch'ih	lake
Ching	stream, canal
Chou	island
Ch'uan	stream, river
Feng	mountain, hill
Hai	sea, bay
Ho	river, canal, stream
Hsia	gorge
Hsü	island
Hu	lake
Kang	mountain, hill
K'eng	ravine
Kou	stream, canal
K'ou	mouth (of river), opening, inlet
Kuan	pass, barrier
Lieh-tao	island group
Ling	mountain, pass, hill
Men	gate, channel
P'ao-t'ai	fort
P'u	creek
Sha	sand, sandbank, sand island
Shan	mountain, hill, island
Shih	rock
Shui	river, stream
Ssu	monastery, temple
T'a	pagoda
T'an	lake, sandbank, flats, rapids
Tang	lake
T'ang	pond, canal, lake, dyked-in land, dyke
Tao	island
Ti	dyke
Ting	mountain, hill
Tsui	point
T'ou	promontory, headlands
Tu, Tu-k'ou	ferry
Tung	mountain, hollow, valley
Wa	hollow, pass
Wan	bay
Yai	pass, defile
Yang	sea, channel
Yen	mountain
Yen-ch'ang	salt works
Yüan	lake, stream

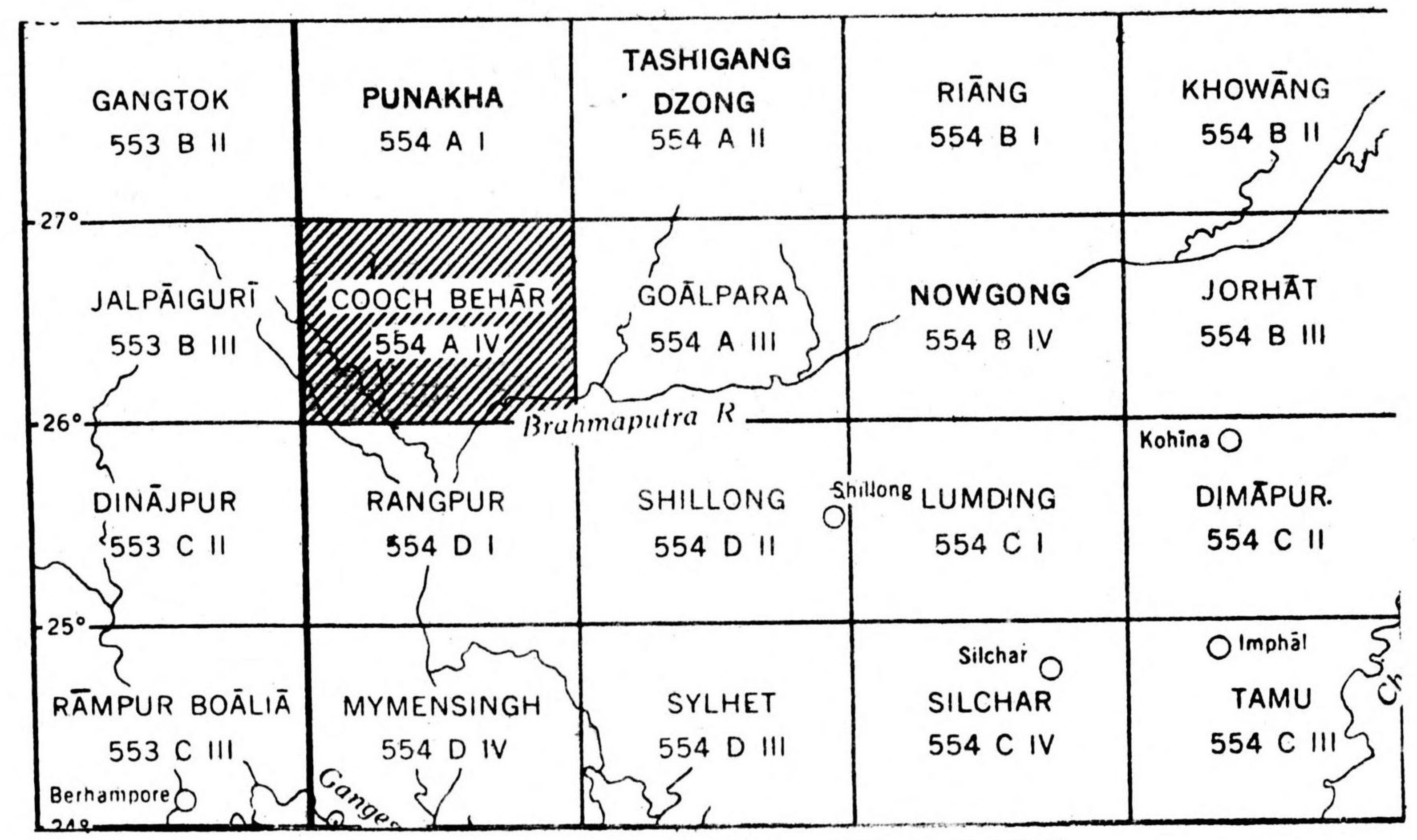
AAF AERONAUTICAL APPROACH CHART

Each Approach Chart is a component part of a Pilotage Chart. The World Pilotage Chart Index, Scale of Series 1:1,000,000, forms the basis for the limits and numbering of the Approach Charts, Scale 1:250,000.

Lambert Conformal Conic Projection
Standard Parallels 7° and 20° Scale 1:250,000

MAP - 12

MAP - 13 RELIEF



AIRPORTS UNCLASSIFIED — NAME 205

ARMY OR NAVY AIRPORT — NAME 205

COMMERCIAL OR MUNICIPAL AIRPORT — NAME 205

MILITARY AND CIVIL AIRPORT — NAME 205

CIVIL AERONAUTICS ADMINISTRATION INTERMEDIATE AIRPORT — NAME 205

EMERGENCY AIRPORT (NO FACILITIES) — NAME 151

SEAPLANE BASE (WITH COMPLETE FACILITIES) — NAME

SEAPLANE ANCHORAGE (WITH REFUELING & LIMITED FACILITIES)

PROTECTED ANCHORAGE (NO FACILITIES)

ROTATING BEACON (WITH FLASHING CODE BEACON)

ROTATING BEACON (WITH COURSE LIGHTS) — 25.—.

FLASHING CODE BEACON

FLASHING BEACON

OBSTRUCTION (CENTER OF SYMBOL MARKS LOCATION, NUMERALS INDICATE HEIGHT ABOVE GROUND IN FEET) — 205

MOORING MAST (WHEN AT FIELD ATTACH TO TOP OF FIELD SYMBOL)

LIGHTSHIP

NIGHT LIGHTING FACILITIES (PLACE NEAR FIELD SYMBOL) — LF

MARINE NAVIGATION LIGHT (WITH CHARACTERISTIC) — Occ W&G

LINES OF EQUAL MAGNETIC DECLINATION — 22° W

CIVIL AIRWAY (DESIGNATION OF LIMITS) — AMBER AIRWAY NO. 5 (airway traffic controlled)

AIRSPACE RESERVATION DANGER ZONE — AIRSPACE RESERVATION DANGER ZONE

FAN MARKER — WINSTON

RADIO MARKER BEACON — 359 H•••• KNOXVILLE RADIO 278

RADIO MARKER BEACON — 379 and 209 I•• NEW FLORENCE RADIO 278

RADIO RANGE NOTE (AT BORDER) — To Big Springs 326 BZ

RADIO RANGE (WITHOUT VOICE) — 206 AP. A N N A 324° 144° 208° 28° 307° 127°

RADIO BROADCASTING STATION — SALEM KFBB RS

AIRPORT CONTROL TOWER — BIGGS FIELD TOWER 396

RADIO RANGE (WITH VOICE) — 391 LN LEBO RADIO 278

RADIO RANGE (SIMULTANEOUS) — WHITEHALL RADIO 284 WW Weather 20m 43m 48m

RADIO DIRECTION FINDER STATION — ALGOA KFOB RC

MARINE RADIOBEACON — 278 Operates 0m-10m & 30m-40m each hour Rbn

RADIO NAVIGATIONAL STATION — Dante ISP

RADIO NAVIGATIONAL STATION WITH RADIOBEACON — Rbn Geneva WJY

RADIO NAVIGATIONAL STATION WITH DIRECTION FINDER FACILITY — Rc Chicago WOR

CONTROL ZONE OF INTERSECTION — CONTROL ZONE OF INTERSECTION

HYDROGRAPHIC FEATURES

RIVERS, STREAMS, LAKES, COASTLINES

RIVERS, STREAMS (INTERMITTENT)

RIVERS, STREAMS, LAKES, COASTLINES (UNSURVEYED)

RAPIDS AND FALLS

CANALS

DRAINAGE DITCHES

SPRINGS

WELLS AND WATER HOLES

RESERVOIRS

INTERMITTENT LAKE

GLACIERS

SALT PONDS

SWAMPS & MARSHES

TOPOGRAPHIC FEATURES

PROMINENT PEAKS AND RIDGES

SAND AREAS

DEPRESSION CONTOURS

HACHURES FOR SPOT ELEVATIONS

CONTOURS (5000)

SAND DUNES

CLIFFS AND BLUFFS

HIGHWAYS AND ROADS

DEPENDABLE HARD-SURFACE, HEAVY DUTY ROAD

SECONDARY HARD-SURFACE, ALL WEATHER ROAD.

LOOSE-SURFACE GRADED, DRY WEATHER ROAD.

UNIMPROVED ROAD, CART TRACK.

TRAIL, NOT SUITABLE FOR MILITARY VEHICLES.

CULTURAL AND MISCELLANEOUS SYMBOLS

STATE AND INTERNATIONAL BOUNDARIES

TUNNELS

RAILROADS (SINGLE TRACK) — Crossties 1.25 mi. apart

RAILROADS (DOUBLE TRACK)

TRANSMISSION LINES (OMIT IN CITIES) — Poles 2 miles apart

TELEGRAPH & TELEPHONE LINES (OPEN COUNTRY ONLY) — Poles 1 mile apart

BRIDGES

1 FATHOM LINE

REEFS AND SHOALS

MINES AND QUARRIES

FORTS

DAMS

MOUNTAIN PASSES

OIL WELLS

OIL TANKS

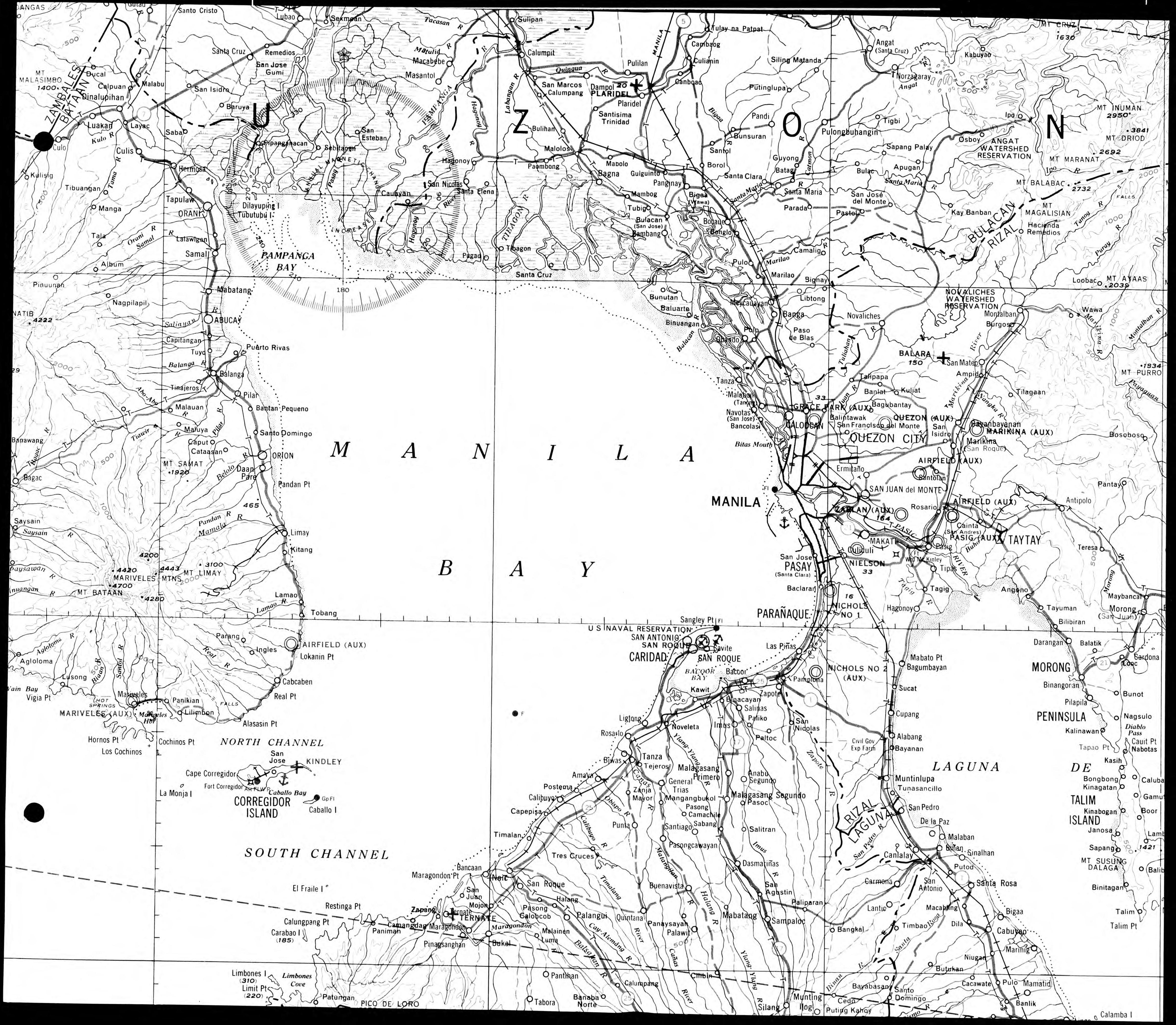
LOCATED STATION (NAME OR DESCRIPTION)

SPOT ELEVATIONS — .5487

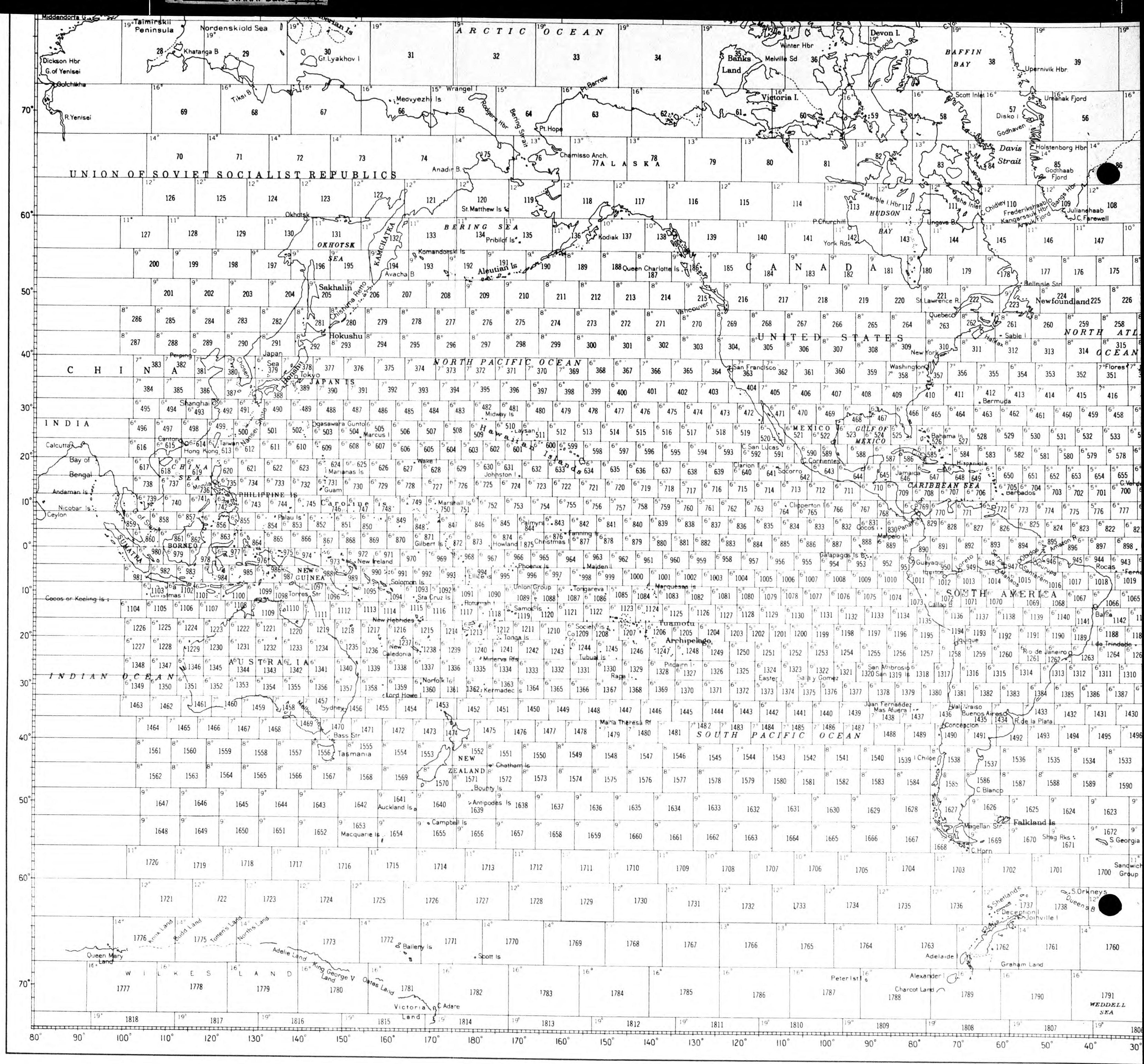
LEVEE

CITIES AND TOWNS

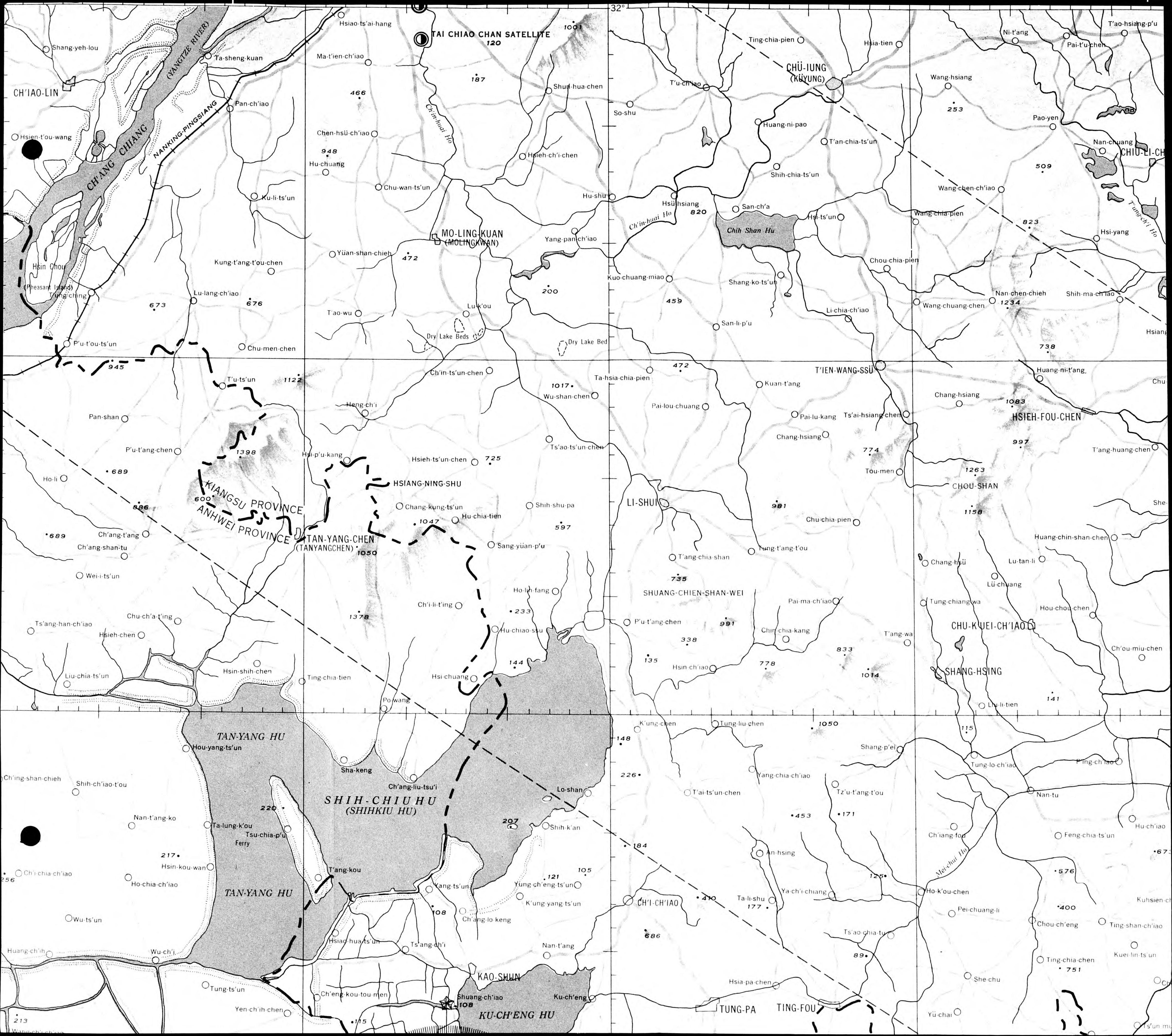
(WHERE CITY OUTLINE IS KNOWN)		(WHERE CITY OUTLINE IS NOT KNOWN)
	LARGE CITIES	
	CITIES	
	CITIES	
	CITIES	
	TOWNS	
	VILLAGES & STATIONS	

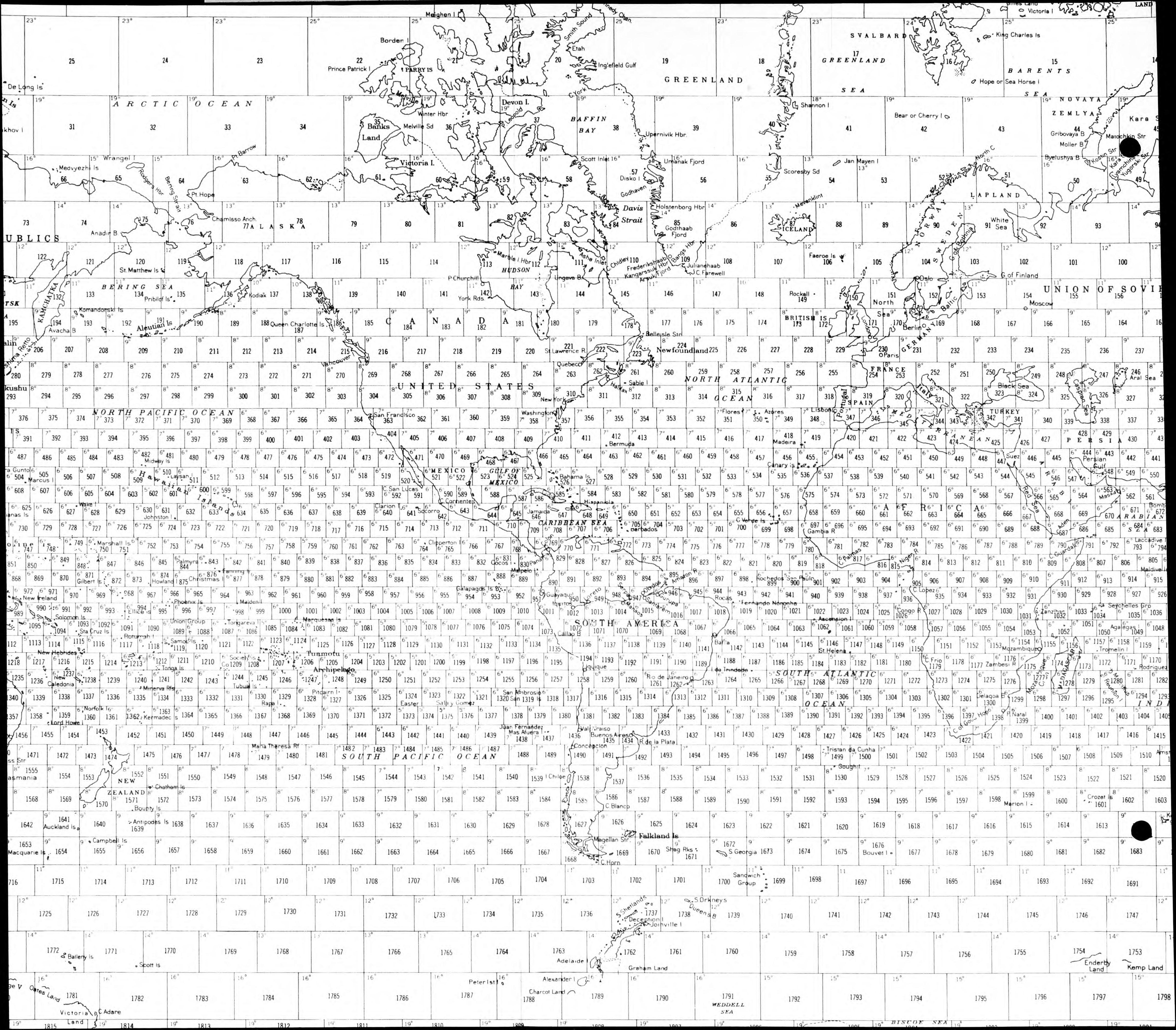


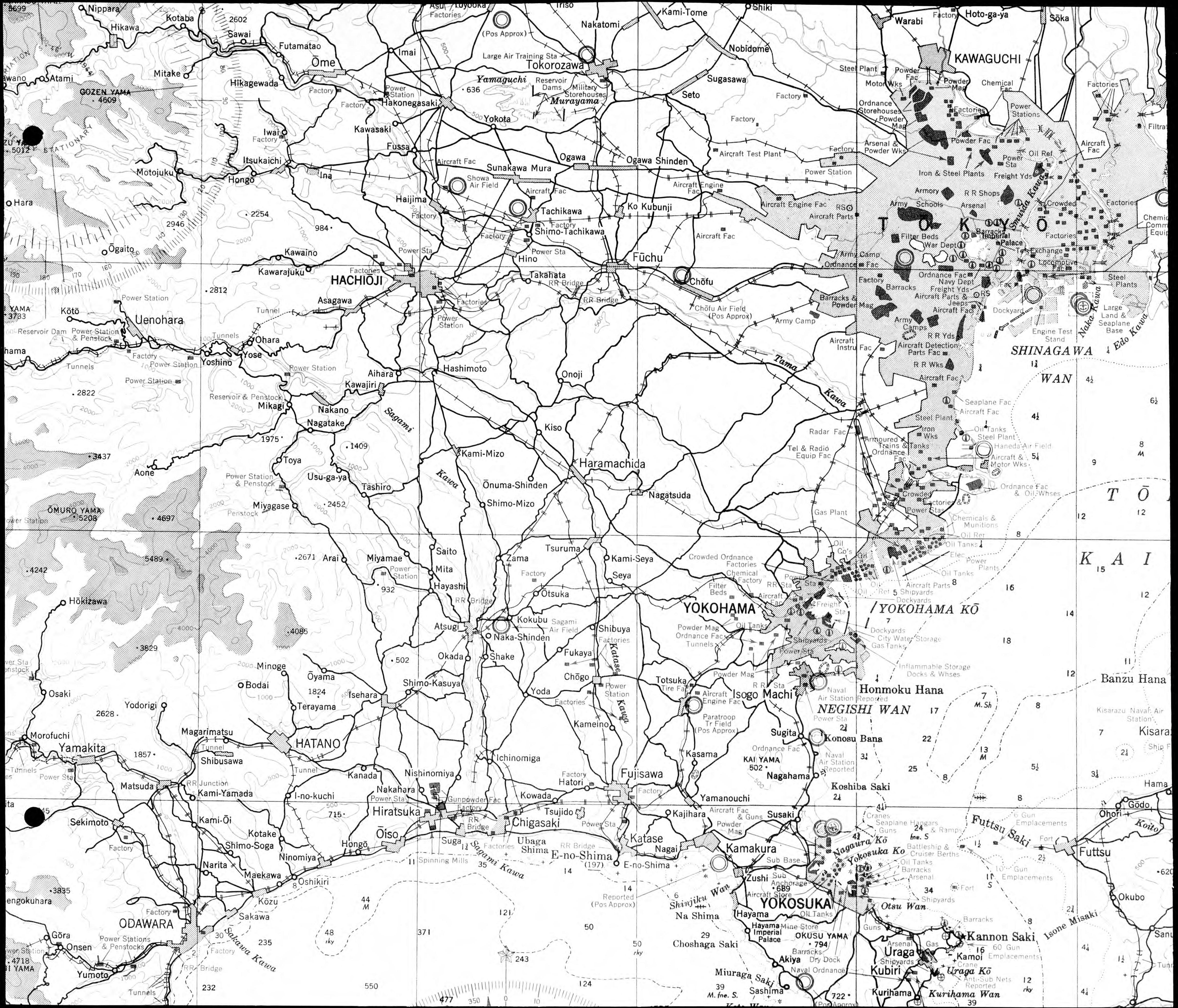
L U Z O N
M A N I L A
B A Y
PAMPANGA BAY
MANILA
QUEZON CITY
PASAY
PARAÑAQUE
CALOOCAN
MAKATI
NORTH CHANNEL
SOUTH CHANNEL
CORREGIDOR ISLAND
Cape Corregidor
Fort Corregidor
Caballo Bay
Caballo I
La Monja I
KINDLEY
San Jose
Hornos Pt
Los Cochinos
Cochinos Pt
MARIVELES (AUX)
Mariveles
MARIVELES MTNS
MT BATAAN
4700
MT LIMAY
MT SAMAT
1920
MT MALASIMBO
1400
ZAMBALES
BATAAN
Dinalupihan
Hermosa
Orani
Samal
Abucay
Balanga
Pilar
Orion
Limay
Lamao
Tobang
AIRFIELD (AUX)
Lokanin Pt
Cabcaben
Real Pt
Alasasin Pt
Bagac
Saysain
Sulipan
Calumpit
Malolos
Plaridel
Hagonoy
Bulacan
Bocaue
Marilao
Meycauayan
Polo
Obando
Malabon
Navotas
Bitas Mouth
Tanza
Angat
Norzagaray
Santa Maria
San Jose del Monte
ANGAT WATERSHED RESERVATION
NOVALICHES WATERSHED RESERVATION
Novaliches
BULACAN
RIZAL
MT INUMAN
2950
MT ORIOD
MT MARANAT
MT BALABAC
MT MAGALISIAN
MT AYAAS
MT PURRO
MT CRUZ
Montalban
Burgos
BALARA
San Mateo
Marikina
MARIKINA (AUX)
GRACE PARK (AUX)
QUEZON (AUX)
AIRFIELD (AUX)
SAN JUAN del MONTE
ZABLAN (AUX)
Rosario
Cainta
Pasig
PASIG (AUX)
TAYTAY
Antipolo
Teresa
Morong
MORONG
Binangonan
PENINSULA
NIELSON
NICHOLS NO 1
NICHOLS NO 2 (AUX)
Taguig
Pateros
Tipas
Baclaran
Las Piñas
US NAVAL RESERVATION
Sangley Pt
SAN ANTONIO
SAN ROQUE
CARIDAD
Cavite
BACOOR BAY
Bacoor
Kawit
Imus
Noveleta
Rosario
Tanza
Ligtong
General Trias
Malagasang Primero
Malagasang Segundo
Dasmariñas
Silang
Naic
Maragondon
TERNATE
Restinga Pt
Calungpang Pt
Carabao I
El Fraile I
Limbones I
Limit Pt
PICO DE LORO
Patungan
Muntinlupa
Alabang
Cupang
Sucat
LAGUNA
DE
BAY
TALIM ISLAND
MT SUSUNG DALAGA
San Pedro
Biñan
Santa Rosa
Cabuyao
Carmona
Calamba
Mamatid
Pulo
Banlik



WORLD PILOTAGE CHART INDEX


32°
TAI CHIAO CHAN SATELLITE
Hsiao-ts'ai-hang
Shang-yeh-lou
Ta-sheng-kuan
CH'IAO-LIN
CH'ANG CHIANG
(YANGTZE RIVER)
NANKING-PINGSIANG
Pan-ch'iao
Hsien-t'ou-wang
Ma-t'ien-ch'iao
Chen-hsü-ch'iao
Hu-chuang
Chu-wan-ts'un
Ch'in-huai Ho
Shun-hua-chen
Hsieh-ch'i-chen
Ku-li-ts'un
Hsin Chou
(Pheasant Island)
T'ung-ch'ing
Kung-t'ang-t'ou-chen
Lu-lang-ch'iao
P'u-t'ou-ts'un
Chu-men-chen
MO-LING-KUAN
(MOLINGKWAN)
Yüan-shan-chieh
T'ao-wu
Lu-k'ou
Dry Lake Beds
Dry Lake Bed
Yang-pan-ch'iao
Hu-shu
Kuo-chuang-miao
Ting-chia-pien
Hsia-tien
CHÜ-IUNG
(KÜYUNG)
T'u-ch'iao
So-shu
Huang-ni-pao
T'an-chia-ts'un
Shih-chia-ts'un
Hsü-hsiang
San-ch'a
Chih Shan Hu
Hsi-ts'un
Shang-ko-ts'un
Li-chia-ch'iao
San-li-p'u
Ni-t'ang
T'ao-hsiang-p'u
Pai-t'u-chen
Wang-hsiang
Pao-yen
Nan-chuang
CHIU-LI-CH
Wang-chen-ch'iao
Wang-chia-pien
T'ang-ch'i Ho
Hsi-yang
Chou-chia-pien
Nan-chen-chieh
Shih-ma-ch'iao
Wang-chuang-chen
Hsiang
T'IEN-WANG-SSÜ
Huang-ni-t'ang
T'u-ts'un
Ch'in-ts'un-chen
Ta-hsia-chia-pien
Wu-shan-chen
Kuan-t'ang
Pai-lou-chuang
Pan-shan
Heng-ch'i
Pai-lu-kang
Ts'ai-hsiang-chen
Chang-hsiang
HSIEH-FOU-CHEN
Chang-hsiang
P'u-t'ang-chen
Ts'ao-ts'un-chen
Hsi-p'u-kang
Hsieh-ts'un-chen
T'ang-huang-chen
Tou-men
Ho-li
HSIANG-NING-SHU
CHOU-SHAN
KIANGSU PROVINCE
ANHWEI PROVINCE
Chang-kung-ts'un
Shih-shu-pa
LI-SHUI
Hu-chia-tien
Chu-chia-pien
TAN-YANG-CHEN
(TANYANGCHEN)
Ch'ang-t'ang
Ch'ang-shan-tu
Sang-yüan-p'u
T'ang-chia-shan
Tung-t'ang-t'ou
Huang-chin-shan-chen
Chang-hsü
Lu-tan-li
Lü-chuang
Wei-i-ts'un
SHUANG-CHIEN-SHAN-WEI
Ho-lin-fang
Pai-ma-ch'iao
Tung-chiang-wa
Hou-chou-chen
Ch'i-li-t'ing
Chu-ch'a-t'ing
P'u-t'ang-chen
Chin-chia-kang
T'ang-wa
CHU-KUEI-CH'IAO
Ts'ang-han-ch'iao
Hsieh-chen
Hu-chiao-ssu
Ch'ou-miu-chen
Hsin-shih-chen
Hsin-ch'iao
SHANG-HSING
Liu-chia-ts'un
Ting-chia-tien
Hsi-chuang
Po-wang
Liu-li-tien
K'ung-chen
Tung-liu-chen
TAN-YANG HU
Hou-yang-ts'un
Shang-p'ei
Tung-lo-ch'iao
P'ing-ch'iao
Ch'ing-shan-chieh
Shih-ch'iao-t'ou
Sha-keng
Ch'ang-liu-tsu'i
Yang-chia-ch'iao
Lo-shan
T'ai-ts'un-chen
Tz'u-t'ang-t'ou
Nan-tu
SHIH-CHIU HU
(SHIHKIU HU)
Nan-t'ang-ko
Ta-lung-k'ou
Tsu-chia-p'u
Ferry
Shih-k'an
Hu-ch'iao
Ch'iang-fou
Feng-chia-ts'un
An-hsing
Hsin-kou-wan
Ch'i-chia-ch'iao
Ho-chia-ch'iao
T'ang-kou
Yang-ts'un
Yung-ch'eng-ts'un
Mei-chui Ho
Ya-ch'i-chiang
Ho-k'ou-chen
TAN-YANG HU
K'ung-yang-ts'un
CH'I-CH'IAO
Ta-li-shu
Kuhsien-ch
Pei-chuang-li
Ch'ang-lo-keng
Wu-ts'un
Chou-ch'eng
Ting-shan-ch'iao
Ts'ao-chia-tu
Hsiao-hua-ts'un
Ts'ang-ch'i
Huang-ch'ih
Wu-ch'i
Nan-t'ang
Kuei-lin-ts'un
Ting-chia-chen
KAO-SHUN
She-chu
Tung-ts'un
Hsia-pa-chen
Ch'eng-kou-tou-men
Shuang-ch'iao
Ku-ch'eng
Yen-ch'ih-chen
KU-CH'ENG HU
TUNG-PA
TING-FOU
Yü-chai
Wang-chia-ch'iao
T'sun-miu


ARCTIC OCEAN
GREENLAND
GREENLAND SEA
SVALBARD
BARENTS SEA
NOVAYA ZEMLYA
BAFFIN BAY
Davis Strait
ICELAND
LAPLAND
ALASKA
BERING SEA
KAMCHATKA
HUDSON BAY
CANADA
UNITED STATES
NORTH ATLANTIC OCEAN
NORTH PACIFIC OCEAN
MEXICO
GULF OF MEXICO
CARIBBEAN SEA
Hawaiian Islands
FRANCE
SPAIN
Portugal
GERMANY
SWEDEN
NORWAY
Italy
MEDITERRANEAN
TURKEY
Black Sea
PERSIA
ARABIA
ARABIAN SEA
AFRICA
UNION OF SOVIE
SOUTH AMERICA
SOUTH ATLANTIC OCEAN
SOUTH PACIFIC OCEAN
Tuamotu Archipelago
NEW ZEALAND
Falkland Is
WEDDELL SEA
Graham Land
Kemp Land



Nippara
Hikawa
Kotaba
Sawai
Futamatao
Ōme
Imai
Tokorozawa
Large Air Training Sta
Nakatomi
Kami-Tome
Shiki
Nobidome
Warabi
Hoto-ga-ya
Sōka
KAWAGUCHI
Atami
Mitake
Hikagewada
GOZEN YAMA
4609
Yamaguchi
Murayama
Reservoir Dams
Military Storehouses
Sugasawa
Seto
Steel Plant
Powder Fac
Powder Mag
Chemical Fac
Motor Wks
Ordnance Storehouses
Hakonegasaki
Power Station
Factory
Yokota
Kawasaki
Iwai
Fussa
Itsukaichi
Motojuku
Hongō
Ina
Aircraft Fac
Sunakawa Mura
Showa Air Field
Ogawa
Ogawa Shinden
Aircraft Test Plant
Arsenal & Powder Wks
Power Stations
Iron & Steel Plants
Oil Ref
Freight Yds
Aircraft Engine Fac
Haijima
Tachikawa
Shimo-Tachikawa
Ko Kubunji
Aircraft Parts
Armory
Army Schools
Arsenal
R R Shops
Crowded
Factories
Hara
2254
2946
984
Ōgaito
Kawaino
Kawarajuku
HACHIŌJI
Hino
Power Sta
Fūchu
Chōfu
Takahata
RR Bridge
T O K Y Ō
Filter Beds
War Dept
Barracks
Imperial Palace
Tel Exchange
Locomotive
Army Camp
Ordnance Fac
Navy Dept
Freight Yds
Aircraft Parts & Jeeps
Steel Plants
Large Land & Seaplane Base
Dockyard
Engine Test Stand
Naka Kawa
Edo Kawa
Asagawa
Chōfu Air Field (Pos Approx)
Barracks & Powder Mag
Army Camps
Aircraft Detection Parts Fac
R R Yds
R R Wks
Aircraft Instru Fac
SHINAGAWA WAN
Kōtō
Uenohara
Reservoir Dam
Power Station & Penstock
Tunnels
Ohara
Yose
Yoshino
2812
Hashimoto
Aihara
Kawajiri
Onoji
Tama Kawa
Seaplane Fac
Steel Plant
2822
Reservoir & Penstock
Mikagi
Nakano
Nagatake
Sagami Kawa
Kiso
Radar Fac
Armoured Trains & Tanks
Ordnance Fac
Oil Tanks
Haneda Air Field
Aircraft & Motor Wks
1975
1409
Toya
3437
Aone
Usu-ga-ya
Tashiro
Kami-Mizo
Haramachida
Ōnuma-Shinden
Shimo-Mizo
Nagatsuda
Tel & Radio Equip Fac
Ordnance Fac & Oil Whses
T Ō
Power Station & Penstock
Miyagase
2452
ŌMURO YAMA
5208
4697
Gas Plant
Chemicals & Munitions
Oil Ref
Elec Power Plants
K A I
4242
5489
2671
Arai
Miyamae
Saito
Mita
Hayashi
Zama
Tsuruma
Kami-Seya
Seya
Crowded Ordnance Factories
Chemical Factory
Filter Beds
Ōtsuka
Aircraft Parts
Shipyards
Dockyards
YOKOHAMA
YOKOHAMA KŌ
Hōkizawa
4085
932
RR Bridge
Atsugi
Kokubu
Sagami Air Field
Naka-Shinden
Shibuya
Powder Mag
Ordnance Fac Tunnels
City Water Storage
Gas Tanks
3829
502
Okada
Shake
Fukaya
Katase Kawa
Inflammable Storage Docks & Whses
Minoge
Ōyama
Bodai
1824
Isehara
Shimo-Kasuya
Yoda
Chōgo
Totsuka
Tire Fac
Aircraft Engine Fac
Isogo Machi
Naval Air Station Reported
Honmoku Hana
Banzu Hana
Osaki
2628
Yodorigi
Terayama
NEGISHI WAN
Paratroop Tr Field (Pos Approx)
Kameino
Kisarazu Naval Air Station
Morofuchi
Yamakita
Magarimatsu
Tunnel
Shibusawa
HATANO
Sugita
Konosu Bana
KAI YAMA
1857
Ichinomiga
Kasama
Naval Air Station Reported
Nagahama
Kanada
Nishinomiya
Matsuda
RR Junction
Kami-Yamada
I-no-kuchi
Nakahara
Gunpowder Fac
Hatori
Fujisawa
Yamanouchi
Koshiba Saki
Hama
Sekimoto
Kami-Ōi
Kotake
715
Hiratsuka
Kowada
Chigasaki
Tsujido
Kajihara
Aircraft Fac & Guns
Susaki
Cranes
Seaplane Hangars & Ramps
Gun Emplacements
Gōdo
Ōhori
Koito
Shimo-Soga
Hongō
Ōiso
Suga
Sagami Kawa
Ubaga Shima
E-no-Shima
Katase
Nagai
Kamakura
Nagaura Kō
Battleship & Cruiser Berths
Futtsu Saki
Fort
Futtsu
Narita
Maekawa
Ninomiya
Spinning Mills
Sub Base
Sub Anchorage
Yokosuka Kō
Oil Tanks
Barracks
Arsenal
Oshikiri
Zushi
Aircraft Store
Reported (Pos Approx)
Shinjiku Wan
YOKOSUKA
Otsu Wan
Shipyards
3835
Kōzu
Sakawa
Na Shima
Hayama
Okubo
ODAWARA
Power Stations & Penstocks
Gōra
Onsen
Sakawa Kawa
Hayama Imperial Palace
Mine Store
OKUSU YAMA
794
Choshaga Saki
Arsenal
Barracks
Dry Dock
Guns
Kannon Saki
Isone Misaki
Uraga
Kamoi
60 Gun Emplacements
Kubiri
Uraga Kō
Anti-Sub Nets Reported
Akiya
Naval Ordnance
Yumoto
Tunnels
RR Bridge
Miuraga Saki
Sashima
Kurihama
Kurihama Wan

JAPAN

AVIATION CHART

TŌKYŌ AREA

HONSHŪ

MERCATOR PROJECTION

Scale 1″=3 Nautical Miles (1:218,880) at Lat. 35° 20′ N

SOUNDINGS IN FATHOMS
HEIGHTS IN FEET

GRADIENT OF ELEVATIONS

MAXIMUM 9000 7000 5000 3000 2000 1000 0

LEGEND

Light A. A. .... ♀

Heavy A. A. .... ①

Searchlight ....

Coastal Defense Battery .... ⊕

Tank .... •

Landplane Base—Military. Complete facilities ....

Landplane Airport—Military. Refueling and limited repair facilities...

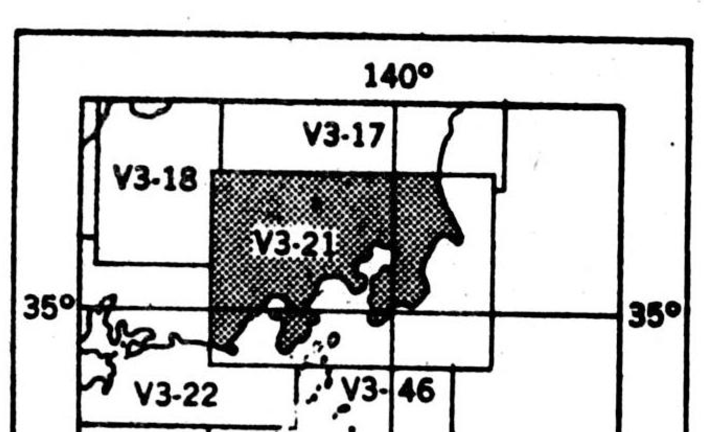
Seaplane Base—Military. Complete facilities ....

Seaplane Airport—Military. Refueling and limited repair facilities....

Lighthouse .... ★

JAPANESE AND ENGLISH TERMS

Hana	*cape, headland*	*Ō; O*	*large; little*
Hama	*beach, seacoast*	*Ko*	*lake, also little*
Saki, Misaki	*point, cape*	*Kō or Minato*	*harbor, port*
Take or Mine	*mountain, peak*	*Numa*	*marsh, lake*
San or Yama	*mount, hill*	*Nada*	*sea*
Kawa	*river*	*Wan*	*large bay*
Kaikyo or Suidō	*strait, channel, passage*	*Byōchi*	*berth, anchorage*
Kaiwan	*gulf*	*Se, Ze, Ne or Sho*	*bank, rock, reef*
Ura	*inlet, small bay*	*Shima or Tō*	*island*



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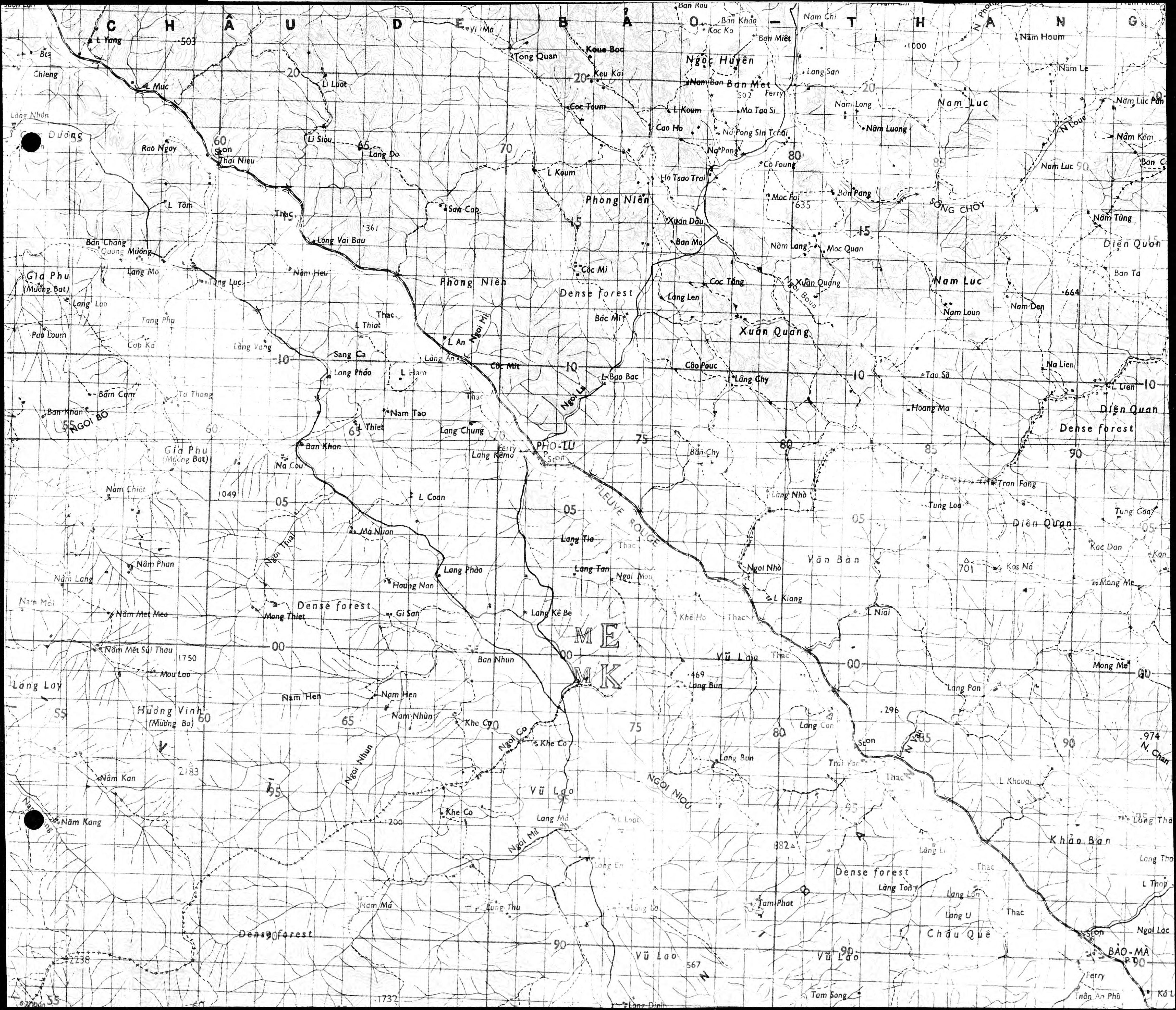
AUTHORITIES

Precise Topographic and Hydrographic Surveys

For Symbols and Abbreviations,
see H. O. Publication No. 8

Corrected through Notices to Aviators
No. C13 Date: 1 July 1944
Holders correct this chart through
subsequent Notices to Aviators.


C H Â U   D E   B Ả O – T H A N G
L Yang
Bts
Chieng
L Muc
Rao Ngay
Thai Nieu
L Luot
Li Siou
Lang Do
Tong Quan
Koue Boc
Keu Kai
Coc Toum
Ngọc Huyền
Nam Ban Bản Met
L Koum
Cao Ho
Na Pong
Ho Tsao Trai
Ma Tao Si
Na Pong Sin Tchai
Lang San
Ferry
Nam Long
Nam Luc
Nam Luong
Nam Luc Pan
Nam Kam
Nam Luc
Ban Co
Nam Houm
Nam Le
Co Foung
Moc Fai
Ban Pang
SÔNG CHÔY
Nam Tung
L Tom
Thac
Long Vai Bau
San Cap
L Koum
Phong Niên
Xuan Dau
Ban Mo
Nam Lang
Moc Quan
Diên Quan
Ban Chang
Quong Muong
Lang Mo
Gia Phu
(Muong Bat)
Nam Heu
Tang Luc
Phong Niên
Coc Mi
Dense forest
Coc Tang
Lang Len
Xuan Quang
Ngoi Baun
Nam Luc
Nam Loun
Ban Ta
Nam Den
Lang Lao
Tang Pha
Pao Loum
Cap Ka
Lang Vang
L Thiat
Thac
Sang Ca
L An
Ngoi Mi
Bac Mi
Xuan Quang
Lang An
Coc Mit
Lang Phao
L Ham
L Bao Bac
Côo Pouc
Lang Chy
Tao So
Na Lien
L Lien
Bam Cam
Ta Thang
Ban Khan
NGOI BO
Nam Tao
Ngoi La
Hoang Ma
Diên Quan
Dense forest
L Thiet
Lang Chung
Gia Phu
(Muong Bat)
Ban Khan
Ferry
Lang Kemo
PHO-LU
Ston
Ban Chy
Tran Fang
Na Cou
Nam Chiet
L Coan
FLEUVE ROUGE
Lang Nhò
Tung Loa
Diên Quan
Tung Goa
Ma Nuan
Lang Tie
Thac
Văn Bàn
Kac Dan
Ngoi Thai
Nam Phan
Lang Phao
Lang Tan
Ngoi Mou
Ngoi Nhò
701
Kos Na
Mong Me
Nam Lang
Hoang Nan
L Kiang
Nam Moi
Dense forest
Mong Thiet
Gi San
Lang Kê Be
Khe Ho
Thac
L Niai
Nam Met Meo
ME
Nam Mét Sùi Thau
1750
Ban Nhun
Vũ Lao
Thac
Mong Me
Mou Lao
MK
469
Lang Bun
Lang Lay
Nam Hen
Nam Hen
Lang Pan
Huong Vinh
(Muong Bo)
Nam Nhun
Khe Co
Lang Con
Ngoi Co
Khe Co
Ston
N Van
974
N. Chan
2183
Nam Kan
Ngoi Nhun
Lang Bun
Trai Van
Thac
L Khaual
NGOI NIOU
Vũ Lao
Nam Kang
Khe Co
1200
Lang Ma
L Loat
Lang Tha
Khao Ban
882
Lang Li
Ngoi Ma
Lang En
Thac
Lang Tha
Dense forest
Lang Ton
L Thap
Nam Ma
Lang Thu
Lang La
Tam Phat
Lang Lon
Thac
Lang U
Dense forest
Châu Quê
Ston
Ngoi Lac
2238
Vũ Lao
Vũ Lao
567
BẢO-MA
Ferry
1732
Tam Song
Than An Pho
Lang Dinh

INDO-CHINA

MAP - 15

A.M.S. L-601

Edition: September, 1942.

1:100,000 or 0.63 Inches to 1 Mile.

Furlongs 8 6 4 2 0 1 2 3 4 5 Miles

Yards 1000 500 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 Yards

Metres 1000 500 0 1 2 3 4 5 6 7 8 9 10 Kilometres

ALL HEIGHTS IN METRES.
CONTOUR INTERVALS 25 METRES.

TO GIVE A REFERENCE ON THIS MAP

LETTERS See LETTERS ON MAP

FIGURES DISREGARD THE SMALLER FIGURES IN THE BORDERS, which give full co-ordinates from origin, viz. 3510000
USE THE LARGER BORDER FIGURES or those printed on the face of the map.

POINT TRAI HUT (Station)

LETTERS NF

EAST-Take line west of POINT, and read figures printed against it in north and south borders, or on line itself on the face of the map.	18	NORTH-Take line south of POINT, and read figures printed against it in east and west borders, or on line itself on the face of the map.	66
Estimate tenths eastwards	4	Estimate tenths northwards	1
East	18 4	North	66 1

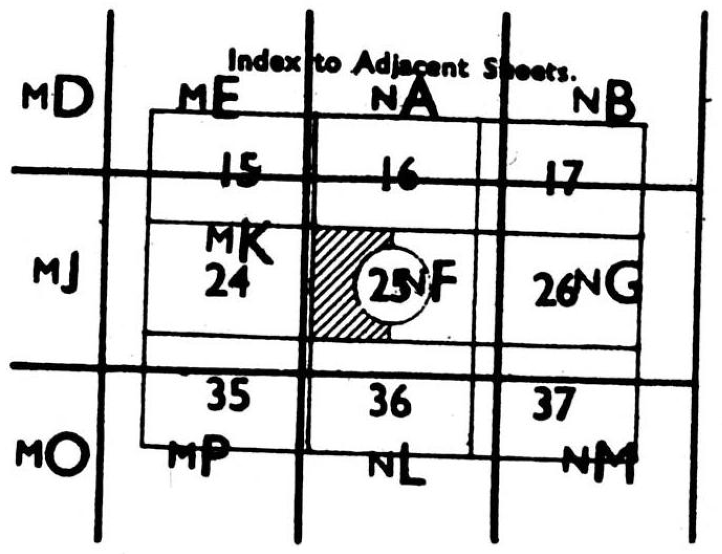
REFERENCE NF 184661 to nearest 100 yards Unit - Yard Square-1,000

Nearest similar reference with two letters, distant 600 miles; with second letter only 160 miles; with figures only 60 miles.

First letter indicates 500,000 yard square; second letter indicates 100,000 yard square.

Heliozincographed at the Survey of India Offices, Dehra Dun.

Index to Adjacent Sheets.



Cultivated Plantations
Post Office .... P
Post & Tel Office ..... P T
Ruins
Trigonometrical Marks .... Primary & Secondary △125; Tertiary .... △125
Heights approximate .... ·125
Boundary: Provincial; State
Rice cultivation .....
Wooded areas ....
Marsh ....
Telegraph Office .... T
Village ....
Church, Pagoda ....
Mangrove ....
Rock .....

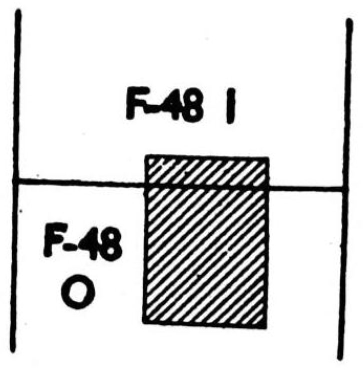
REG. No. 206X.D.D. No 5 D.O. (E.C.) 42.

HIND 1000.

Colonial

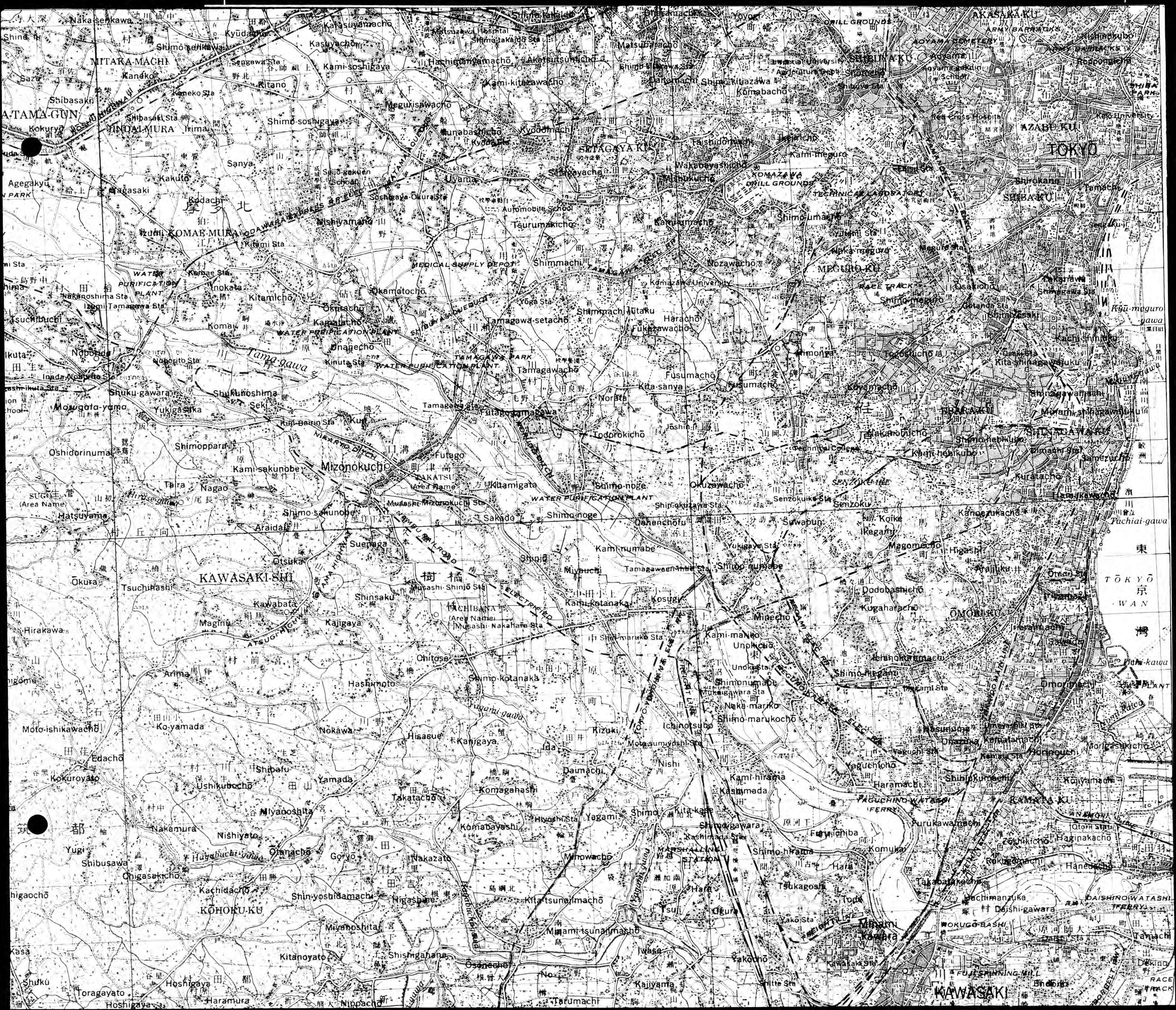
Roads Metalled ..
,, Unmetalled ..
Pack tracks .....
Railways ......
Canal navigable ..
Embankments ..
Roads Other
Cart tracks
Foot-path
Tramways
Canal Irrigation
Cutting ...

Index to International Numbering.



Indo-China edition 1926 with corrections to 1934.

Reproduced with the addition of Grid, Dehra Dun, 1942 (September)



Naka-senkawa
MITAKA-MACHI
Kaneko
Shibasaki
TAMA-GUN
JINDAI MURA
Kokuryo
Agegakyu
Kakuto
Nagasaki
Kodachi
Sanya
Karasuyamacho
Kyudacho
Shimo-senkawa
Sengawa Sta
Kitano
Kasuyacho
Kami-soshigaya
Shimo-soshigaya
Meguirisawacho
Hachimanyamacho
Akatsutsumicho
Matsuzawa Hospital
Kami-kitazawacho
Funabashicho
Kyodo Sta
Kyodomachi
SETAGAYA-KU
Setagayacho
Uyama
Soshigaya-Okura Sta
Nishiyamacho
KOMAE-MURA
Kitami Sta
Komae Sta
WATER PURIFICATION PLANT
Izumi Tamagawa Sta
Inokata
Kitamicho
Okamotocho
Okatacho
Kamatacho
Unanecho
Kinuta Sta
WATER PURIFICATION PLANT
MEDICAL SUPPLY DEPOT
Automobile School
Tsurumakicho
Shimmachi
Yoga Sta
Tamagawa-setacho
TAMAGAWA PARK
Tamagawacho
Tama-gawa
Noborito Sta
Noborito
Shuku-gawara
Shukunoshima
Seki
Yukigaya
Tamagawa Sta
Futagotamagawa
Futago
Mizonokucho
TAKATSU
(Area Name)
Kitamigata
Shimoppara
Oshidorinuma
Kami-sakunobe
Nagao
Tsuta
SUGE
(Area Name)
Hatsuyama
Shimo-sakunobe
Araidai
Suenaga
Sakado
Shimo-noge
Shinjo
Miyauchi
Otsuka
KAWASAKI-SHI
Okura
Tsuchihashi
Musashi-Shinjo Sta
TACHIBANA
(Area Name)
Musashi-Nakahara Sta
Kawabata
Maginu
Kajigaya
Shinsaku
ATSUGI HIGHWAY
Hirakawa
Arima
Chitose
Hashimoto
Shimo-kotanaka
Kami-kotanaka
Kosugi
Moto-ishikawacho
Ko-yamada
Nokawa
Hisasue
Kanigaya
Ida
Kizuki
Edacho
Kokuroyato
Shibafu
Ushikubocho
Yamada
Takatacho
Komagahashi
Daimachi
Nishi
Miyanoshita
Nakamura
Nishiyato
Komabayashi
Hiyoshi Sta
Yagami
Shimo
Yugi
Shibusawa
Chigasakicho
Kachidacho
KOHOKU-KU
Orenacho
Goryo
Nakazato
Minowacho
Shin-yoshidamachi
Higashi
Kita-tsunashimacho
Miyanoshita
Kitanoyato
Shishigahana
Minami-tsunashimacho
Hoshigaya
Toragayato
Haramura
Nippacho
Tarumachi
Kajiyama
Iwase
Kasa
Shuku
Hoshigaya
Shimo-takaido Sta
Matsubaracho
Yoyogi
DRILL GROUNDS
Daitamachi
Shimo-kitazawa
Komabacho
Taishidomachi
Wakabayashicho
Mishukucho
KOMAZAWA DRILL GROUNDS
Kami-meguro
Kamiumacho
TAMAGAWA ELEC RR
Nozawacho
Komazawa University
Shimmachi Jutaku
Fukazawacho
Haracho
Fusumacho
Kita-sanya
Norate
Todorokicho
Joshin
Okuzawacho
Shimo-noge
WATER PURIFICATION PLANT
Denenchofu
Kami-numabe
Tamagawaden Sta
Shimo-numabe
Kami-mariko
Shimo-marukocho
Ichinotsubo
Nishi
Kami-hirama
Kashimada
Shimo-hirama
MARSHALLING STATION
Tsukagoshi
Hara
Tsuji
Ogura
Yakocho
Minami Kawara
Kawasaki Sta
KAWASAKI
FREIGHT LINE
AKASAKA-KU
ARMY BARRACKS
AOYAMA CEMETERY
SHIBUYA-KU
Shibuya Sta
Nishikubo
Roppongi
Red Cross Hospital
Keio University
AZABU-KU
TOKYO
SHIBA-KU
Shirokane
Tamachi
TECHNICAL LABORATORY
Shimo-umacho
Yutenji Sta
Naka-meguro
Meguro Sta
MEGURO-KU
RACE TRACK
Osakicho
Shimo-meguro
Gotanda Sta
Takanawa
Shinagawa Sta
Kita-shinagawa
Kyu-meguro gawa
Togoshicho
Koyamacho
Shinagawamachi
EBARA-KU
SHINAGAWA-KU
Kami-hebikubo
Oimachi Sta
Samezucho
Kuratacho
SENZOKU-IKE
Senzoku
Senzokuike Sta
Suwabun
Yukigaya Sta
Koike
Kagami
Magomecho
Higashi
Dodobashicho
Kugaharacho
OMORI-KU
Omori Sta
TOKYO WAN
Minecho
Unoki Sta
Shimo-maruko
Ichinokubomachi
Omorimachi
Yaguchi Sta
Yaguchicho
Haramachi
KAMATA-KU
Kamata Sta
YAGUCHINO WATASHI (FERRY)
Furukawamachi
Komukai
Rokugomachi
Haginakacho
Hanedacho
Takabatakecho
Daishi-gawara
DAISHINO WATASHI (FERRY)
ROKUGO BASHI
Daishi Sta
FUJI SPINNING MILL
Morigasakicho
Koujiyamachi
Tamachi
RACE TRACK
Pachiai-gawa

SOUTHERN HONSHŪ 1:50,000

A.M.S. L775

First Edition (AMS 1) 1944

CONTOUR INTERVAL 20 METERS

HEIGHTS IN METERS

ONE THOUSAND YARD WORLD POLYCONIC GRID BAND III N. ZONE "B"
THE OVERLAPPING GRID ZONE "C" IS INDICATED BY SHORT BROKEN TICKS CROSSING THE NEAT LINE
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

INDEX TO PREFECTURE BOUNDARIES

INDEX TO ADJOINING SHEETS

131°00′ — 131°45′; 34°10′ — 33°40′

4349-III	4349-II	4449-III
4348-IV	4348-I	4448-IV
AMS 13 L772		AMS 14 L772

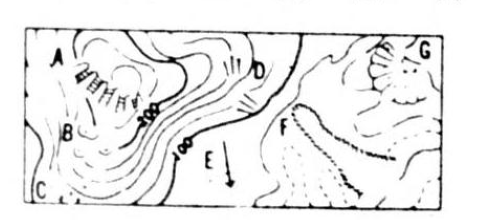
GLOSSARY

- -bae .... rock
- -bama .... beach
- -bana .... point
- -bara .... plain, field
- -bashi .... bridge
- -chō .... township
- -dai .. plateau, plain, hill, field
- -daira .... plain, field
- -dake .... mountain
- -daki .... waterfall
- -dani .... valley, stream
- -fu .... prefecture
- -gan .... rock, cliff
- -gata .... lake, inlet, bay
- -gawa .... river
- -goe .... mountain pass
- -goshi .... mountain pass
- -gun .... county
- -guntō .... archipelago
- -hae .... rock
- -hama .... beach
- -hana .... point
- -hantō .... peninsula
- -hara .... plain, field
- -hashi .... bridge
- -heiya .... plain, field
- -hō .... mountain
- -ike .... pond
- -ishi .... rock, cliff
- -iso .... rock, shoal, shore
- -iwa .... rock, cliff
- -ji .... temple
- -jima .... island(s)
- -jinja .... shrine
- -jinsha .... shrine
- -kai .... bay, gulf
- -kaikyō .... strait
- -kata .... lake, inlet, bay
- -kawa .... river
- -ken .... prefecture
- -ko .... lake, pond
- -kō .... harbor
- -koe .... mountain pass
- -koshi .... mountain pass
- -ku .... ward
- -machi .... township
- -minato .... harbor
- -mine .... mountain
- -misaki .... cape, point
- -mori .... mountain, forest
- -mura .... township
- -nada .... sea
- -ne .... rock, isle
- -no .... field, plain
- -numa .. lake, pond, swamp
- -oka .... hill, mountain
- -onsen .... hot spring, spa
- -rettō .... island chain
- -saka .... grade, slope
- -saki .... cape, point
- -sammyaku .. mountain range
- -san .... mountain, ridge, hill
- -sawa .. stream, ravine, marsh
- -se .... reef, shoal, rapid
- -seto .... strait
- -shi .... municipality, city
- -shima .... island(s)
- -shō .... reef, shoal
- -shotō .... island group
- -suidō .... channel
- -tai .. plateau, plain, hill, field
- -taira .... plain, field
- -take .... mountain
- -taki .... waterfall
- -tani .... valley, stream
- -tō .... island(s)
- -tōge .... mt pass, mountain
- -umi .... bay, gulf, lake, pond
- -ura .... inlet, beach, lake
- -wan .... bay, gulf
- -yama .... mountain, ridge, hill
- -yu .... mineral spring, spa
- -zaka .... grade, slope
- -zaki .... cape, point
- -zan .... mountain, ridge, hill
- -zawa .. stream, ravine, marsh

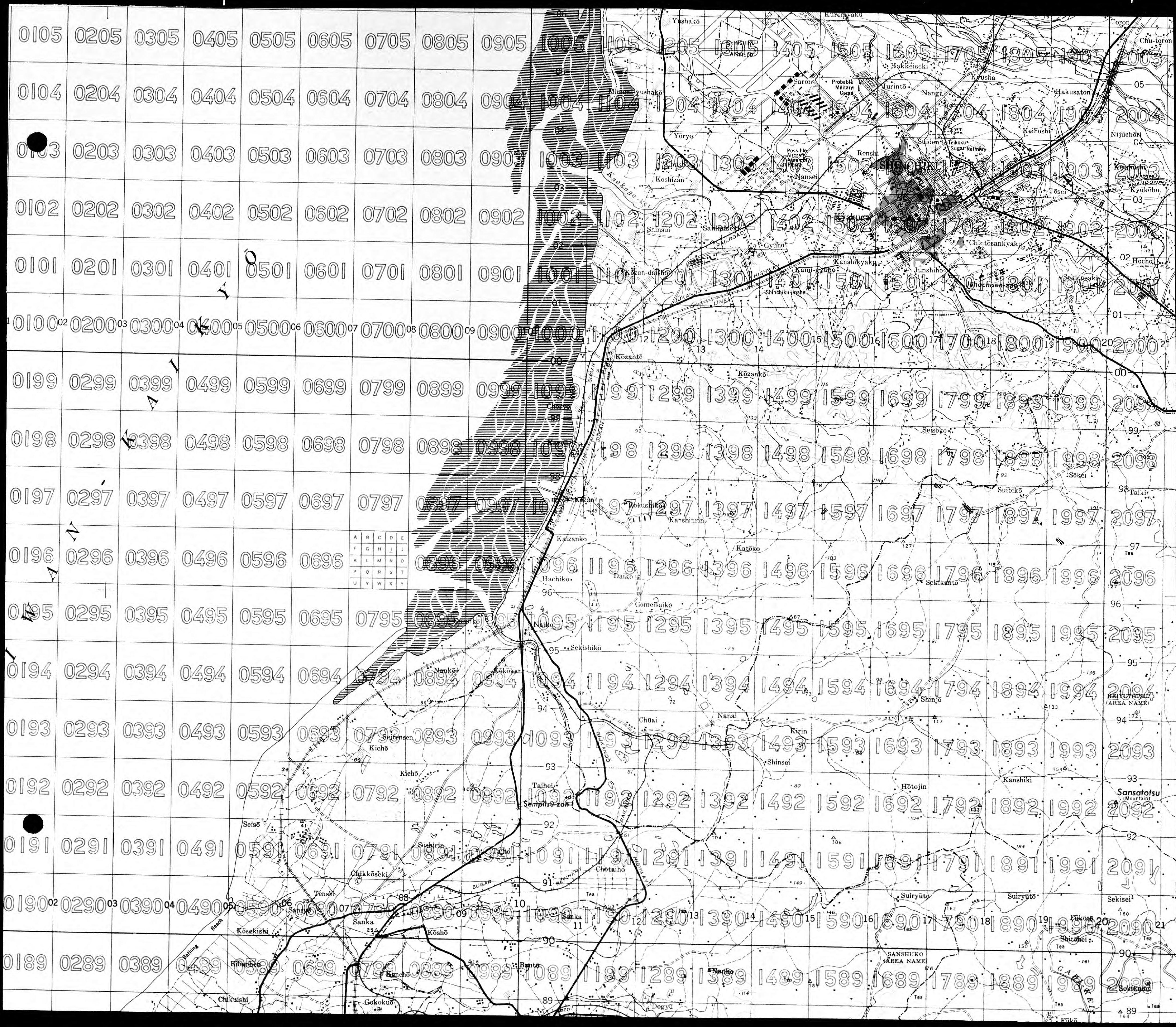
LEGEND

Density of Construction in Urban Areas: Dense, Moderate, Sparse

- Navy Lookout Tower
- Factory
- Bank
- Powder Magazine
- Water Wheel or Mill
- Generating Plant
- Masonry Wall
- Fences
- Bamboo Fences
- Stone Wall
- Earthen Wall
- Hedge
- Cemetery
- Ditches
- Shrine Gate
- Stone Lantern
- Shrine
- Temple
- Grave
- Pagoda
- Church
- Japanese Government Building
- Foreign Government Building
- Military Reservation
- Naval Reservation
- Division Headquarters
- Brigade Headquarters
- Fortress and Defense Headquarters
- Battalion Headquarters and Garrison
- Regimental Headquarters
- Naval Station
- Secondary Naval Station
- Naval Camp
- Army Camp
- Shipyard
- Prefectural Seat
- Monument
- Statue
- Signpost
- Stone Steps
- Crane
- Oil Well
- Mileage Marker
- Stumps
- Isolated Trees
- Chimney
- Triangulation Point (96.1)
- Secondary Control Point (365.37)
- Bench Mark (423.42)
- Spot Elevation (32.5)
- (All above Sea Level)
- Old Battlefield
- Spring
- Tomb
- Castle Site
- Volcano
- Mineral Spring
- Material Dump
- Mine
- Boundary Marker
- Sub-prefectural, Island-office or Gun Seat
- City Office
- Town, Village or Ward Office
- School
- Hospital
- Isolation Hospital
- Gendarmerie Post
- Police Station
- Court of Appeals
- Prison
- Customs House
- Tax Office
- Forestry Office
- Mining Office
- Government Monopoly Bureau Office or Factory
- Office of Maritime Affairs
- Meteorological Station
- Post Office (with Telegraph and Telephone service)
- Post Office
- Telegraph Office
- Telephone Office
- National Highway
- Main Prefectural Roads
- More than 3 Meters Wide
- More than 2 Meters Wide
- More than 1 Meter Wide
- Less than 1 Meter Wide
- Impassable for Carts
- Tree-lined Roads: (A) Narrow (B) Wide
- Power Lines along Road: (A) Ordinary (B) High Tension
- Main Railways: (A) Two Tracks (B) Single Track (C) Station
- Special Railways: (D) Double (E) Single
- Boundaries: International
  - Prefectural (A) Fixed (B) Approximate
  - Province (Obsolete)
  - Gun, shi or Sub-prefectural
  - Ward, Machi or Mura (A) Fixed (B) Approx
  - Government Lands
  - Property Lines (A) Fixed (B) Approximate
- (A) Iron Bridge
- (B) Wooden Bridge
- (C) Foot Bridge
- (D) Foot Ford
- (E) Vehicular Ford
- (F) Passenger Ferry (Single Boat)
- (G) Passenger and Horse Ferry (Two Boats)
- (H) Steam Ferry
- Height of Bank (4.7)
- Depth of Water (2.8)
- Lighthouse
- Radio Mast
- Warning Signal
- Boat Anchorage
- Ship Anchorage
- Anchorage
- Commercial Port
- Fixed Beacon
- Fixed Beacon (Lightless)
- Buoy (Lightless)
- (A) Flower Garden (B) Grove (C) Truck Garden
- (A) Orchard (B) Tea (C) Mulberry (D) Cultivated marsh (E) Irrigated rice field (F) Dry Rice Field
- (A) Wild Land (B) Palm (C) Bamboo (D) Conifers (E) Broad-leaf Trees (F) Grass Land



(A) Cliff (B) Rock Outcropping (C) Scattered Rock (D) Talus Slope (E) Depression (F) Ravine, Gully (G) Crumbling Bank



Yushakō
Kureikyaku
Toron
Chū-toron
Saron
Probable Military Camp
Jurintō
Hakkeiseki
Kyusha
Nanga
Hakusaton
Minamiyushakō
Yōryō
Suiden
Teikoku Sugar Refinery
Keihoshi
Nijuchōri
Possible Aircraft Assembly Plant
Ronshi
Nansei
Koshizan
Shinsui
Gyuho
Kami-gyuho
Kanshikyakyu
Chintōsankyakyu
Junshiho
Juhachisen-zan
Sekidosaki
Hocho
Kyūkōho
Tōsei
PROBABLY ABANDONED
RAILROAD
HIGHWAY
JUKANDO LINE
SUGAR REFINERY
Kōzantō
Kōzanko
Seisōko
Sōkei
Suibikō
Taiki
Rokushi
Kanshinrin
Kaizanko
Katōko
Hachiko
Daiko
Sekikanto
Gomeisaikō
Naikō
Sekishikō
Naukō
Kokokan
Shinjō
(AREA NAME)
Chūai
Nanai
Kirin
Shinsei
Seitensen
Kichō
Taihei
Sempitsu-zan
Hōtojin
Kanshiki
Sansatotsu (Mountain)
Seisō
Sōshirin
Chikkōseki
Chotaiho
Tenshi
Sanka
Kōshō
Suiryūtō
Sekisei
Fukōtō
Shitōhei
Kōsekishi
Bathing Beach
Banto
Kanchō
Nanko
SANSHUKO (AREA NAME)
Chikuishi
Gokokuo
Dogyū
Tea

FORMOSA 1:50,000

MAP - 17

A.M.S. L792

Prepared under the direction of the Chief of Engineers, U. S. Army, Washington, D. C., 1944, by the 29th Engineers, U. S. Army, from 1:25,000 Original Japanese Imperial Land Survey Maps, Kagi, Shirakawa, Koheki, Santo, published 1928 (Reliable) and Sheet F-51-XXXI-12, 1:50,000 Japanese Imperial Land Survey, published 1928 (Reliable).
Planimetric detail revised from intelligence data and aerial photographs dated 1944.
All place names transcribed in their Japanese form according to the Modified Hepburn (Romaji) System.

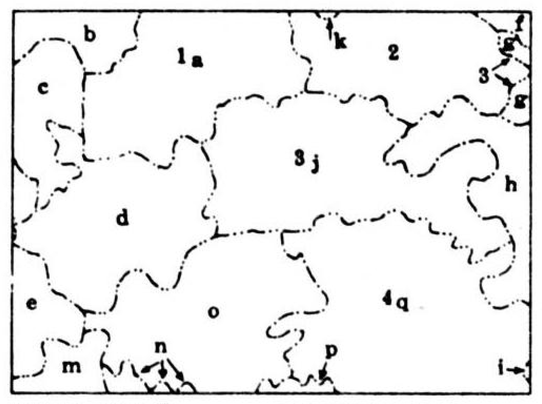
CONTOUR INTERVAL 20 METERS

Auxiliary 10 meter contours shown by long dashed lines
Auxiliary 5 meter contours shown by short dashed lines

POLYCONIC PROJECTION

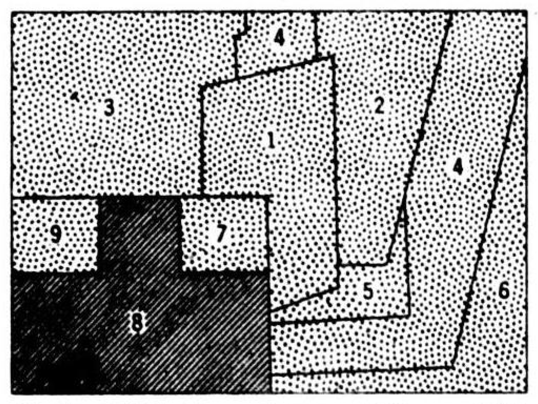
ONE THOUSAND YARD WORLD POLYCONIC GRID, BAND III N ZONE "D"
(THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED)

INDEX TO BOUNDARIES



TAINAN-SHŪ
1. TŌSEKI-GUN
a. TAIHO-SHŌ
b. ROKKYAKU-SHŌ
c. BOKUSHI-KAI
d. ROKUSŌ-SHŌ
e. GICHIKU-SHŌ
2. KAGI-SHI
3. KAGI-GUN
f. TAKEZAKI-SHŌ
g. BANRŌ-SHŌ
h. CHŪHŌ-SHŌ
i. SHŌ NAME UNKNOWN
j. MIZUKAMI-SHŌ
k. TAMIO-SHŌ
4. SHINEI-GUN
m. ENSUI-KAI
n. SHINEI-KAI
o. KŌHEKI-SHŌ
p. BANSHA-SHŌ
q. SHIRAKAWA-SHŌ

PHOTO COVERAGE DIAGRAM



(1)	Sortie M13/4C	January, 1944	24"V.
(2)	Sortie M13/2C	January, 1944	24"V.
(3)	Sortie M15/1C	March, 1944	6"T.V.
(4)	Sortie M13/2C	January, 1944	6"V.
(5)	Sortie M13/4C	January, 1944	6"T.V.
(6)	Sortie M15/1C	March, 1944	6"R.O.
(7)	Sortie 4MC7	June, 1944	24"V.
(8)	Sortie 4M8143	August, 1944	6"T.V.
(9)	Sortie 4MB159	August, 1944	24"R.V.

COMPILATION METHODS

PLANIMETRIC METHODS — STEREO METHODS

INDEX TO ADJOINING SHEETS

120°00' — 120°45'
23°40' — 23°10'

2117 IV	2117 I	2217 IV
2117 III	2117 II	2217 III
2116 IV	2116 I	2216 IV

LEGEND

Areas densely built-up and Large buildings
Areas moderately built-up
National or Prefectural Road
Generally metalled Road, over 4 m. wide
Road, 2-4 meters wide
Track or Trail
Railroads:
3'6" gauge, Single track, with Station
3'6" gauge, Double track
Narrow, Light, or Special gauge, Single track
Single Track in Road or Street
Boundaries:
Prefectural (Chō or Shū)
Gun or Shi
Kai or Shō
Cemetery, Orchard
Mineral spring, Falls
Mud Flat or Tidal Flat
Generally Rice or Sugarcane
Control point, Bench mark, Spot elevation ·128
Shipyard, Fumarole, Powerhouse
Temple, Shrine
Pagoda, Tomb
Church, Chimney
Stone steps, Mine
Radio mast, Prison
High Tension line
Fence or Permanent Field Boundary

GLOSSARY

-bashi	bridge
-byō	temple
-chi	lake, pond
Daisha	push car railway
-gun	county
-kai	township
-kei	river, stream
-kyō	bridge
-oka	hill, mountain
-shi	city, municipality
-shō	township
-shū	prefecture
-tani	stream, ravine
-yama	mountain, hill, peak, ridge
-zan	mountain, hill, peak, ridge

Information added from Intelligence Reports indicated in blue type

HEIGHTS IN METERS

TO GIVE GRID AND TARGET-AREA REFERENCES ON THIS SHEET
FIGURES. IGNORE the SMALLER figures printed around the margin of the map.
These are for finding the full co-ordinates.
USE ONLY THE LARGER FIGURES PRINTED IN THE MARGIN OR ON THE FACE OF THE MAP. Viz. 2824000

POINT RAILROAD STATION

FOR STANDARD MILITARY GRID REFERENCE

East		North	
Take West edge of square in which point lies, and read the figure printed opposite this line on North or South margin or on the line itself on the face of the map. *Estimate tenths Eastwards*	61 6	Take South edge of square in which point lies, and read the figure printed opposite this line on East or West margin or on the line itself on the face of the map. *Estimate tenths Northwards*	42 7
East	616	North	427

STANDARD MILITARY GRID REFERENCE 616-427 (To nearest 100 yards)

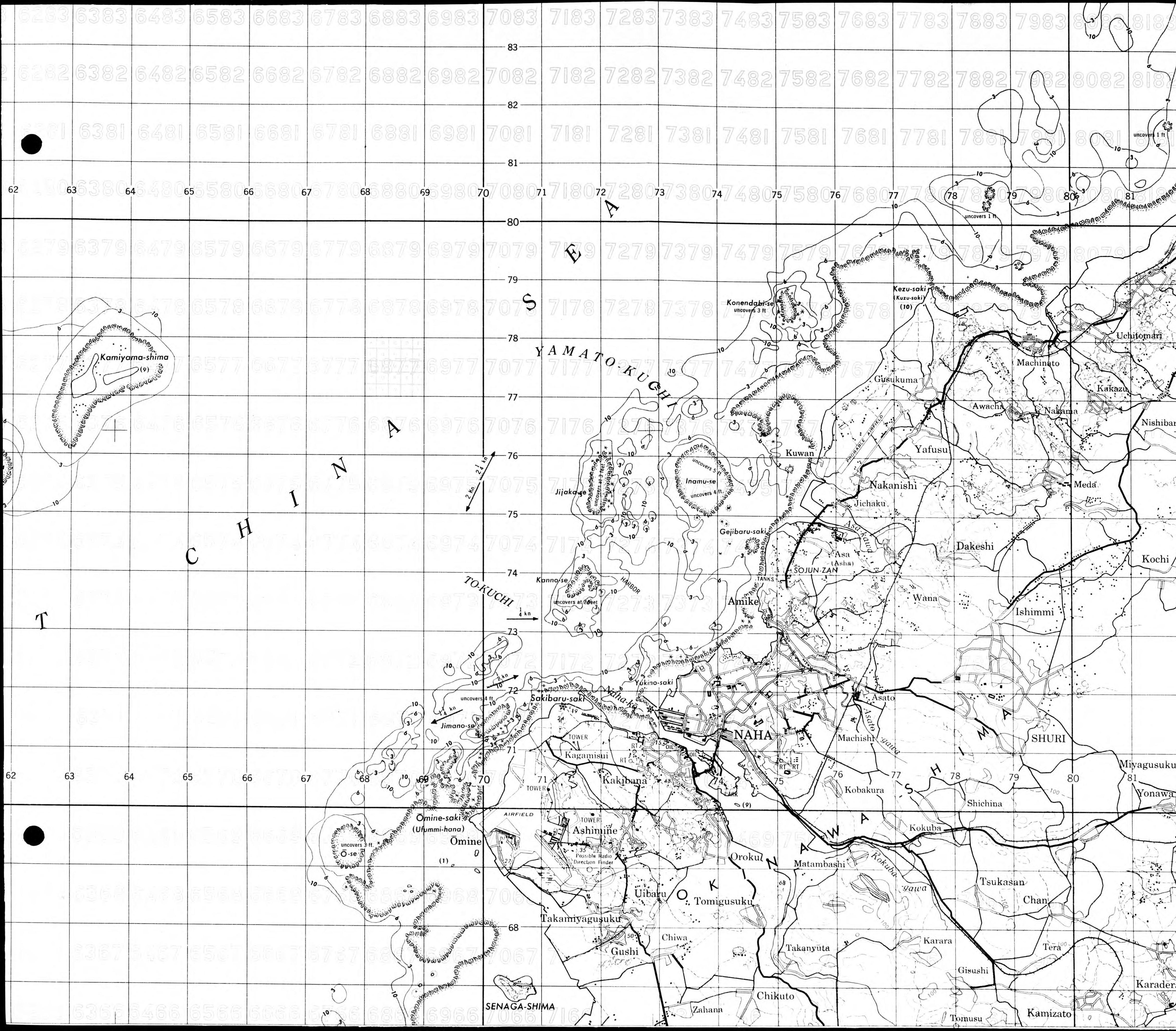
FOR TARGET-AREA DESIGNATOR

Number Take NUMBER of the 1000 yard square in which the point lies.	6142	
Letter Take LETTER from diagram at right, so that letter indicates position of point within the 1000 yard square.	I	

A	B	C	D	E
F	G	H	I	J
K	L	M	N	O
P	Q	R	S	T
U	V	W	X	Y

TARGET AREA DESIGNATOR 6142I (Locates within 200-yard square)

Nearest similar grid or target-area reference—100,000 yards (Approximately 57 miles)



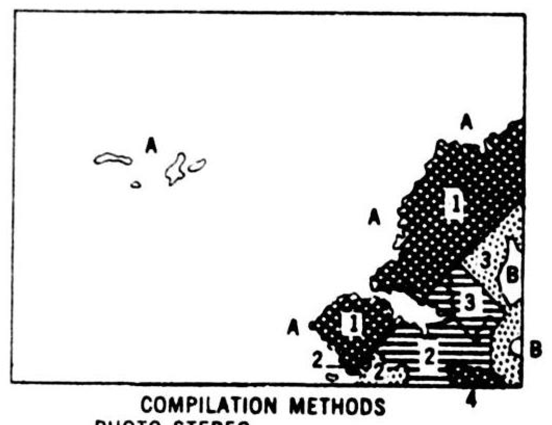
EAST CHINA SEA
YAMATO-KUCHI
TO-KUCHI
HARBOR
Kamiyama-shima
Konendabi-se
uncovers 3 ft
Kezu-saki
(Kuzu-saki)
Uchitomari
Machinato
Gusukuma
Kakazu
Awacha
Nakama
Nishibara
Yafusu
Kuwan
Inamu-se
uncovers 5 ft
uncovers 4 ft
Jijaka-se
Nakanishi
Jichaku
Meda
Gejibaru-saki
Asa-kawa
Asa
(Asha)
SOJUN-ZAN
TANKS
Dakeshi
Kochi
Kanno-se
uncovers at 2 feet
Amike
Wana
Ishimmi
PROBABLE AIRFIELD
2 Kn
2¼ kn
¼ kn
uncovers 4 ft
Sakibaru-saki
Naha-ko
Yukino-saki
Asato
Asato-gawa
Jimano-se
TOWER
Kagamisui
OIL
RT
NAHA
Machishi
SHURI
Kakibana
PARK
Kobakura
Miyagusuku
Yonawa
Shichina
AIRFIELD
Omine-saki
(Ufummi-hana)
Omine
Ashimine
Possible Radio
Direction Finder
Kokuba
Uncovers 3 ft.
O-se
Oroku
Matambashi
Kokuba-gawa
OKINAWA SHIMA
Tsukasan
Uibaru
Tomigusuku
Chan
Takamiyagusuku
Chiwa
Karara
Gushi
Takanyuta
Tera
Gisushi
Karadera
SENAGA-SHIMA
Chikuto
Zahana
Tomusu
Kamizato
uncovers 1 ft

RYUKYU-RETTO 1:50,000

MAP - 17A

A.M.S. L791

COVERAGE DIAGRAM

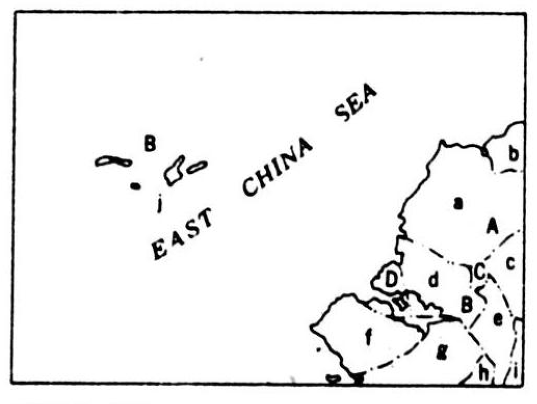


COMPILATION METHODS
PHOTO STEREO

- 6" Vertical
- Intensified from 6" & 12" coverage
- PHOTO PLANIMETRIC
- Oblique
- MAP

A. Hydrographic Compilation, (Reliability fair)
B. Obscured by clouds
1. Sortie FRANK 125 B, Oct. 1944
2. Sortie 11 PL-MR 7, Sept. 1944
3. Sortie 14 PL-MR 7, Sept. 1944
4. Sortie 14 PL-MR 7, WASP 231 Sept; Oct 1944

INDEX TO BOUNDARIES

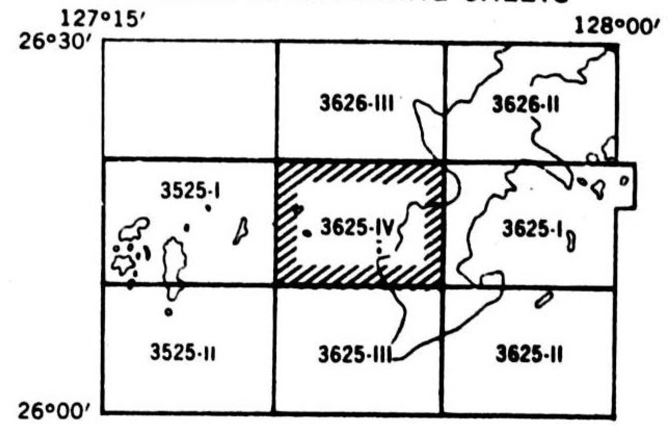


OKINAWA-KEN
A. NAKAGAMI-GUN
- a. URASOE-MURA
- b. KINOWAN-MURA
- c. NISHIBARA-MURA

B. SHIMAJIRI-GUN
- d. MAWASHI-MURA
- e. HAEBARU-MURA
- f. OROKU-MURA
- g. TOMIGUSUKU-MURA
- h. KOCHINDA-MURA
- i. ŌZATO-MURA
- j. TOKASHIKI-MURA

C. SHURI-SHI
D. NAHA-SHI

INDEX TO ADJOINING SHEETS



CONTOUR INTERVAL 20 METERS

APPROXIMATE CONTOURS SHOWN IN AREAS OF SPARSELY CONTROLLED TRIMETROGON OBLIQUE COVERAGE

POLYCONIC PROJECTION

ONE THOUSAND YARD WORLD POLYCONIC GRID, BAND IIIN, ZONE "C"
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

HYDROGRAPHIC DATUM: APPROXIMATE LEVEL OF LOWEST LOW WATER
REEFS MAY BE COVERED AT LOW WATER

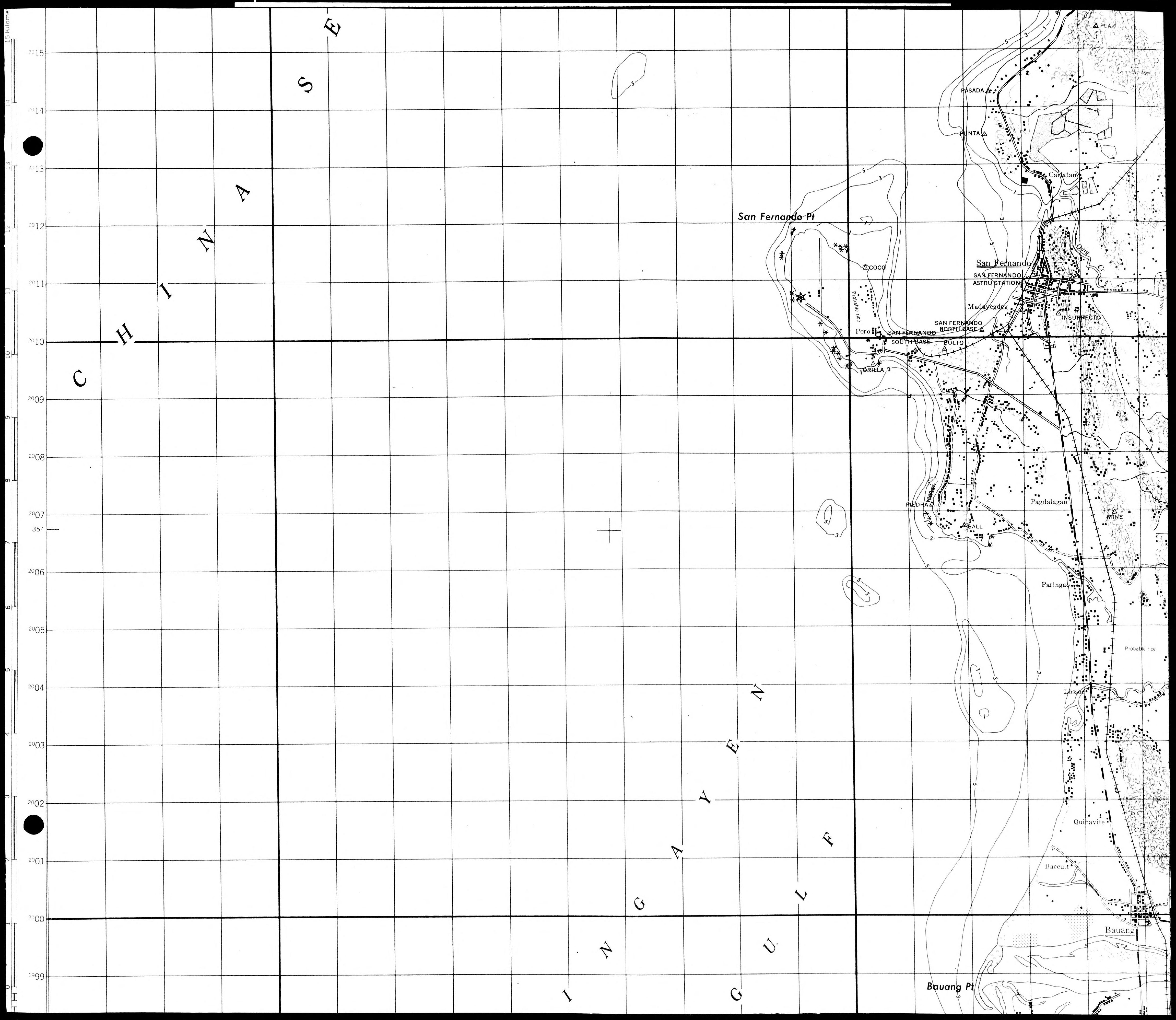
HEIGHTS IN METERS–DEPTHS IN FATHOMS

LEGEND

- Prefectural Road
- Road, 2–4 meters wide
- Track and Trail
- Road in built-up areas
- Mud or tidal flats
- Rice field
- Orchard
- Railroad 3′6″ gauge---steam
- Railroad 3′6″ gauge---electric (ELECTRIFIED)
- Railroad 2′6″ narrow gauge
- Railroad 2′6″ narrow gauge---horse-drawn (HORSE-DRAWN)
- Rock: awash, submerged
- Fathom line (6)
- Limiting danger line or low water line

GLOSSARY

-gun	county
-gusukū (-jō)	castle
-kawa (-gawa)	river
-ken	prefecture
-kō (-minato)	harbor
-kuchi (-guchi)	channel
-mura	township
-saki (-zaki, -misaki)	cape
-se (-ze)	reef, shoal
-shima (-jima)	island
-yama (-zan, -san)	mountain
-shi	city



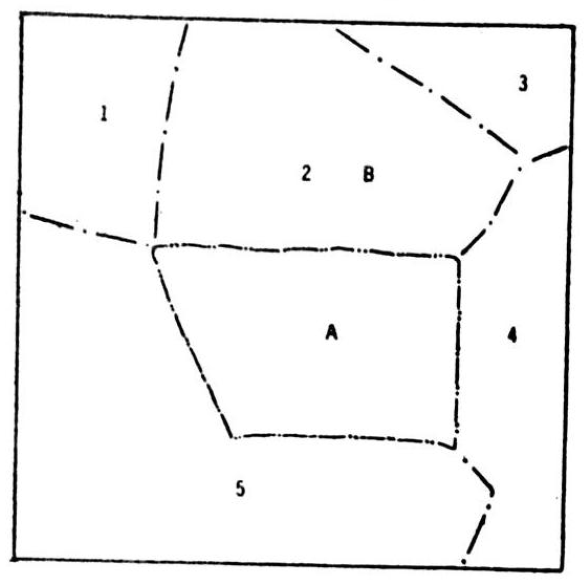
C H I N A S E
L I N G A Y E N G U L F
San Fernando Pt
San Fernando
SAN FERNANDO ASTRU STATION
Madayegdeg
INSURRECTO
SAN FERNANDO NORTH BASE
SAN FERNANDO SOUTH BASE
BULTO
Poro
TORILLA
COCO
Probable rice
PASADA
PUNTA
Catbatan
PIEDRA
BALL
Pagdalagan
MINE
Paringao
Probable rice
Quinavite
Baccuit
Bauang
Bauang Pt
35′

LUZON 1:50,000

A.M.S. S712.

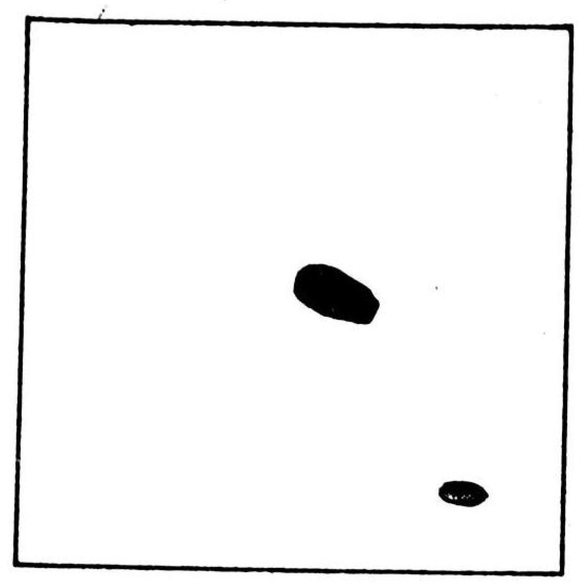
First Edition (AMS 1), 1944.

INDEX TO BOUNDARIES



A. Chartered City of Baguio
B. Mountain Province, Benguet Sub-province
1. Sablan Municipality
2. La Trinidad Municipality
3. Tublay Municipality
4. Itogan Municipality
5. Tuba Municipality

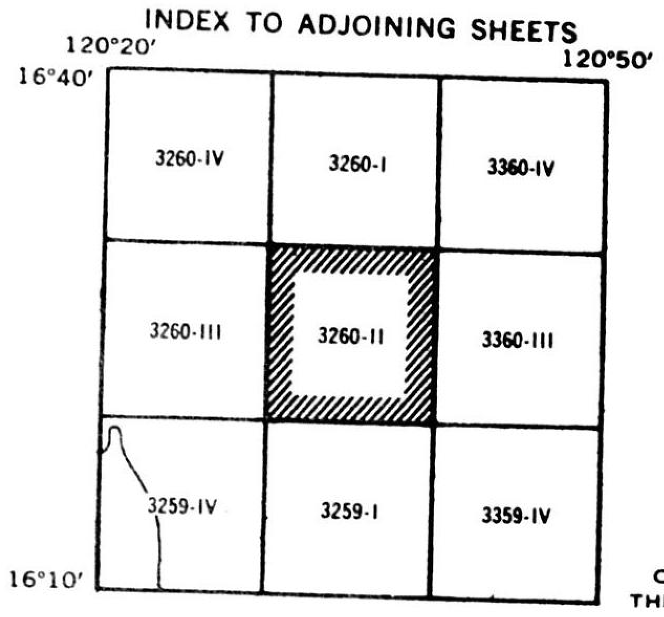
COVERAGE DIAGRAM



Interior Luzon, 1:31,680, Controlled Reconnaissance Survey, Reliability Poor.

Oblique photography 1923

INDEX TO ADJOINING SHEETS



HEIGHTS IN FEET

Single underline denotes municipal capital
Double underline denotes provincial capital

CONTOUR INTERVAL 100 FEET

POLYCONIC PROJECTION
APPROXIMATE LUZON DATUM

ONE THOUSAND YARD PHILIPPINE POLYCONIC GRID
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

LEGEND

Roads:
- Surfaced, All-weather, Regularly Maintained
- Partly Surfaced, Dry-weather, Irregularly Maintained
- Other Dry-weather Road or Track
- Trail
- Trail from Sources Prior to 1920
- Road Under Construction, 1941

Railroads:
- Single Track 3'6", with Cut and Fill
- Double Track 3'6", with Station
- Single Track, Light and Narrow Gauge

Town, Plan Unknown

Village or Settlement, Plan Unknown

Towns from Sources Prior to 1920 [Rosina]

Treetop Elevation T T 312

Woodland; Logged-off Area

Bamboo; Brushwood or Low Tropical Growth

Banana or Abaca; Palm, Palmetto or Cocoanut

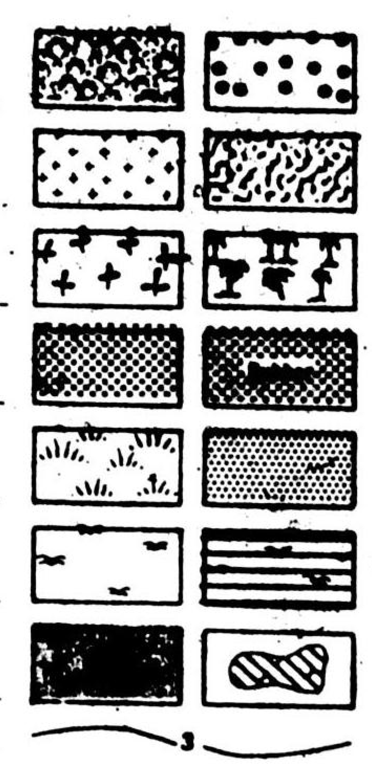
Orchard; Plantation

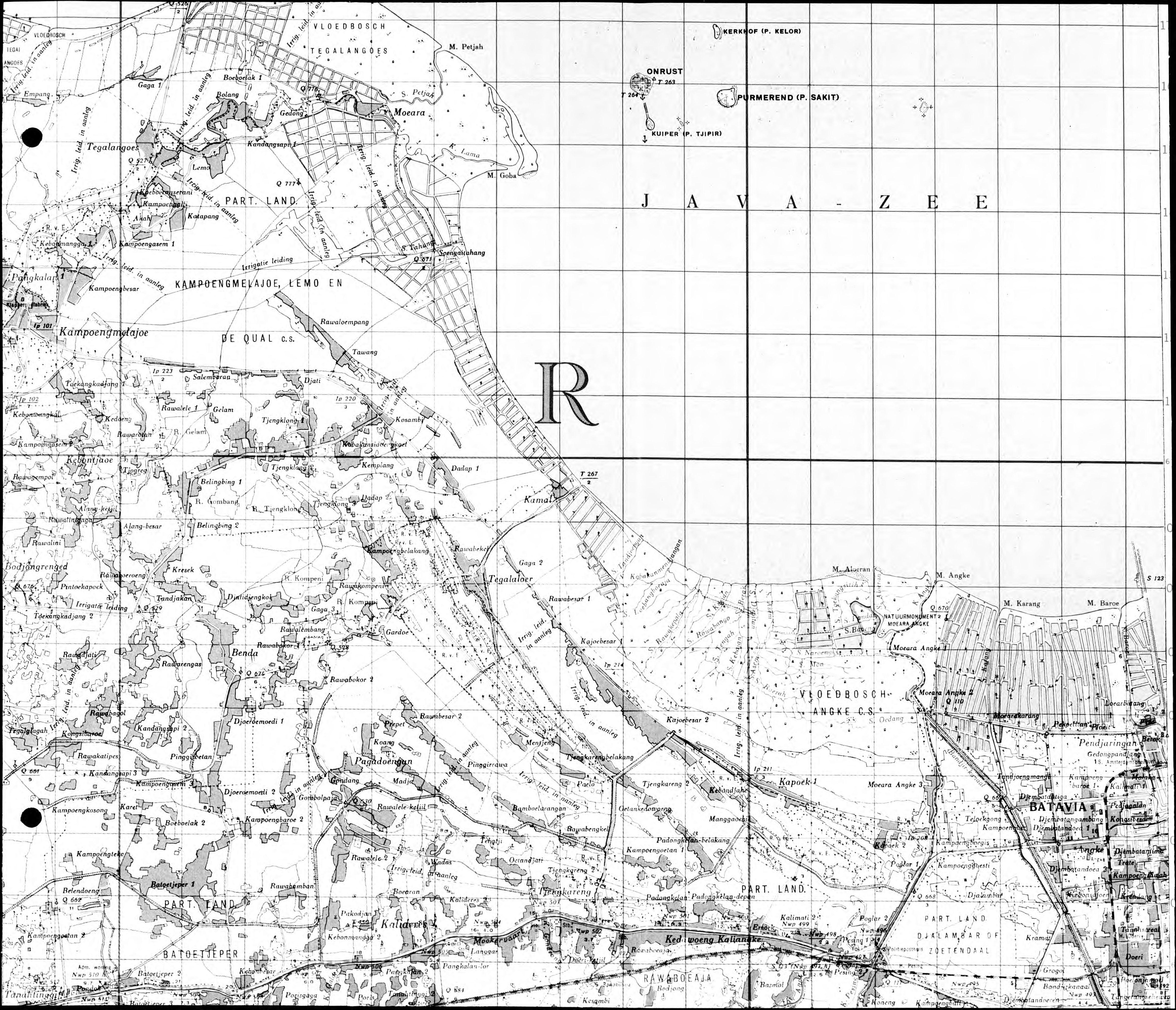
Tropical Grass; Vineyard

Nipa; Nipa Swamp

Mangrove; Rice Field

Depth Curve in Fathoms 3




JAVA - ZEE
R
KERKHOF (P. KELOR)
ONRUST
PURMEREND (P. SAKIT)
KUIPER (P. TJIPIR)
VLOEDBOSCH
TEGALANGOES
M. Petjah
Moeara
M. Goba
Tegalangoes
PART. LAND
KAMPOENGMELAJOE, LEMO EN
DE QUAL c.s.
Kampoengmelajoe
Irrigatie leiding
Soengaitahang
Rawaloempang
Tawang
Kosambi
Dadap 1
Kamal
Tegalaloer
Kajoebesar 1
Kajoebesar 2
Kapoek 1
Tjengkareng
Tjengkareng 2
Benda
Pagadoengan
Kalideres
Mookervaart
Kedawoeng Kaliangke
M. Aloeran
M. Angke
M. Karang
M. Baroe
NATUURMONUMENT
MOERA ANGKE
VLOEDBOSCH
ANGKE C.S.
Moeara Angke 3
BATAVIA
Pendjaringan
PART. LAND
DJALAMBAR OF
ZOETENDAAL
PART. LAND
BATOETJEPER
Batoetjeper 1
RAWABOEAJA
Tanahtinggi
Kampoengmelajoe
Pangkalan
Bodjongrenged
Kresek
Gaga 1
Gaga 2
Gaga 3

JAVA & MADURA 1:50,000

A. M. S. Extension of Geographic Section. General Staff No. 4202.

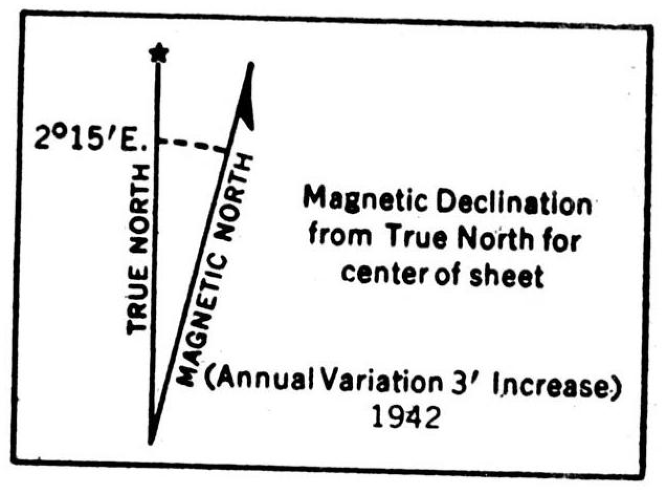
Photolithographed and reprinted from a Dutch map dated 1925 by the Army Map Service, U. S. Army, Washington, D. C., 1943, 106517

3/43 SC.

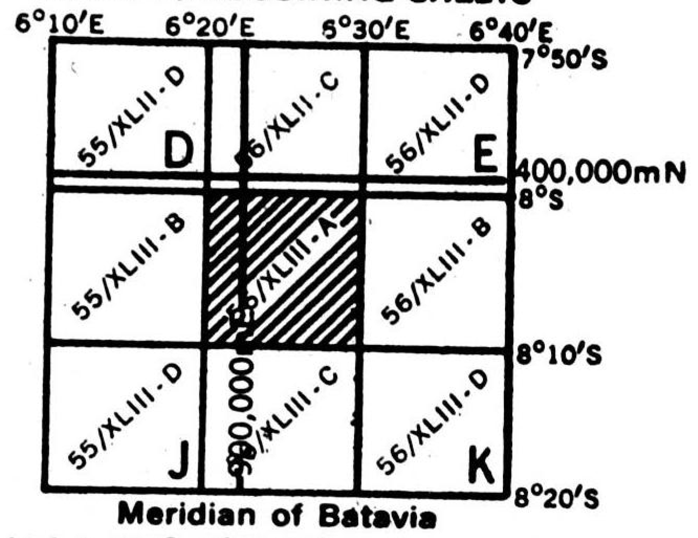
Dutch East Indies, Southern Zone Grid

Projection	Lambert Conical Orthomorphic
Spheroid	Bessel
Origin	8° South, 110° East
False Co-ordinates of Origin	550,000 Meters East 400,000 Meters North

S0800-E11308/10 (Greenwich)



INCIDENCE OF GRID LETTERS and INDEX TO ADJOINING SHEETS



Meridian of Batavia
(which is 106°48′27.79″E. of Greenwich)

TO GIVE A GRID REFERENCE ON THIS SHEET

LETTER. Must be used for this sheet. Obtain from face of map or from diagram.
FIGURES. IGNORE the SMALLER figures printed near the sheet corners. These are for finding the full co-ordinates, viz. 381000.
USE ONLY THE LARGER FIGURES PRINTED IN THE MARGIN OR ON THE FACE OF THE MAP. Viz. 381000

POINT Tenggir		LETTERS K	
East Take West edge of square in which point lies, and read the figure printed opposite this line on North or South margin or on the line itself on the face of the map. *Estimate tenths Eastwards*	00 4	**North** Take South edge of square in which point lies, and read the figure printed opposite this line on East or West margin or on the line itself on the face of the map. *Estimate tenths Northwards*	88 3
East	004	North	883
REFERENCE K004883		To nearest 100 metres	

Unit - - - - - - - Metre
Square - - - - - - - 1,000 Metres
Nearest similar reference with one letter distant - - - 500 Kms.

LEGEND

- Main surfaced roads: (a) · more than 4 meters wide; (b) · 2 · 4 meters wide
- Surfaced roads, less suitable for auto traffic
- Unsurfaced roads, suitable for field artillery at all times
- Unsurfaced roads, suitable for field artillery in dry season
- (a) · stone mileage post; (b) · iron bridge; (c) · stone bridge; (d) · stone culvert
- (a) · wooden bridge; (b) · bamboo bridge; (c) · stone sluice; (d) · gradient; (e) · bamboo or wood culvert
- River; (a) · sandbank; (b) · sandy shore; (c) · island; (d) · artificially raised bank or shore line
- (a) · stone sluice; (b) · passable; (c) · bridgeway across; (d) · ford
- Contours · Interval 25 meters with every 10th contour heavy; (a) · elevation figures; (b) · auxiliary contour lines (c) · spring; (d) · slight elevation; (e) · uneven ground
- Raised portion of road
- Road under construction
- Tunnel
- Dike
- Plantation road
- Residency boundary
- Department boundary
- State boundary
- Subdivision boundary
- District boundary
- Railroad (a) · culvert under roadbed
- Decauville
- Narrow guage railroad
- UNSURVEYED
- Small rivers or streams
- Lake
- Fishpond
- Christian church
- Christian cemetery
- Stone wall
- Barbed wire fence
- Graves: Chinese and Native
- Stone boundary markers or posts
- Mosque
- Chinese temple
- Triangulation points
- Monuments
- Ruins
- Wayside stopping point
- Astronomical station
- Trees (various types)
- Regularly laid out gardens and fields
- Plantations: rubber, tea, coffee
- Settlement
- Sparsely settled area
- Buildings: iron, stone, wood, bamboo
- Dry rice field
- Temporary settlement
- Warehouses: stone, wood, bamboo
- Forest
- Underbrush
- Tobacco shed
- Rocks: above and below water
- Mud springs
- Depression contour
- Bores
- Living hedge
- Dead hedge
- Anchorage
- Wharf or quay
- Marsh
- Swamp
- Breakers
- Coffer-dam
- Grass, alang alang grass, and reeds
- Lighthouse
- Air-cable route
- Horsepath
- Footpath
- Barrel-buoys (black or white)

FORMOSA 1:25,000

A.M.S. L892

CONTOUR INTERVAL 20 METERS

Auxiliary 10 meter contours shown by dashed lines

POLYCONIC PROJECTION

ONE THOUSAND YARD WORLD POLYCONIC GRID. BAND III N. ZONE "D"
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

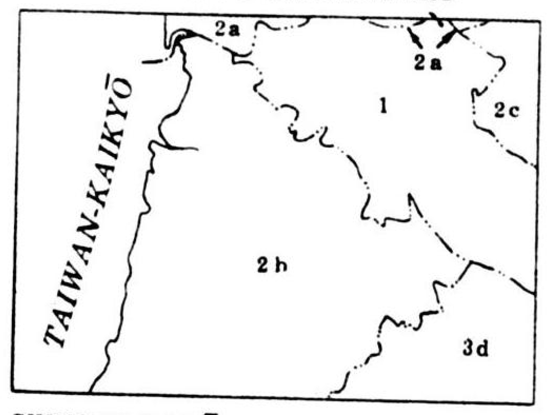
NOTE: OFFICERS USING THIS MAP WILL MARK HEREON CORRECTIONS AND ADDITIONS WHICH COME TO THEIR ATTENTION AND MAIL DIRECT TO THE CHIEF OF ENGINEERS, WASHINGTON, D. C.

HEIGHTS IN METERS

GLOSSARY

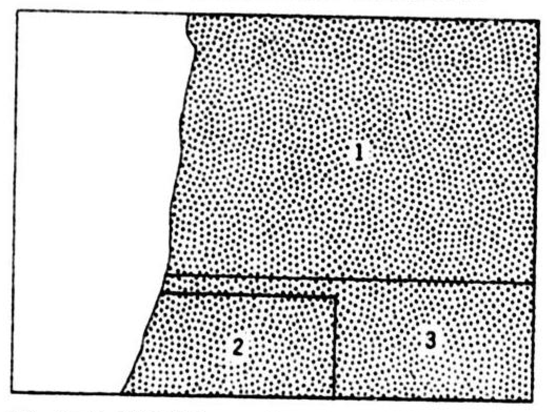
-chō .... prefecture
-gun .... county
-shō .... township
-kei .... river, stream
-sha .... aboriginal colony

INDEX TO BOUNDARIES



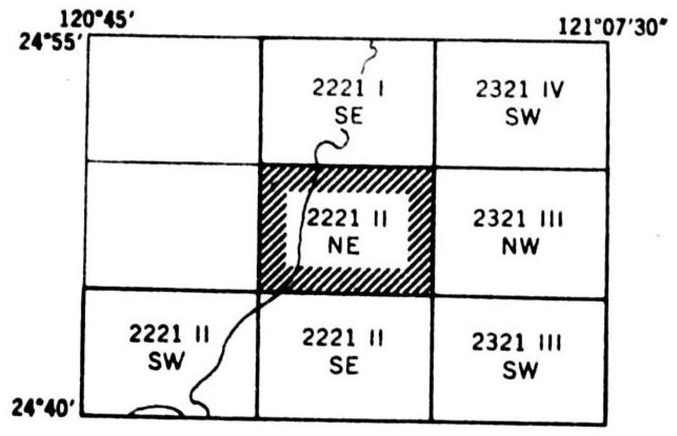
SHINCHIKU-SHŪ
1. SHINCHIKU-SHI
2. SHINCHIKU-GUN
a. KYŪKŌ-SHŌ
b. KŌZAN-SHŌ
c. ROKUKA-SHŌ
3. CHIKUTŌ-GUN
d. HŌZAN-SHŌ

PHOTO COVERAGE DIAGRAM



(1) Sortie M11/3C November, 1943 24"V.
(2) Sortie M14/5C February, 1944 24"V.
(3) Sortie M11/3C November, 1943 6"T.V.

INDEX TO ADJOINING SHEETS



COMPILATION METHODS

PLANIMETRIC METHODS

STEREO METHODS

All place names are transcribed according to the Modified Hepburn (Romaji) System.
Elevation measured from the mean tide of Kiirun Bay

LEGEND

- Areas densely built-up
- Areas moderately built-up, and Large buildings
- National or Prefectural Road, generally metalled, over 4 m. wide
- Road, 2-4 meters wide
- Track or Trail
- Railroads:
  - 3'6" gauge, Single track, with Station
  - 3'6" gauge, Double track
  - Narrow, Light, or Special gauge, Single track
  - In street, labeled with gauge (3'6")
- Boundaries:
  - Prefectural (Chō or Shū)
  - Gun or Shi
  - Kai or Shō
- Temple, Shrine, Pagoda
- Church, Tomb, Dam
- School, Chimney, Powerhouse or Station
- Prison, Radio mast, Mine
- Ship Anchorage, Fence, Cemetery
- Shipyard, Mineral spring, Fumarole
- Control point, Bench mark, Spot elevation (•120)
- Generally Rice or Sugar Cane
- Orchard or Vineyard, Bamboo
- Mud or Tidal Flat
- High tension line
- Masonry retaining wall or Revetment, Falls

FORMOSA PHOTO MAPS 1:25,000

A.M.S. L092.

Reliability of grid uncertain due to local minor disagreement between photo map and topographic map.

ONE THOUSAND YARD WORLD POLYCONIC GRID. BAND IIIN. ZONE "D"
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

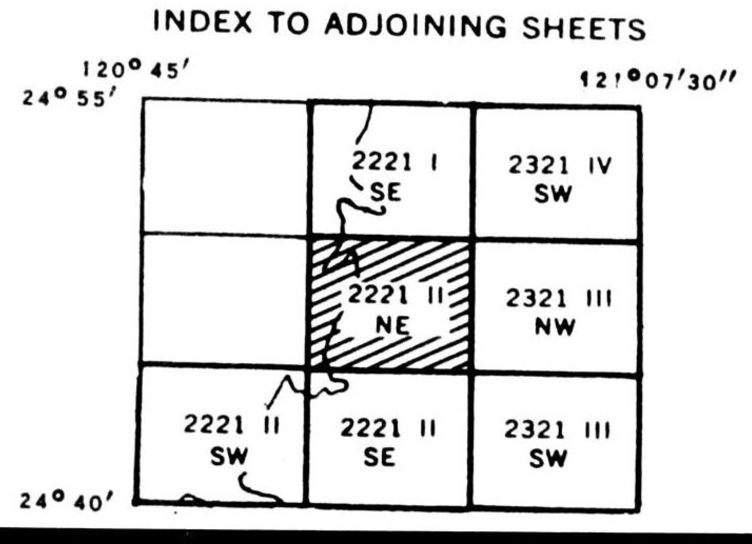
POLYCONIC PROJECTION

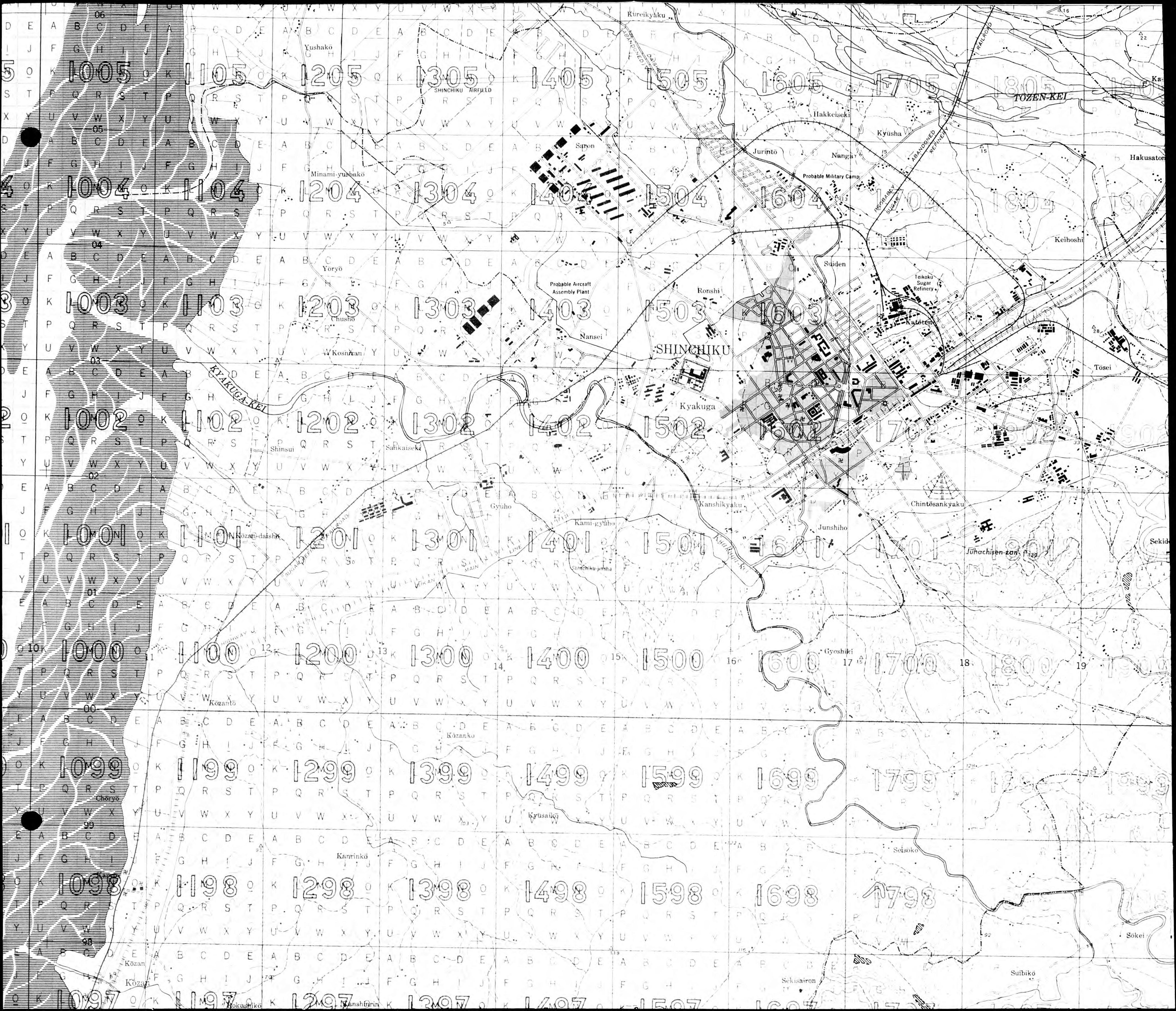
HEIGHTS IN METERS

LEGEND

- Main Roads
- Secondary Roads
- Railroads
- Streams
- Clouds [C]
- No Photos Available [U]

INDEX TO ADJOINING SHEETS




Kureikyaku
Yushakō
SHINCHIKU AIRFIELD
TOZEN-KEI
Hakkeiseki
Kyūsha
Jurintō
Nanga
Saron
Hakusaton
Probable Military Camp
Minami-yushakō
Keihoshi
Suiden
Teikoku Sugar Refinery
Yoryō
Probable Aircraft Assembly Plant
Ronshi
Chūshō
Katōten
Nansei
SHINCHIKU
Tōsei
KYAKUGA-KEI
Kyakuga
Shinsui
Gyuho
Kanshikyaku
Chintōsankyaku
Kami-gyuho
Junshiho
Jūhachisen-zan
Gyoshiki
Kōzantō
Kōzanko
Chōryō
Kyūsaikō
Kanrinkō
Seisoko
Sōkei
Kōzan
Suibikō
Sekisairon

APS 1:25,000

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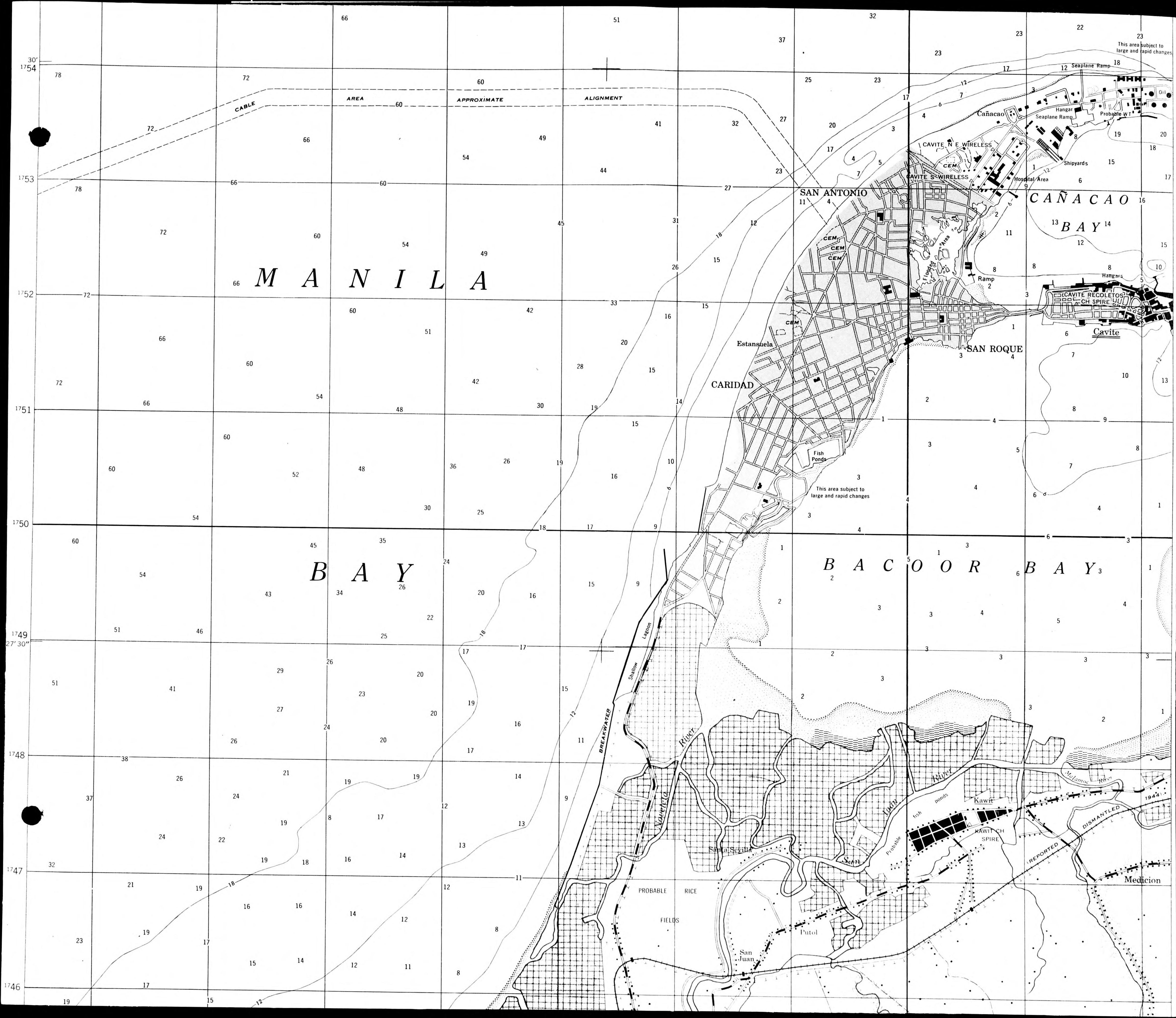
Not for sale or distribution

SHINCHIKU NE

FIRST EDITION-AMS



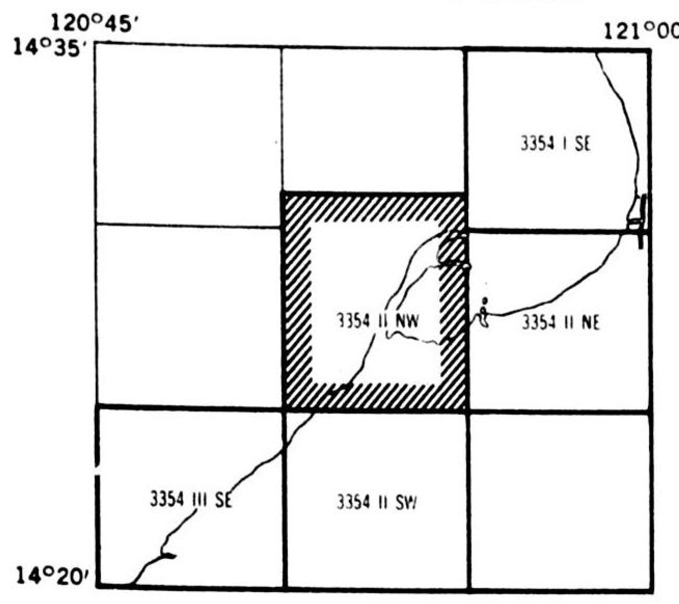
MANILA BAY
CANACAO BAY
BACOOR BAY
CABLE AREA APPROXIMATE ALIGNMENT
SAN ANTONIO
Cañacao
Seaplane Ramp
Hangar
Probable W T
Oil
CAVITE N E WIRELESS
CAVITE S WIRELESS
CEM
Hospital Area
Shipyards
Flooded Area
Ramp
Hangars
CAVITE RECOLETOS CH SPIRE
Cavite
SAN ROQUE
Estansuela
CARIDAD
Fish Ponds
This area subject to large and rapid changes
BREAKWATER
Shallow Lagoon
Noveleta River
San Juan River
Probable fish ponds
Kawit
KAWIT CH SPIRE
Santa Sevilla
PROBABLE RICE FIELDS
Putol
San Juan
Medicion
REPORTED DISMANTLED 1944

LUZON 1:25,000

A. M. S. S812

MAP - 21

INDEX TO ADJOINING SHEETS



POLYCONIC PROJECTION

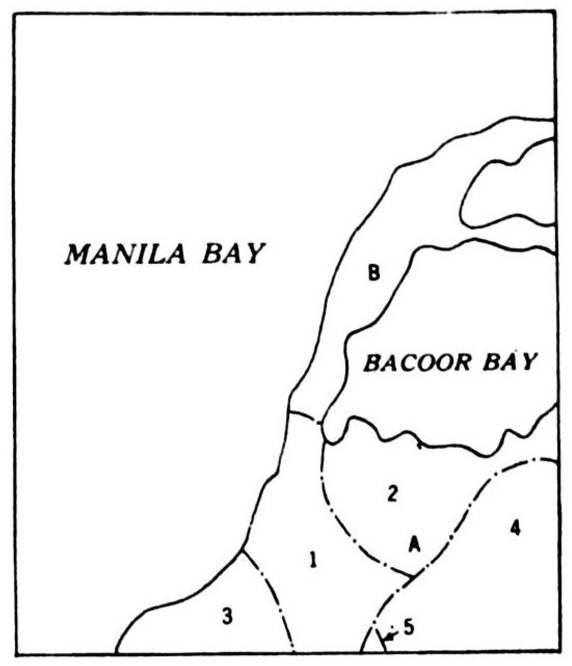
APPROXIMATE LUZON DATUM

ONE THOUSAND YARD PHILIPPINE POLYCONIC GRID

THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

Single Underline Denotes Municipal Capital
Double Underline Denotes Provincial Capital

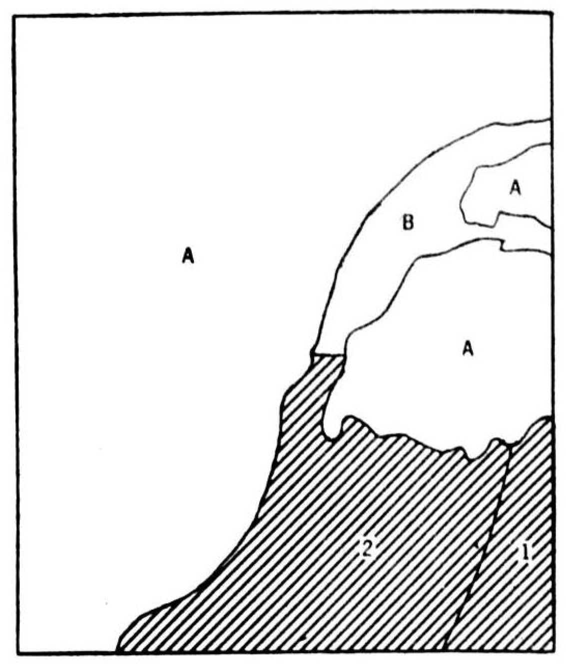
INDEX TO BOUNDARIES



A. Cavite Province
1. Noveleta Municipality
2. Kawit Municipality
3. Rosario Municipality
4. Imus Municipality
5. General Trias Municipality

B. Chartered City of Cavite

COVERAGE DIAGRAM



COMPILATION METHODS

PHOTO PLANIMETRIC | PHOTO STEREO | MAP

A. USC&GS, 1:20,000, Hydrographic Compilation, Trigonometric Survey, Reliability Good
B. Cavite City Plan, 1:10,000. Reliability Good.
1. Sortie: 21PR/4MB 33, Date: May, 1944. Oblique Photography.
2. Sortie 21PR/4MB 33, Date: May, 1944. Vertical Photography.

Reefs Along the Shore may be Covered One to Two Feet at Low Tide

DEPTHS AT MEAN LOWER LOW WATER

HEIGHTS AND DEPTHS IN FEET

LEGEND

Roads:
- Surfaced, All-weather, Regularly Maintained
- Partly Surfaced, Dry-weather, Irregularly Maintained
- Other Dry-weather Road or Track
- Trail
- Trail from Sources Prior to 1920
- Road Under Construction, 1941

Railroads:
- Single Track 3'6", with Cut and Fill
- Double Track 3'6", with Station
- Single Track, Light and Narrow Gauge

Town, Plan Unknown

Village or Settlement, Plan Unknown

Town from Sources Prior to 1920 — [Rosina]

Treetop Elevation — T T 312

Woodland; Logged-off Area

Bamboo; Brushwood or Low Tropical Growth

Banana or Abaca; Palm, Palmetto or Cocoanut

Orchard; Plantation — Rubber

Tropical Grass; Vineyard

Nipa; Nipa Swamp

Mangrove; Rice Field

Depth Curve in Feet — 12

772
771
770
769
768
767
766
Bancolasi
Cocomo Island
VITAS MOUTH
MANILA
BAY
MANILA
NORTH
HARBOR
PASIG RIVER
LIGHTHOUSE
PASIG
RIVER
MARINE
RY SLIP
MARINE
RY SLIP
WEST BREAKWATER
MANILA HARBOR
ERMITA

LUZON PHOTO MAPS 1:25,000

A.M.S. S011.

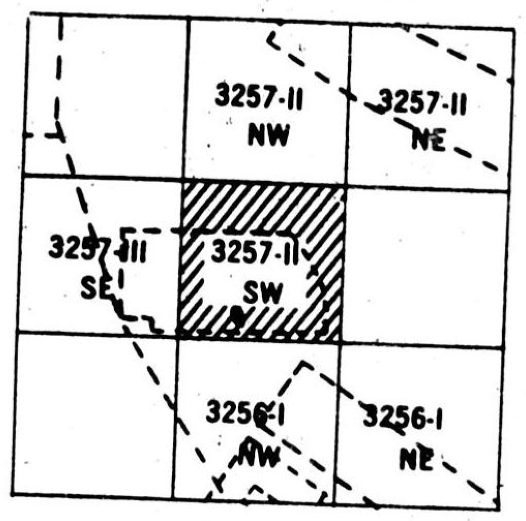
First Edition (AMS 1), 1944.

POLYCONIC PROJECTION,
APPROXIMATE LUZON DATUM

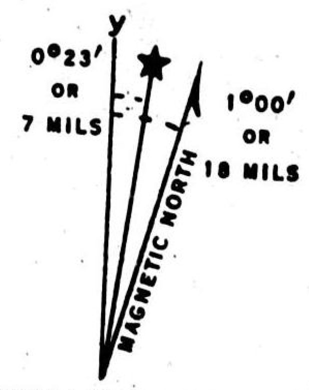
ONE THOUSAND YARD PHILIPPINE POLYCONIC GRID
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

HEIGHTS IN FEET

INDEX TO SHEETS



- - - - - LIMIT OF PHOTOGRAPHY



APPROXIMATE MEAN DECLINATION 1944
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 1' INCREASE

Use diagram only to obtain numerical values. To determine magnetic north line, connect the pivot point "P" on the south edge of the map with the value of the angle between GRID NORTH and MAGNETIC NORTH, as plotted on the degree scale at the north edge of the map.

Controlled mosaic 1944 from large scale vertical photography flown 1938.
Control by slotted templet tied to U.S.C.& G.S. Field Sheets along coast line.

LEGEND

Roads
Trails
Spot Elevations

WARNING: Cloud patches should not be confused with clearings.

Reliability of grid uncertain due to lack of sufficient horizontal control.

Disregard grid in black on photograph area.

RYUKYU-RETTO 1:25,000

MAP - 22

A.M.S. L891

COVERAGE DIAGRAM

COMPILATION METHODS

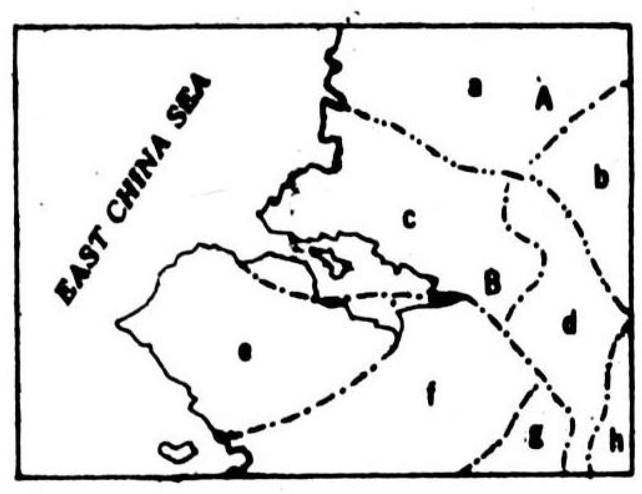
PHOTO STEREO	PHOTO PLANIMETRIC	MAP

OBLIQUE

A. Hydrographic Compilation (Reliability fair)
B. Obscured by clouds
1. Sortie FRANK 125B, October 1944
2. Sortie WASP 231, October 1944
3. Sortie 11PL-MR7, September 1944
4. Sortie 14PL-MR7, September 1944
5. Sortie CV6 129, October 1944

INTENSIFIED FROM 12″ COVERAGE

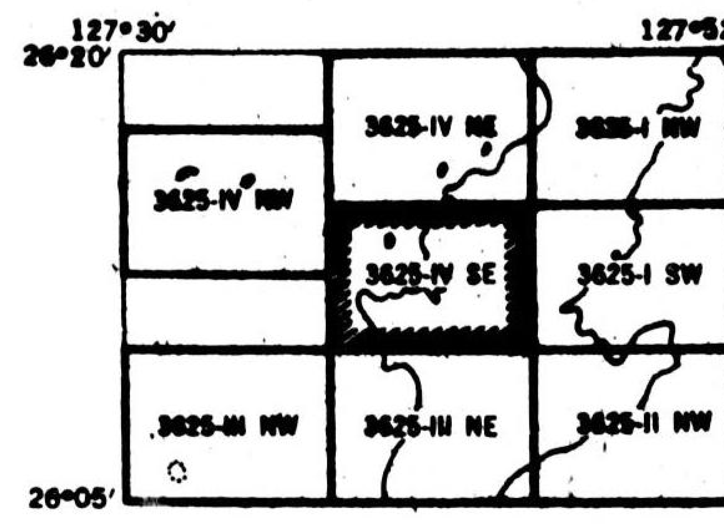
INDEX TO BOUNDARIES

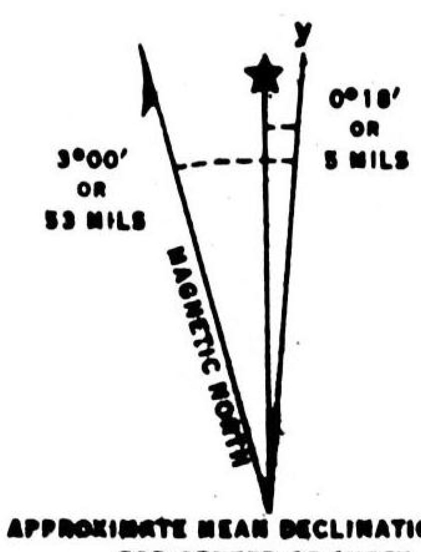


OKINAWA-KEN

A. NAKAGAMI-GUN
  a. URASOE-MURA
  b. NISHIBARA-MURA
B. SHIMAJIRI-GUN
  c. MAWASHI-MURA
  d. HAEBARU-MURA
  e. OROKU-MURA
  f. TOMIGUSUKU-MURA
  g. KOCHINDA-MURA
  h. ŌZATO-MURA

INDEX TO ADJOINING SHEETS





APPROXIMATE MEAN DECLINATION 1944
FOR CENTER OF SHEET
NO ANNUAL MAGNETIC CHANGE

CONTOUR INTERVAL 10 AND 20 METERS

Approximate Contours Shown in Areas of Sparsely Controlled
Trimetrogon Oblique Coverage

POLYCONIC PROJECTION

ONE THOUSAND YARD WORLD POLYCONIC GRID, BAND IIIN, ZONE "C"
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

NOTE: OFFICERS USING THIS MAP WILL MARK HEREON CORRECTIONS AND ADDITIONS WHICH COME TO THEIR ATTENTION AND MAIL DIRECT TO THE CHIEF OF ENGINEERS, WASHINGTON, D. C.

GLOSSARY

-gun	county	-mura	township
-gusuku (-jo)	castle	-saki (-zaki, -misaki)	cape
-kawa (-gawa)	river	-se (-ze)	reef, shoal
-ken	prefecture	-shima (-jima)	island
-ko (minato)	harbor	-yama (-zan, -san)	mountain
-kuchi (-guchi)	channel		

HYDROGRAPHIC DATUM: APPROXIMATE LEVEL OF LOWEST LOW WATER
REEFS MAY BE COVERED AT LOW WATER

HEIGHTS IN METERS—DEPTHS IN FATHOMS

LEGEND

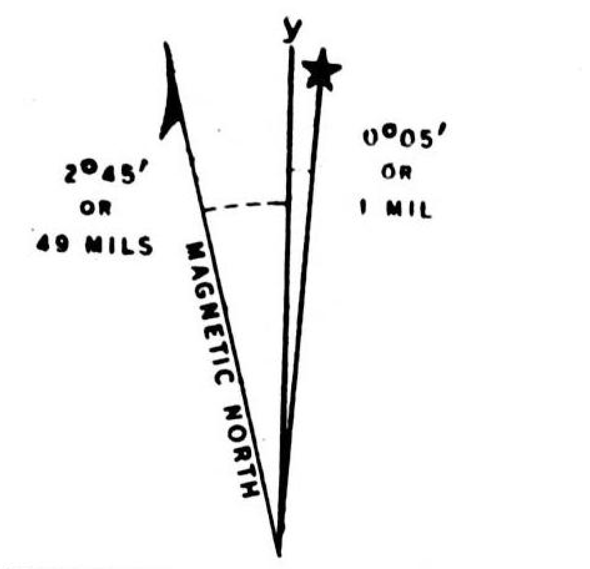
Prefectural Road	Railroad 3′6″ gauge--steam
Road, 2-4 meters wide	Railroad 3′6″ gauge--electric (ELECTRIFIED)
Track and Trail	Railroad 2′6″ narrow gauge
Road in built-up areas	Railroad 2′6″ narrow gauge - horse-drawn (HORSE-DRAWN)
Mud or tidal flats	Soundings 10
Rice field	Fathom line 6
Orchard	Limiting danger line or low water line

RYUKYU-RETTO PHOTO MAPS

A.M.S. L091

First Edition (AMS 1), 1944.

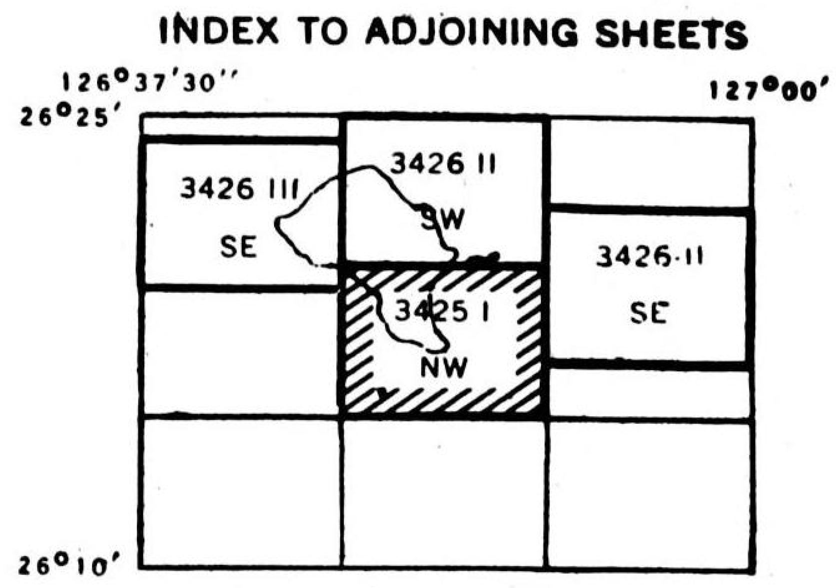
1:25,000



APPROXIMATE MEAN DECLINATION 1944
FOR CENTER OF SHEET
NO ANNUAL MAGNETIC CHANGE

Use diagram only to obtain numerical values. To determine magnetic north line, connect the pivot point "P" on the south edge of the map with the value of the angle between GRID NORTH and MAGNETIC NORTH, as plotted on the degree scale at the north edge of the map.

INDEX TO ADJOINING SHEETS



Reliability of grid uncertain due to loca' minor disagreement between photo map and topographic map.

Mosaic controlled by average fit to 1:25,000 map. Aerial photographs flown by U.S.A.A.F. and U.S.N Sorties: CV6 130 12"V October 1944.

ONE THOUSAND YARD WORLD POLYCONIC GRID, BAND IIIN, ZONE "C"
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

POLYCONIC PROJECTION

HEIGHTS IN METERS

TO GIVE GRID AND TARGET-AREA REFERENCES ON THIS SHEET
FIGURES. IGNORE the SMALLER figures printed around the margin of the map. These are for finding the full co-ordinates.
USE ONLY THE LARGER FIGURES PRINTED IN THE MARGIN OR ON THE FACE OF THE MAP Viz. 3177000

POINT SHIMAJIRI

FOR STANDARD MILITARY GRID REFERENCE

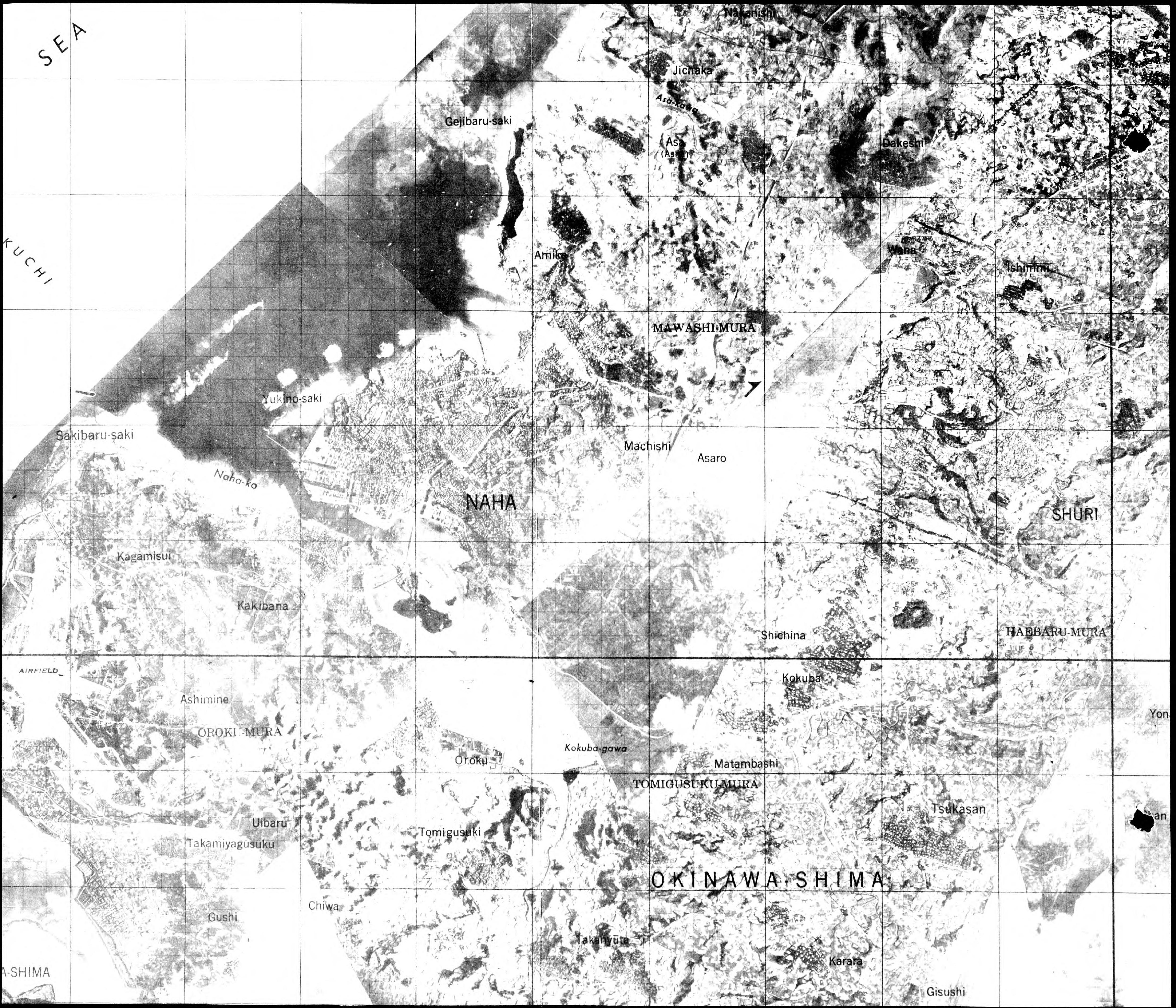
East		North	
Take West edge of square in which point lies, and read the figure printed opposite this line on North or South margin or on the line itself on the face of the map. *Estimate tenths Eastwards*	78 6	Take South edge of square in which point lies, and read the figure printed opposite this line on East or West margin or on the line itseil on the face of the map. *Estimate tenths Northwards*	82 8
East	786	North	828

STANDARD MILITARY GRID REFERENCE 786828 (To neaiest 100 yards)

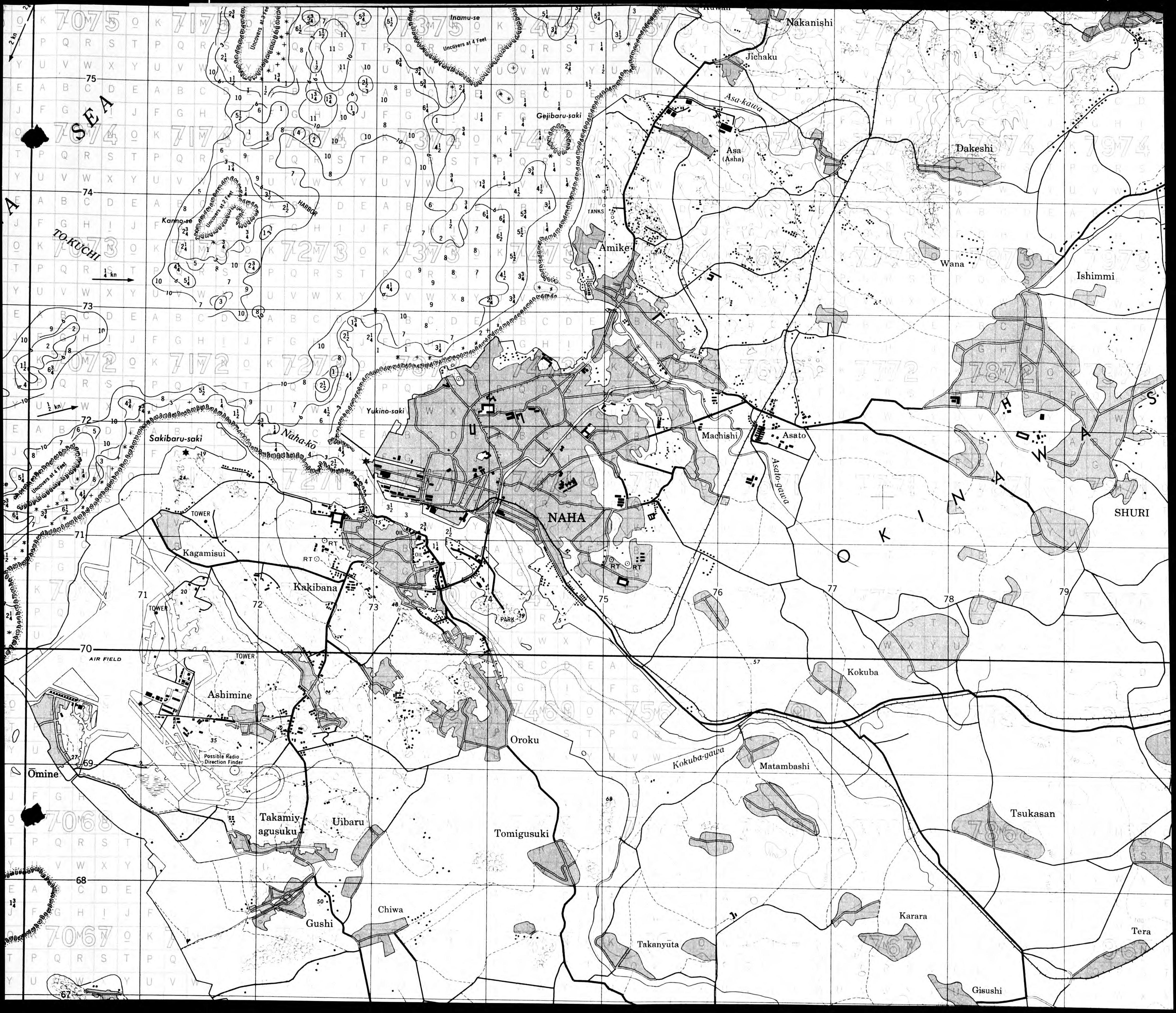
FOR TARGET-AREA DESIGNATOR

Take NUMBER of the 1000 yard square in which the point lies. Take LETTER of the 200 yard square in which the point lies.	7882 I
TARGET AREA DESIGNATOR (Locates within 200 yard square)	7882 I

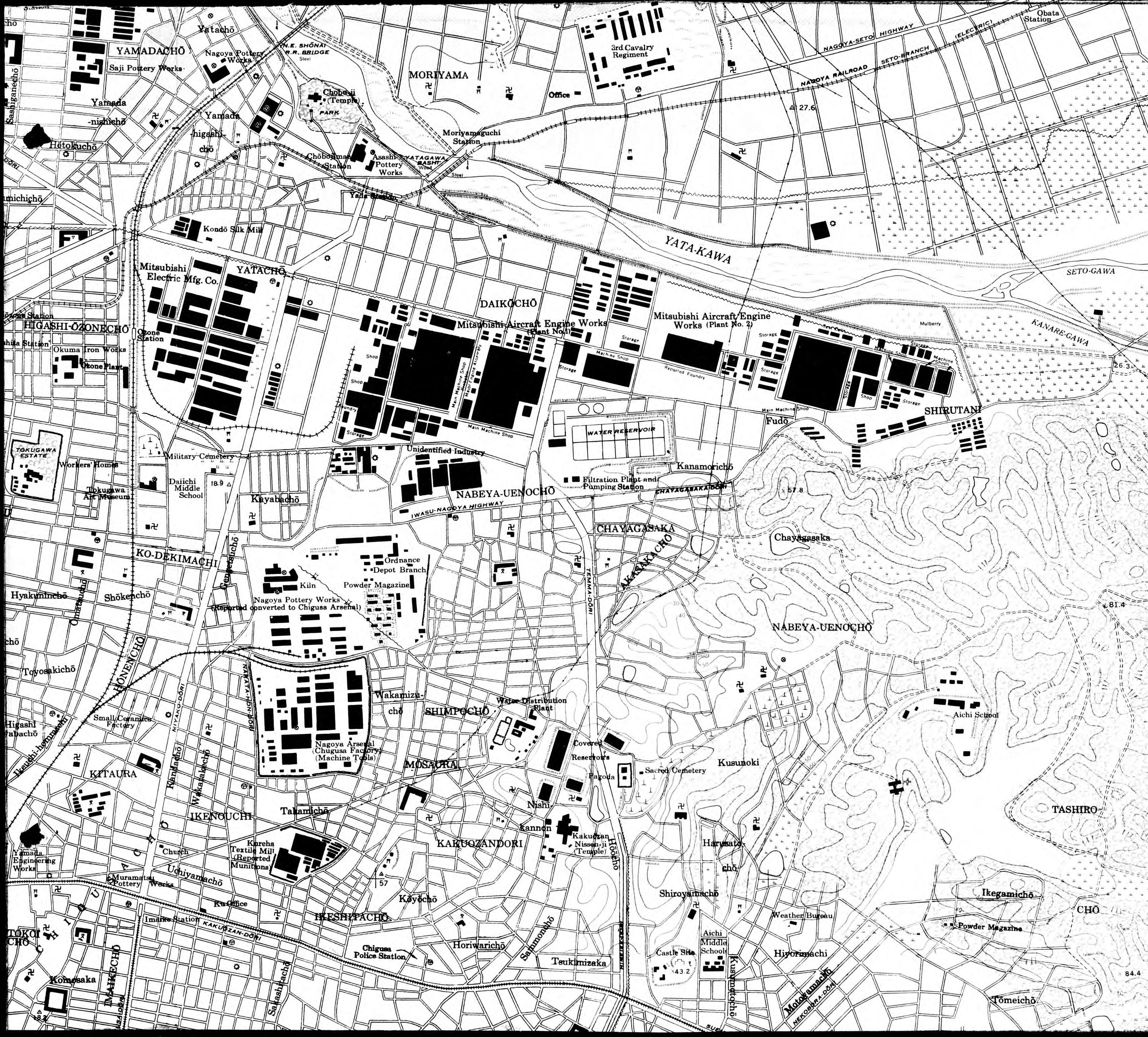
Nearest similar grid or target-area reference–100,000 yards (Approximately 57 miles)



SEA
KUCHI
Jichaka
Asa-kawa
Gejibaru-saki
Asa
Dakeshi
Amike
Wana
Ishimmi
MAWASHI-MURA
Yukino-saki
Sakibaru-saki
Machishi
Asaro
Naha-ko
NAHA
SHURI
Kagamisui
Kakibana
Shichina
HAEBARU-MURA
AIRFIELD
Kokuba
Ashimine
OROKU-MURA
Kokuba-gawa
Oroku
Matambashi
TOMIGUSUKU-MURA
Tsukasan
Uibaru
Tomigusuki
Takamiyagusuku
OKINAWA-SHIMA
Chiwa
Gushi
Takanyūta
Karara
A-SHIMA
Gisushi



SEA
TO-KUCHI
HARBOR
Kanno-se
Uncovers at 2 Feet
Uncovers at 4 Feet
Inamu-se
Gejibaru-saki
Nakanishi
Jichaku
Asa-kawa
Asa
(Asha)
Dakeshi
TANKS
Amike
Wana
Ishimmi
Yukino-saki
Naha-kō
Sakibaru-saki
Machishi
Asato
Asato-gawa
NAHA
SHURI
TOWER
Kagamisui
Kakibana
OIL
RT
PARK
AIR FIELD
Ashimine
Possible Radio Direction Finder
Ōmine
Oroku
Kokuba
Kokuba-gawa
Matambashi
Tsukasan
Takamiy-
agusuku
Uibaru
Tomigusuki
Gushi
Chiwa
Karara
Takanyūta
Tera
Gisushi



Yatachō
YAMADACHŌ
Nagoya Pottery Works
Saji Pottery Works
N.E. SHŌNAI R.R. BRIDGE
Steel
3rd Cavalry Regiment
Obata Station
NAGOYA-SETO HIGHWAY
(ELECTRIC)
SETO-BRANCH
NAGOYA RAILROAD
MORIYAMA
Chōbōji (Temple)
PARK
Office
27.6
Yamada -nishichō
Yamada -higashi-chō
Moriyamaguchi Station
Asashi Pottery Works
YATAGAWA BASHI
Wood
Steel
Kondō Silk Mill
YATA-KAWA
SETO-GAWA
KANARE-GAWA
Mulberry
Mitsubishi Electric Mfg. Co.
YATACHŌ
DAIKŌCHŌ
Mitsubishi Aircraft Engine Works (Plant No. 1)
Mitsubishi Aircraft Engine Works (Plant No. 2)
HIGASHI-OZONECHŌ
Ozone Station
Okuma Iron Works
Ozone Plant
Storage
Machine Shop
Reported Foundry
Main Machine Shop
Shop
Foundry
26.3
SHIRUTANI
Fudō
WATER RESERVOIR
TOKUGAWA ESTATE
Workers' Homes
Military Cemetery
Unidentified Industry
Tokugawa Art Museum
Daiichi Middle School
18.9
Kayabachō
NABEYA-UENOCHŌ
Filtration Plant and Pumping Station
Kanamorichō
CHAYAGASAKA-DŌRI
IWASU-NAGOYA HIGHWAY
57.8
CHAYAGASAKA
Chayagasaka
AKASAKACHŌ
TEMMA-DŌRI
KO-DEKIMACHI
Ordnance Depot Branch
Kiln
Powder Magazine
Nagoya Pottery Works (Reported converted to Chigusa Arsenal)
Hyakuninchō
Shōkenchō
81.4
NABEYA-UENOCHŌ
Toyosakichō
HŌNENCHŌ
Wakamizu-chō
SHIMPOCHŌ
Water Distribution Plant
Small Ceramics Factory
Nagoya Arsenal (Chigusa Factory) (Machine Tools)
Covered Reservoirs
Pagoda
Sacred Cemetery
Kusunoki
Aichi School
KITAURA
MOSAURA
Nishi
Takamichō
IKENOUCHI
Kannon
Kakuozan Nissen-ji (Temple)
KAKUOZANDORI
TASHIRO-
Church
Kureha Textile Mill (Reported Munitions)
Yamada Engineering Works
Muramatsu Pottery Works
Uchiyamachō
57
Kōyōchō
Shiroyamachō
Ikegamichō
CHŌ
Ku Office
Imaike Station
KAKUOZAN-DŌRI
IKESHITACHŌ
Weather Bureau
Powder Magazine
Chigusa Police Station
Horiwarichō
Tsukimizaka
Castle Site
43.2
Aichi Middle School
Hiyorimachi
Komesaka
MAIKECHŌ
Motoyamachō
NEKOGAHORA-DŌRI
84.4
Tomeichō
11'
10'

MAP - 23

NAGOYA NORTHEAST
AICHI PREFECTURE, HONSHU, JAPAN

Scale 1:12,500

½ 0 ½ Miles

500 0 500 Meters

500 0 500 Yards

POLYCONIC PROJECTION

CONTOUR INTERVAL 10 METERS

Office of the Assistant Chief of Air Staff, Intelligence, Washington, D.C.
Compiled for the Commanding General, U.S. Army Air Forces under the direction of the Aeronautical Chart Service by the Lake Survey Branch Army Map Service, Detroit, Mich. January 1945

Compiled from:
1. Japan 1:25,000, Japanese Imperial Land Survey, Nagoya North and South (1933) (trigonometric survey—base map)
2. Japan 1:50,000, Japanese Imperial Land Survey, Nagoya North and South (c.1939, expurgated) (trigonometric survey—added streets, buildings and town area, drainage changes)
3. Greater Nagoya Street Map, pub. Shunyuki 1:25,000 (1938, 1941) (diagrammatic plan—added streets and town area, location of buildings, place names)
4. City Plan, pub. Tōkyō-Takeuchi 1:10,000 (1935) (diagrammatic plan—location of buildings, place names)
5. Complete Map of Nagoya, pub. Matsuoka Meibundo, 1:20,000 (1929) (diagrammatic plan—location of buildings, place names)
6. Japanese Government Railway Timetable (1941) (railroad gauges)
7. Intelligence data (location of industries)

Names transcribed according to the Modified Hepburn (Romaji) System

Selected industrial installations and other major features revised from vertical photography (November 1944)

LEGEND

Factory

Hospital

Shrine

Temple

Chimney

Monument

School

Post Office

Depth of Water

Police Station

Cemetery

Densely Built-up

Sparsely Built-up

National or Prefectural Road generally metalled over 4 m wide, or streets in city area

Other roads 2-4 m wide

Road, Track, or Trail less than 2 m wide

3'6" Gauge, Double Track Railroad

3'6" Gauge, Single Track Railroad

Narrow Gauge, Single Track Railroad

Railroad Stations

Carline

High Tension Power Line

Woodland

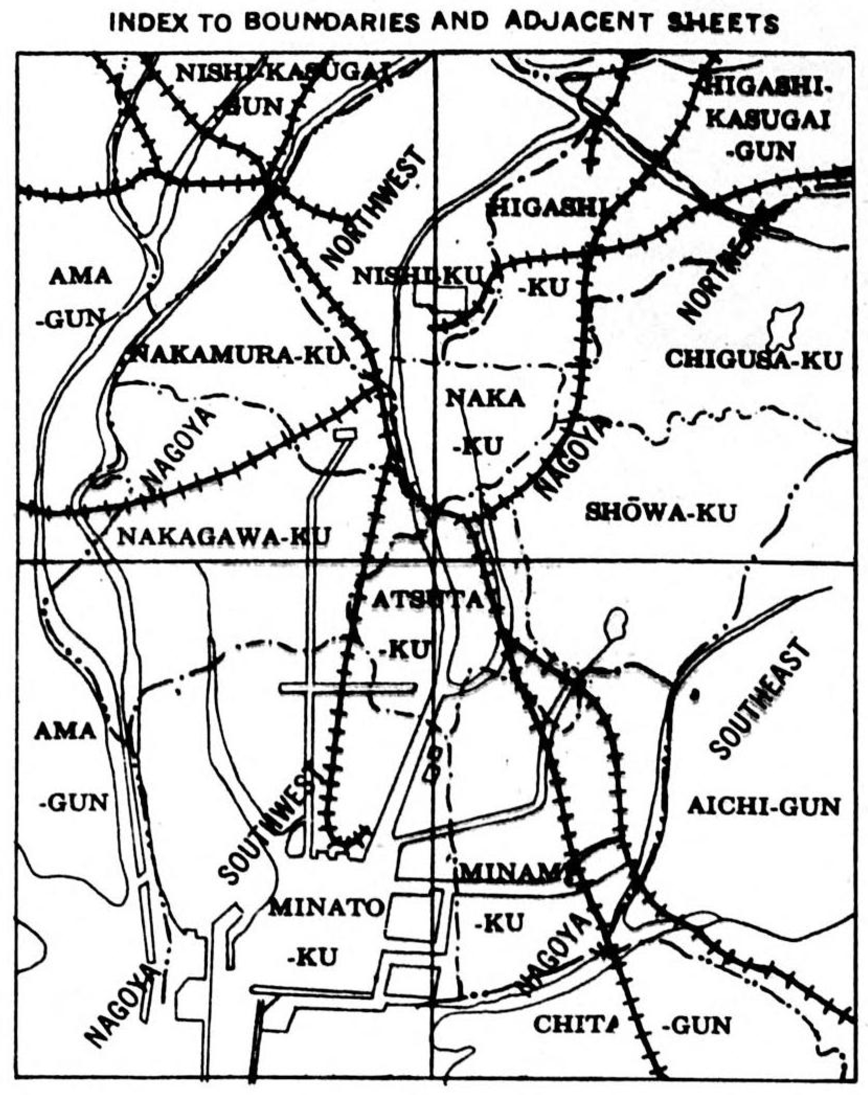
Grassland

Rice

GLOSSARY

-bashi	bridge
-chō	street, precinct
-dōri	street
-gun	county
-gawa, -kawa	river
higashi-	east
kami-	upper
kita-	north
-ku	ward
-machi-	street, precinct
minami-	south
-mura	township
naka-	middle
nishi-	west
shimo-	lower
shin-	new

INDEX TO BOUNDARIES AND ADJACENT SHEETS



KU BOUNDARIES — GUN BOUNDARIES

HEIGHTS IN METERS, DEPTHS IN FATHOMS

LANDFALL RELIEF MODELS

INSTRUCTION MANUAL
UNITED STATES NAVY
SPECIAL DEVICES DIVISION
BUREAU OF AERONAUTICS

SPECIAL DEVICES DIVISION
U.S.N. BUREAU AERONAUTICS

RESTRICTED
Device 16-E-26

RESTRICTED

LANDFALL RELIEF MODELS

THEIR DEVELOPMENT, CONSTRUCTION, AND USE

PREPARED BY SPECIAL DEVICES DIVISION
BUREAU OF AERONAUTICS
U. S. NAVY

FOREWORD

THE Bureau of Aeronautics initiated a project to devise techniques for rapid construction of miniature land and seascapes in combat areas, and work was begun in December of 1942. Since inception, techniques and devices have been developed and officer personnel of the Navy, Marine Corps, and Army trained in them. Some of the officers have prepared models under combat conditions for battle planning.

This manual is a compilation of methods used in the building of recognition relief models, and in the instruction of personnel trained in these techniques. The project was developed with the cooperation of the Air Technical Analysis Division and the Photographic Interpretation Unit, and was aided by the resources of the Graphics Division of the Office of Naval Intelligence. Material assistance was given by agencies and individuals too numerous to list. Particular mention, however, should be made of the facilities of the American Museum of Natural History which were put at the disposal of the Bureau by its directors, and of the advice and services of Dr. Charles Russell of the museum, his staff, and the guest lecturers of the workshop sessions: Dr. A. K. Lobeck, Dr. Charles Kellogg, and Mr. Seward Mott. The extensive collection of geographic photographs belonging to Dr. Charles Melton was frequently used for reference and illustration.

CONTENTS

INTRODUCTION

CARTOGRAPHY has come a long way since man first scratched a few lines in the dust and said, "The enemy is here. We attack here." Wars are now as complex as modern civilization can make them, and cartography has become a science demanding equipment, abilities, and experience. There is not enough time to learn all the various skills which are connected with a particular job. The work must be divided into sections, each section being in the hands of a highly trained technical specialist. It takes more than a year for a man to become such a specialist in combat flying. He hasn't time also to become an expert at reading, interpreting, and visualizing the charts he must use, and must rely on his senior officers, and others who have had special training in photo interpretation and air information. The accurate transfer of knowledge from one expert to another is always difficult, and sometimes must be accomplished in a very short time.

Landfall Recognition was developed to aid in this pooling of specialized technical trainings. Making of relief models and miniatures of combat topography as explained in this manual is an aid in bringing the task force to its mission and back to its base. By the simple means of models and miniatures, tactical operations and recognition information can be given the impact of reality to a personnel trained in other specialties. This manual goes farther than to tell you how to do the job; it gives you a method by which to *organize* your work and devices to help you prepare such topographical models in 12 hours' time if needed. It requires no special tools, no bulky supplies; but it does require organization, clear thinking, skill of hand, and initiative. No means is too simple or obvious, but it takes an alert eye to discern the obvious in a maze of complexity.

BACKGROUND

A GOOD MODEL contains as much information as hundreds of maps and photographs, and may be used far more

conveniently for the same general purposes--planning, briefing, and orientation. In the present war they have been employed by the Russians in smashing the Mannerheim Line, by the Germans in their 1940 blitz, and by the English for Commando raids and desert tactics. These complex operations demanded more than the usual piecemeal study of reconnaissance data. The objectives and their surrounding areas had to be studied from all sides at once in order to exploit every possibility of attack. The attackers had to know their approaches so well that there could be no fumbling for position, no chance of being surprised around the next corner. These, however, were mainly ground operations.

The possibilities for air combat with its split-second timing and vast range of space have not until recently been utilized. True, the Japanese carried very small models in their bombers when attacking Pearl Harbor, but the plans for that offensive had been years in preparation. The time, the materials, and the space requirements thought necessary to produce the models, prohibited their use in ordinary combat. By the time they could be made at a big base and shipped to the theater of action, the disposition of military objectives would be so changed as to destroy a great deal of their value. Now, however, methods

have been developed whereby *a single man can do a good model in the short space of 12 hours,* and the reasons for not using its great advantages disappear.

The advantages of reliefs for air operations are much the same as for ground operations, and yet differ in that the primary consideration is for individuals rather than for masses of men. A few highly trained officers can lead an uninformed ground force of considerable size by a disciplined chain of command, but the pilot must usually work out his own salvation. At 300 miles an hour he has no time to ask for guidance, no time to weigh decisions or seek alternatives. He must know exactly where he is, what he is going to do, and where he is going, or he is less help than if he had stayed at home.

DIFFICULTIES OF BRIEFING

This, of course, is one of the reasons why A. C. I. and P. I. U. officers make such an effort to gather every bit of available "dope" on enemy positions and activities. Usually they *do* get a surprising amount of very valuable information, and analyze and interpret it with great skill. The difficulty is in passing it on to the pilots in a form they will understand and remember. They may have organized a fine display of charts, maps, and photographs, and presented it in a masterly fashion, only to find that the picture in the pilot's mind is entirely different from the true one.

"YES, SIR, I UNDERSTAND PERFECTLY!"

THE PILOT'S PROBLEM

When confronted by the real thing he finds that he cannot recognize his surroundings at all! Perhaps he is coming in low to avoid Radar detection and finds that the string of lakes he has chosen as a guide has been pulled out of shape by perspective. The target which showed clearly from the vertical may now be hidden by a range of hills. Perhaps the approach is from a different angle than that shown in the photographs, or perhaps it is simply the difference between the flatness of a high altitude shot, and the textured solidity of low altitudes. At any rate he is *lost*, and if he pauses to study his position, he either runs out of gas or is rudely interrupted by the enemy.

The fault lies in the nature of maps and photographs whose only sin is that they are *fixed* and *flat*. The wonder is

that pilots and briefing officers have done so well with such limited material. Make no mistake, they are still the foundation of all accurate visual information, but consider the advantages of a model!

A good model is really the target area itself in miniature, colored and textured just as it would be seen from the cockpit of an airplane. It can be as complete and accurate as a map, and as varied as an infinite number of photographs taken from every angle and altitude. More than this, it is *three-dimensional!* A pilot can *move around* the landscape as he would in flight.

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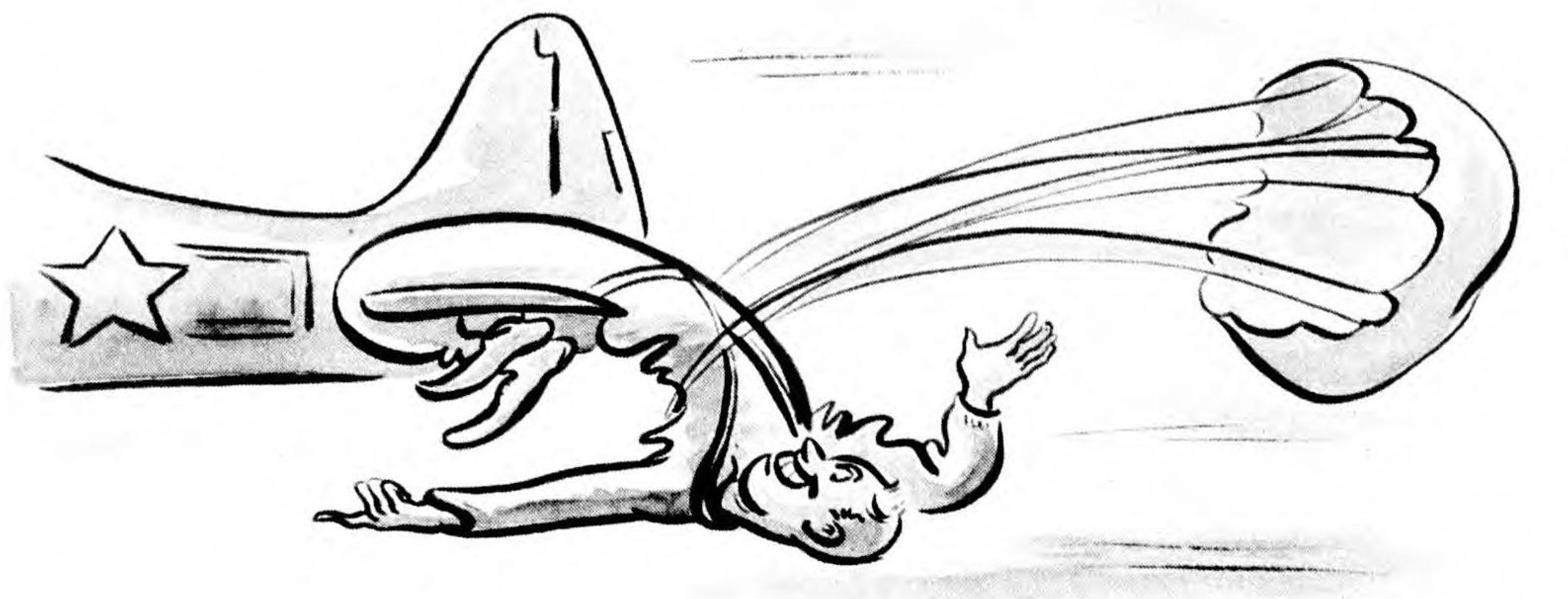
ADVANTAGES OF THE MODEL

He can rehearse his approach, bombing run, and getaway, as many times as he likes—gliding down the valleys, and rounding the hills with his hands until he has the actual "feel" of the place in his bones, and knows it as well as he knows his own home town. No matter where he chances to find himself in the freaks of combat, he will be able to orient himself because he has been there before.



"AH—THERE I AM, OF COURSE!"

For the officer planning the attack there are other advantages. He can choose his tactics, not by a complicated system of reading maps and interpreting contours and photographs, but by simply squinting along a line of hills, testing each hollow and bump for the perfect cover, the most unexpected approach. If he wants to show the latest developments of intelligence reports, or to reveal such camouflaged areas as military installations, industrial targets and lines of communication, he may follow the method of colored pins and paint, or have them modeled as they actually would look.

USES OF THE MODEL

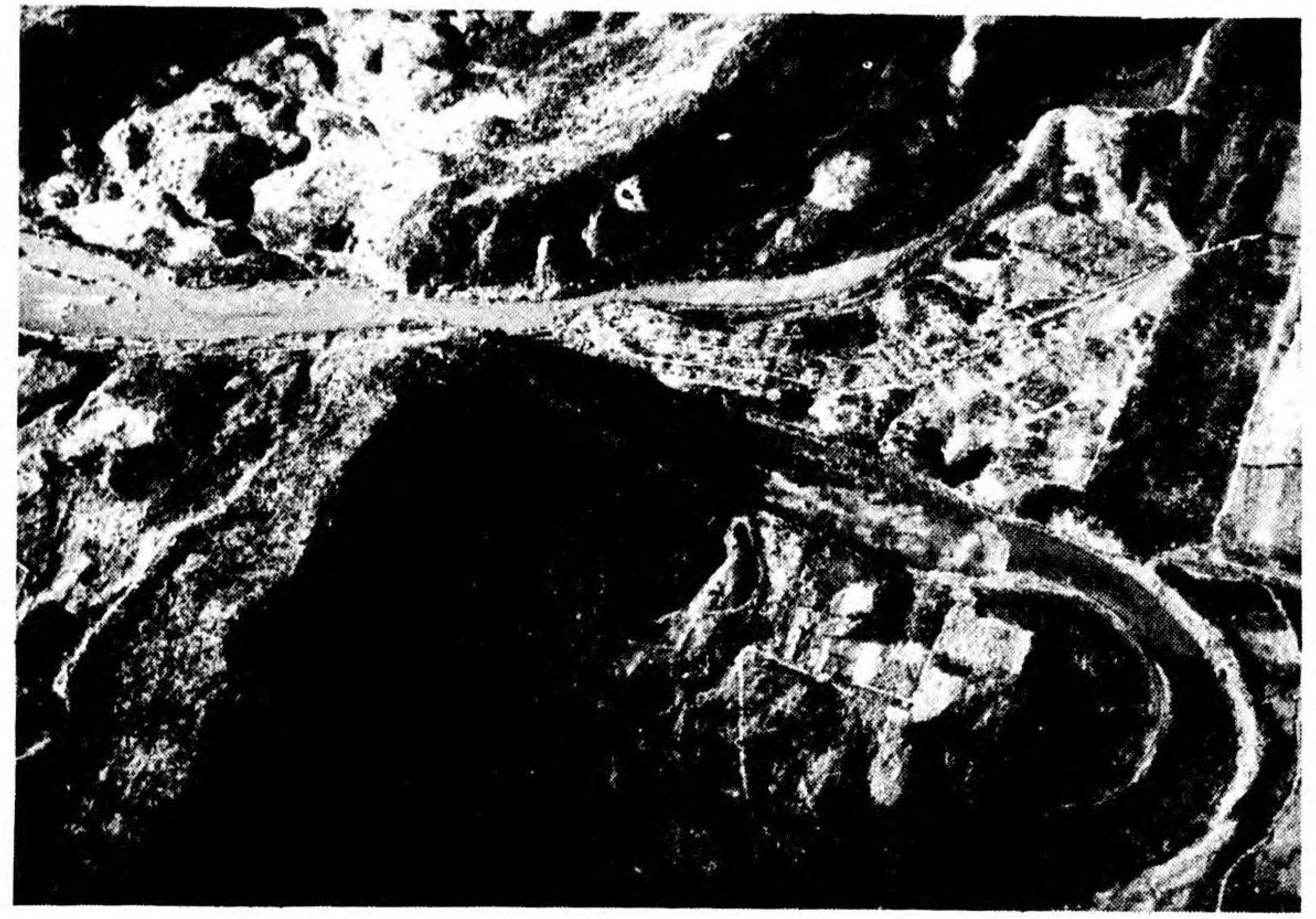
If flight photos or flight charts are desired, the model may be painted with complete diagrams and directions and photographed from the exact altitude and angle planned for the individual run. And the photographer needn't worry about pea-soup visibility or *shell-fire!* In any case he may eliminate a great deal of guesswork as to the effects of sunrise, sunset, and moonlight on the attack plan, by casting an appropriate light on the relief.

These are some of the things you can do with a Landfall model to hit the enemy as hard as possible. You need only a small amount of time and equipment, and a reasonable foundation of reconnaissance data. If the latter is lacking you will have to interpolate a little, but your estimate, based on some degree of geological knowledge and observation of nature, should be better than most.

Models don't perform miracles, but they do provide *the best way to study a lot of difficult material and to get it across to the men in the planes.*

The rest of the book will show you how to make them.

SUNRISE



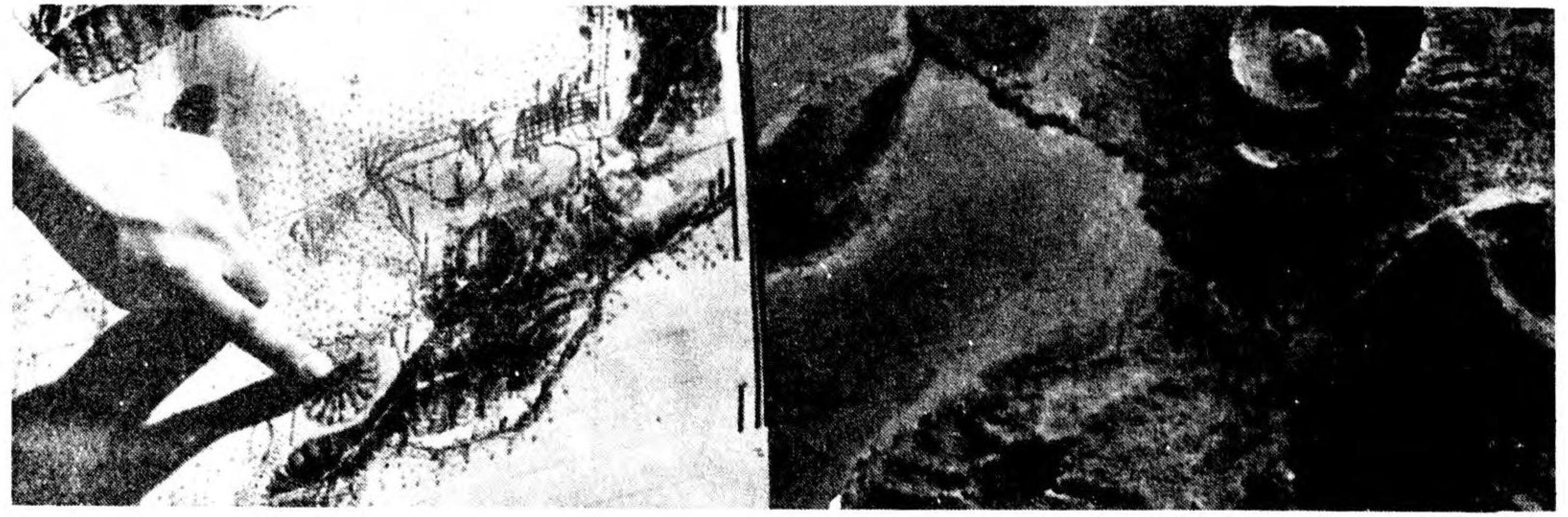
SUNSET

SOURCE MATERIAL

LANDFALL recognition models must be based on good solid "dope" to be valuable, and it may take a good deal of thought and work to find the dope. Sources include such old favorites as standard charts, maps, sailing directions, intelligence monographs, air target folders, terrain studies, vertical and oblique photographs, field sketches, and of course, the pilots themselves. Any combination of these is possible, but only a magician could find all of them at once. At best, you'll have a really good contour map plus complete photographic coverage of recent date; but sometimes the only available information will be a Hydrographic Office chart and a descriptive line or two in the sailing directions.

CAUTIONS

You'll soon learn, if you don't know now, where to get these, and which are most complete and reliable, but it won't do any harm to go over a few of the pitfalls they contain. A good example is the "emergency reproduction". This is not an original Hydrographic Office job, but a copy of a British Admiralty chart. Thus if an HO and a BA chart agree on the shape of an island, it doesn't necessarily mean that an accurate check has been made. They may be the same thing with different names. Intelligence documents are another fertile field for the gremlins. They'll give you a photostat of a map that looks perfect, and you'll find too late that they have left the original representative fraction to be used as a scale for the copy which is entirely different, having been enlarged or reduced. Tokyo will appear to be only 1 mile across. It's a bit bigger than that—a fault which will be corrected soon, we trust.



All data, in fact, should be regarded with suspicion. Legends should be studied carefully to find whether the soundings and elevations are in feet, meters, or fathoms. Are the miles statute or nautical? Are the spot elevations trustworthy? The Japs have been known to falsify their own maps to conceal or distort any valuable information, and surveys by Ancient Mariners often go even farther with the best of intentions. Constant reference to all available photographs is the best check for these errors.

INTERROGATION

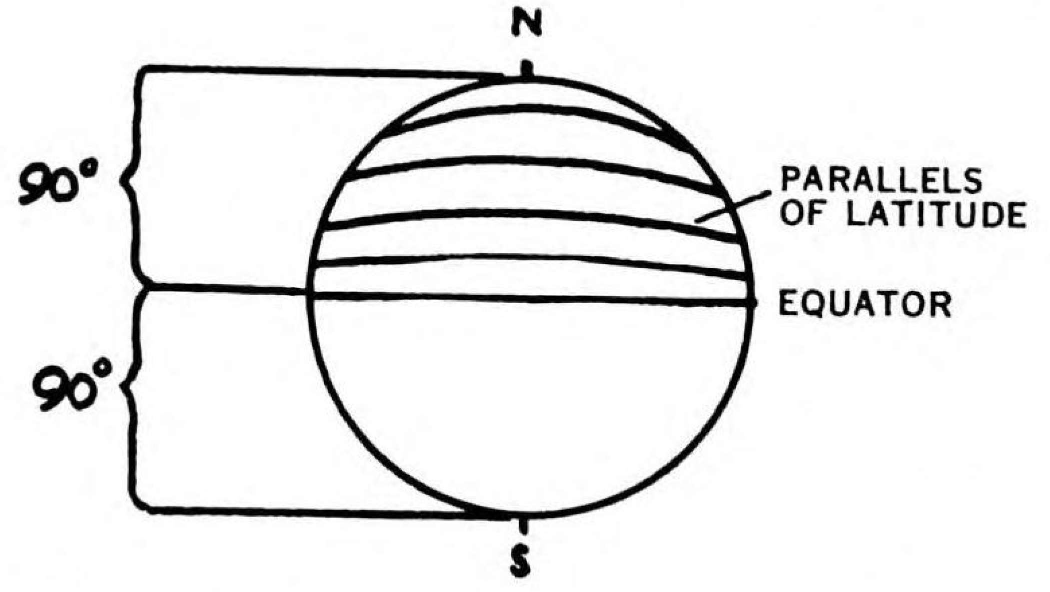
Last, but certainly not least as a source of data is the interrogation of pilots, navigators, and bombardiers, who have flown over the area in question. As this will be in addition to the usual interrogation, it will have to be handled with particular care. Men get touchy when they're tired. But if he is in a receptive mood, he can help fill in the gaps of known facts about the area to be modeled—general appearance, color, unusual features, details, etc. He can be as unreliable as a bad chart, however, so without leading his answer, try to give him some actual examples for comparison. There are all sorts of names for colors, such as "cardinal red", and "puce", but men usually let it go with "sorta reddish". If, however, he has some color slides or some pictures of typical geological formations to compare with his memory, he has a good chance to get it over to you without too much distortion. He is already taught to remember intelligence data, and should not find it too great a burden to recall shore lines and shapes of mountains. If he can draw a rough diagram, you may be able to interpolate the rest. If he can only say that a hill looked like a sleeping dog, he will have told you a great deal.

MAPS AND CHARTS

COORDINATES

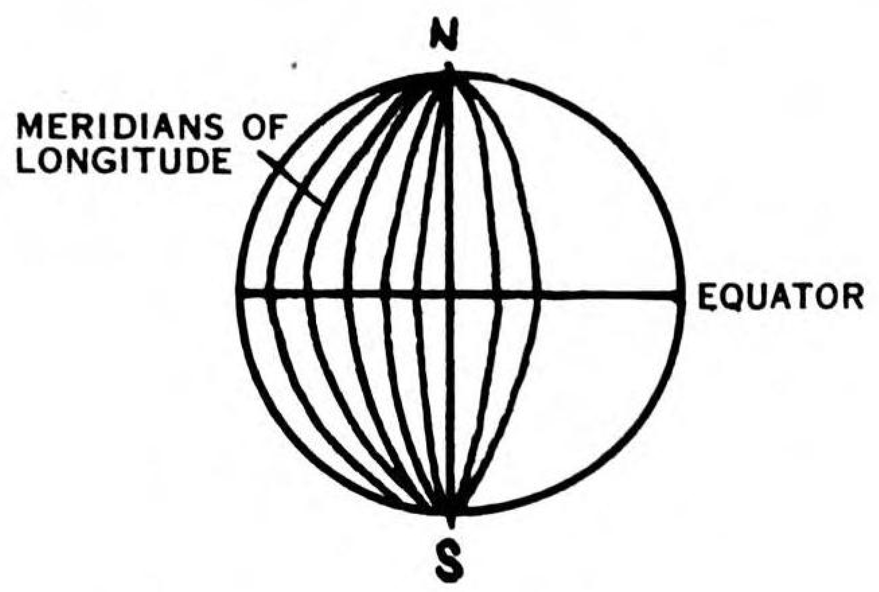
For those of you who are a bit rusty on maps and map reading this simplified review may be of some value.

Latitude.—Horizontally the earth is divided into parallels of latitude. Of these only the equator is a great circle whose



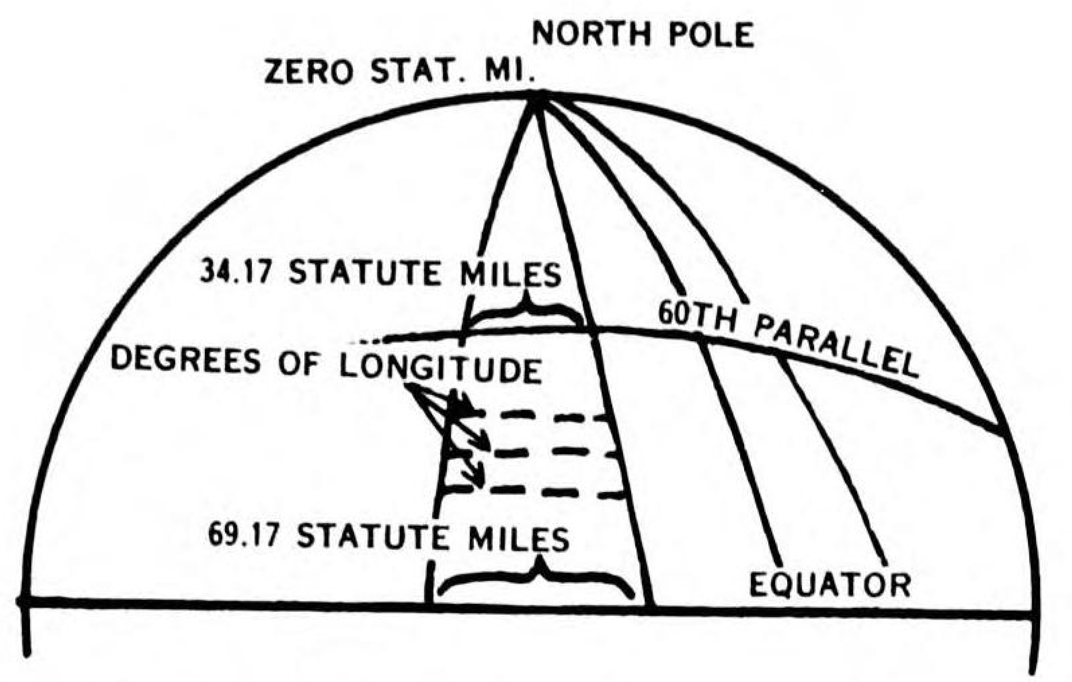
plane passes through the center of the earth. The rest of the parallels grow smaller as they approach the poles.

Longitude.—Vertically the earth is divided into 180 great circles called meridians which radiate from the poles at equal angles, splitting the earth into 360 degrees of longitude. Meridians of longi-



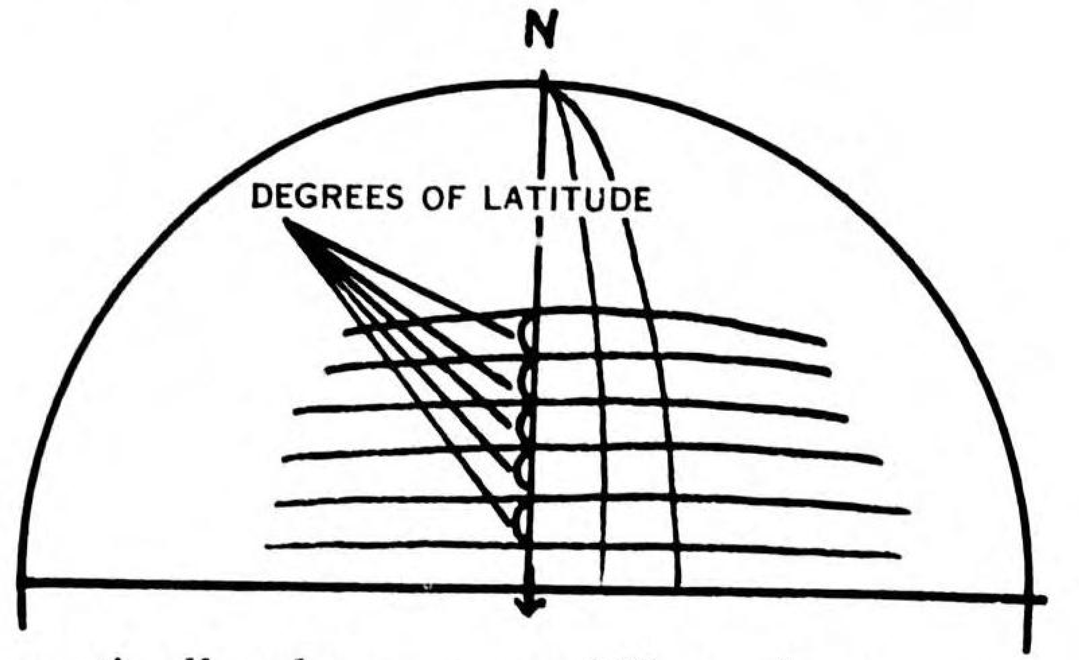
tude may be considered to be always the same size.

Measurements.—Degrees of longitude, the distance *between* two meridians, are measured *horizontally* along a parallel of latitude. Thus, their size will depend on their position on the globe. At the equator they are equal to 69.17 statute miles; at the 60th parallel of latitude, they are



equal to 34.17 statute miles; and at the poles they are equal to zero.

Degrees of latitude, the distance *between* two parallels of latitude, are measured



vertically along a meridian. As no convergence is involved, they may be considered equal at all times.

AT THE EQUATOR "A MILE A MINUTE"

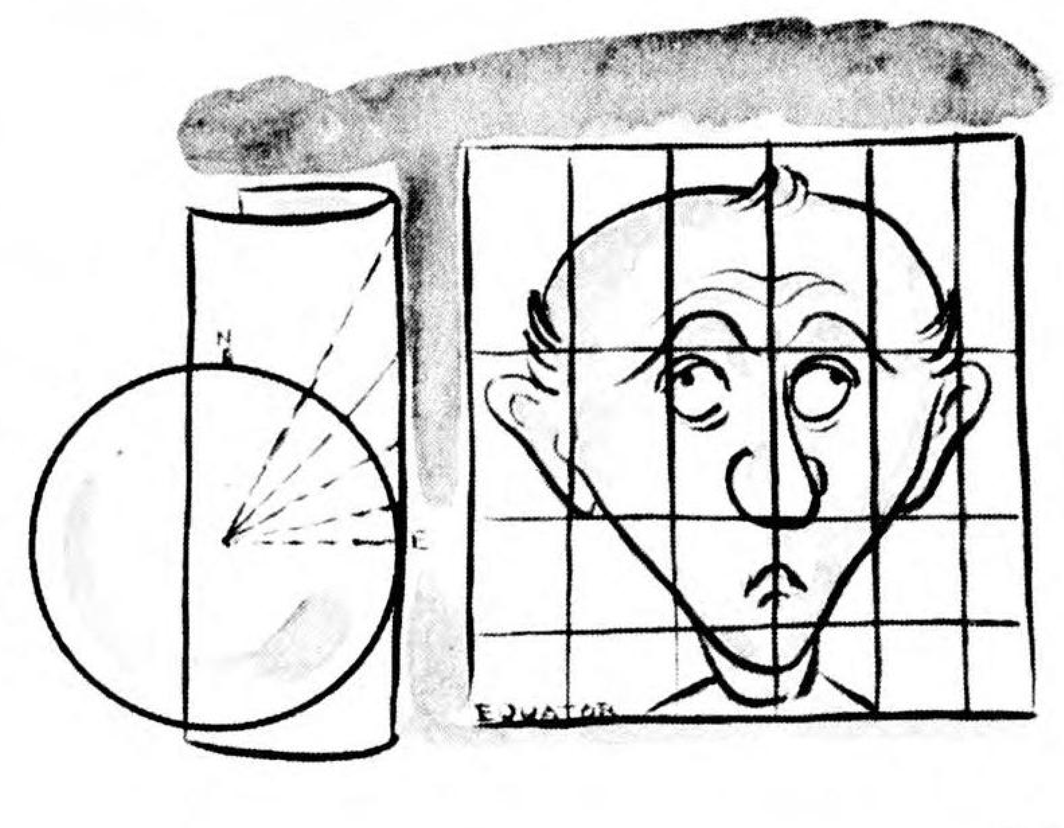
Nautical Miles.—Each degree of latitude or longitude is divided into 60 minutes, and each minute is divided into 60 seconds. A standard measurement for degrees is the nautical mile. It may be defined as the mean value of a minute of latitude, or a minute of longitude measured along the equator. Thus the memory aid of "a mile a minute" is universally true only for latitudes. The nautical mile is 6,080 feet as compared with 5,280 feet for the statute mile—so, if you have lost your tables, remember that the latter is 33/38 of the former.

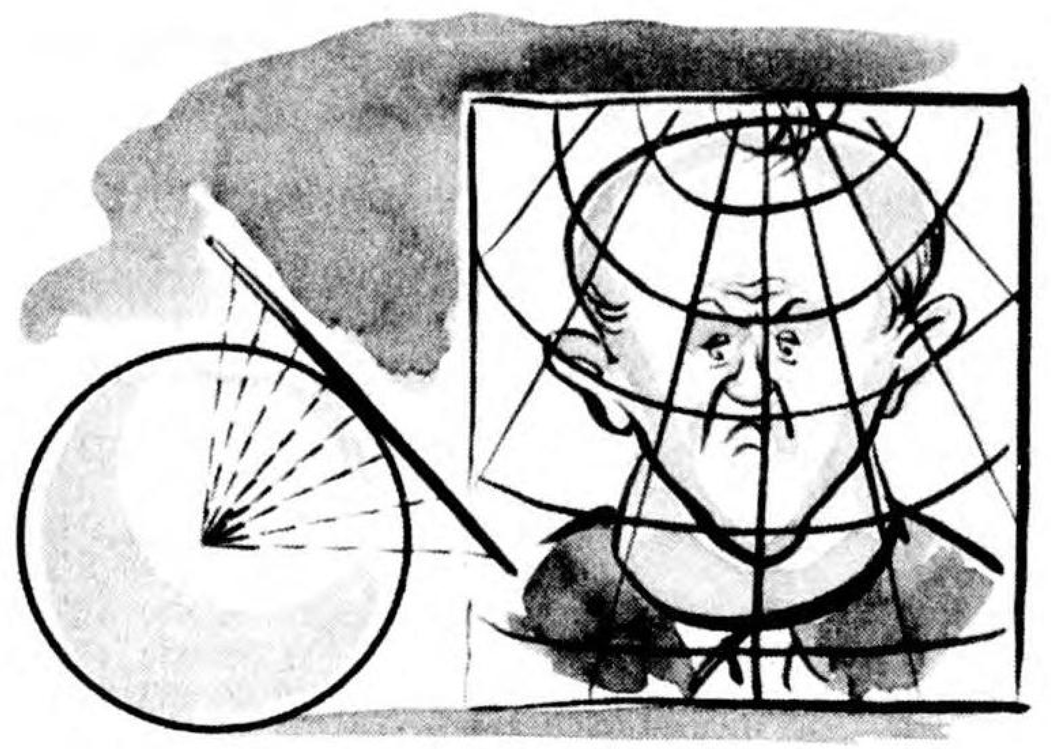
PROJECTIONS

Landfall Recognition models generally cover so small an area that the type of map involved is relatively unimportant, but you should have some familiarity with those you will use most. These are the Mercator, the Gnomonic, the Lambert Conformal, and the Polyconic. All are compromise attempts to reproduce the parallel and meridian system of the globe on a flat surface.

MERCATOR

The Mercator is widely used because of its simplicity, but the rectangular arrangement of lines based on a cylindrical projection causes considerable distortion. East and west dimensions are so expanded by the lack of convergence in the meridians that the parallels must be widened to keep the whole shape consistent. While serious errors develop in comparing the size of large areas, say Greenland and South America, it is accurate enough for any areas suitable for modeling. When accuracy for large areas is desired, it is best to use the Lambert Conformal, described on the next page.



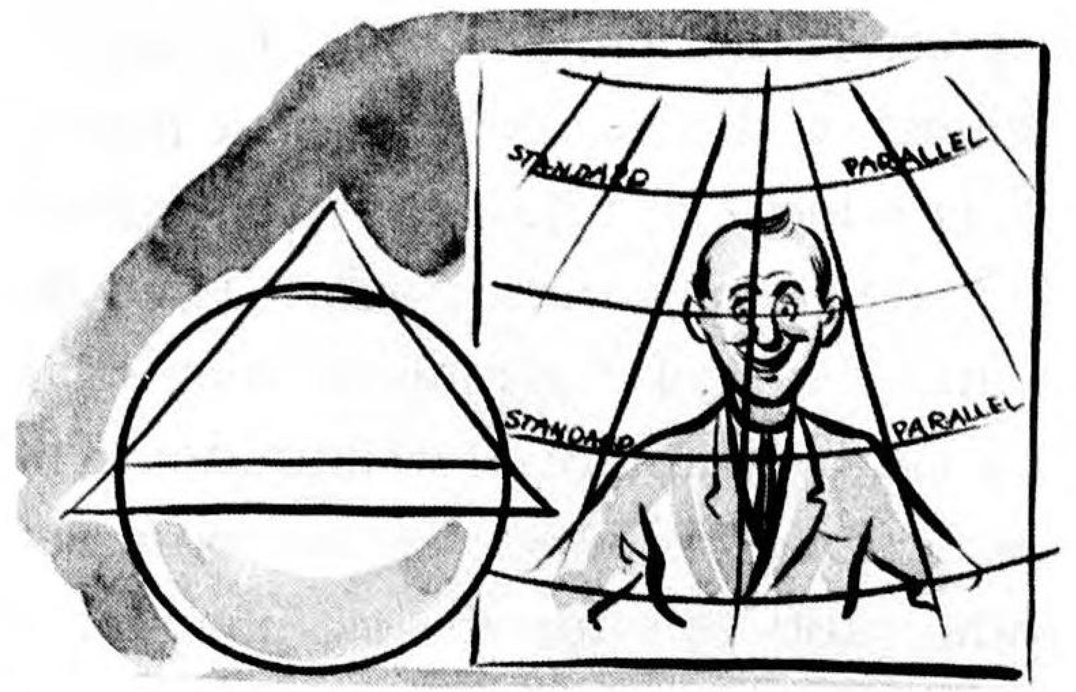


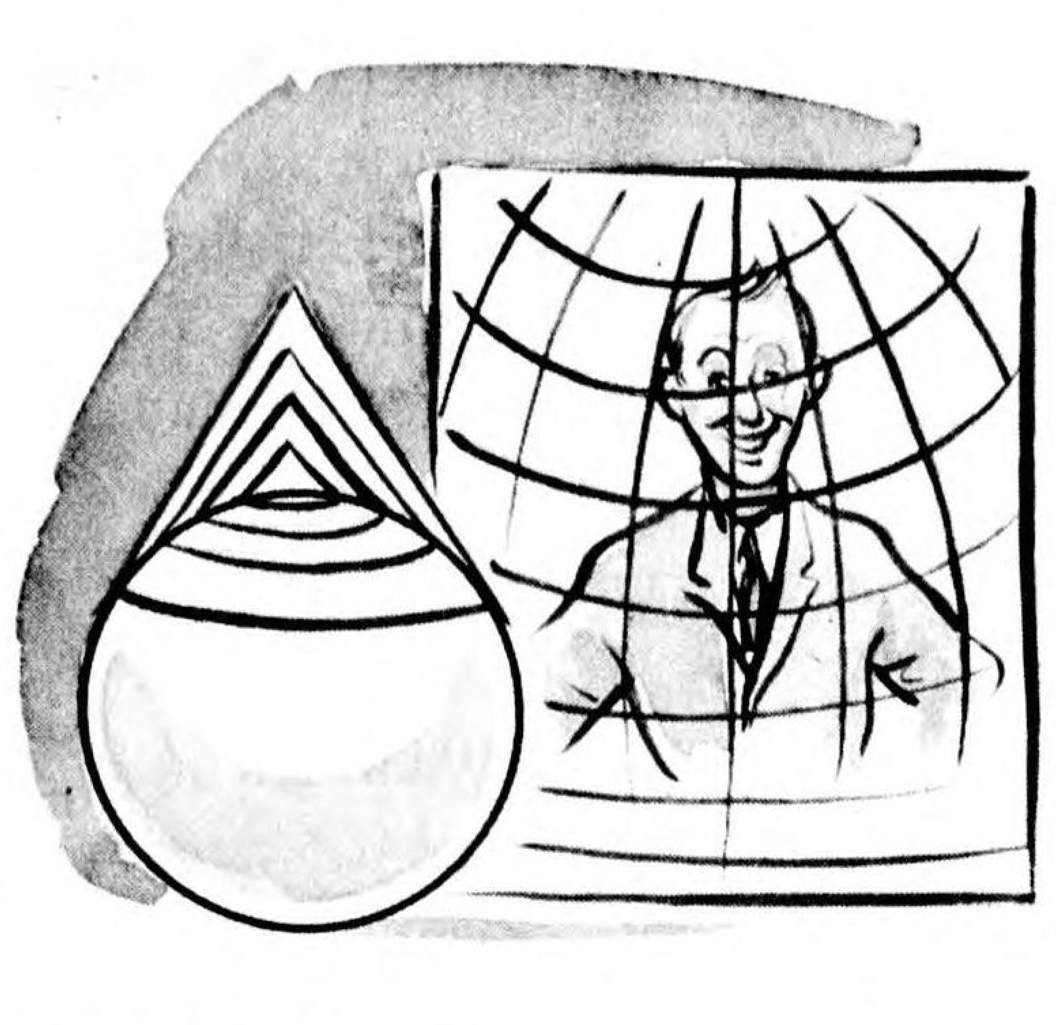
GNOMONIC

Although the Mercator will probably be your standard projection as it is most used in coastwise charts and charts of island areas, you will probably become familiar with its running mate, the *Gnomonic Projection.* Due to its projection of the surface of the earth upon a tangent plane, the Gnomonic converges the meridians, and curves the parallels of latitude. This type of projection is often employed in mapping polar regions, but its main advantages is that a great circle course, the shortest distance between two points on the globe, may be plotted on the map by simply drawing a straight line.

LAMBERT CONFORMAL

The Lambert Conformal is prized for its accuracy and is generally used for aerial and military problems. It is based on the intersection of a cone and a sphere along two standard parallels, thus converging the meridians upon a point beyond the limits of the map, and curving the parallels of latitude in concentric circles. Between the selected parallels and a short distance beyond them it is extremely faithful, but the farther we go from these parallels, the more distortion appears.



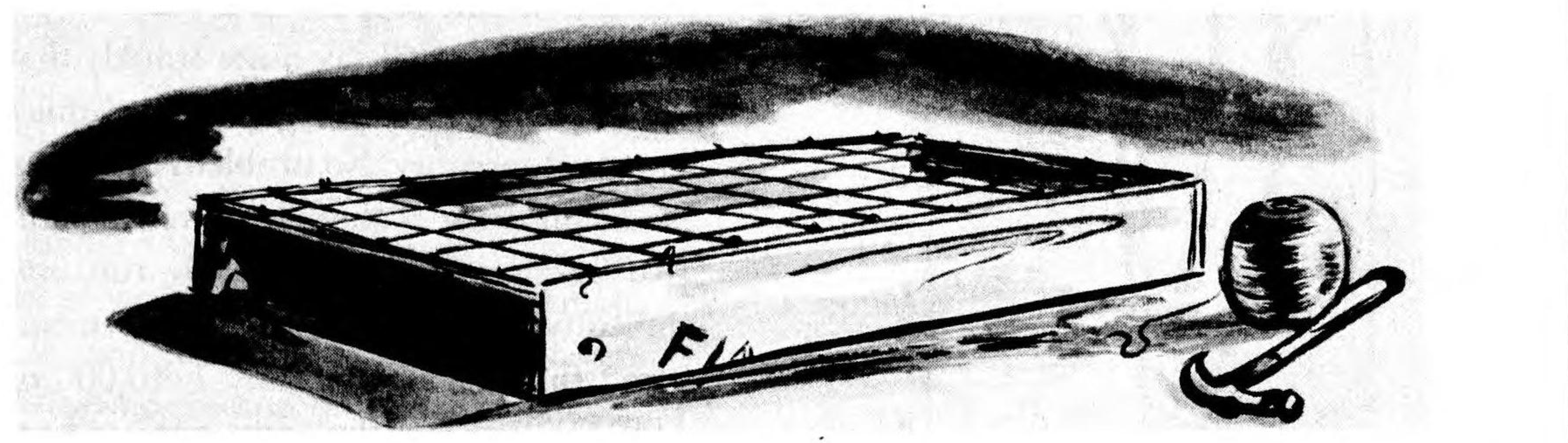


POLYCONIC

Another compromise projection often found in the mapping of land areas is the Polyconic. This is based upon the projection of the earth's surface on a series of cones, each one tangent to and having a common axis with the earth. Each cone has a separate parallel for its base, thus giving considerable accuracy over a fairly wide area.

STRING GRID

No matter what kind of projection has been used on your map or chart, the area covered by your model will be so small that all lines of latitude and longitude will appear straight to the naked eye. Thus it is possible to construct a simple string grid conforming to the coordinates, over any model that is enclosed in a box. This framework of latitudes and longitudes may be of considerable value in finding points and measuring distances while making the model and using it thereafter. Only minutes of degrees need be considered, as the total terrain will rarely take in more than 1 degree, and for many models it may be best to divide the minutes into halves. The modeler should be careful at all times that the coordinates are what they seem to be. Sometimes they appear in units of 5′, 10′, or 15′ instead of the usual 1-minute interval. Obviously large scale errors will occur from a misinterpretation.



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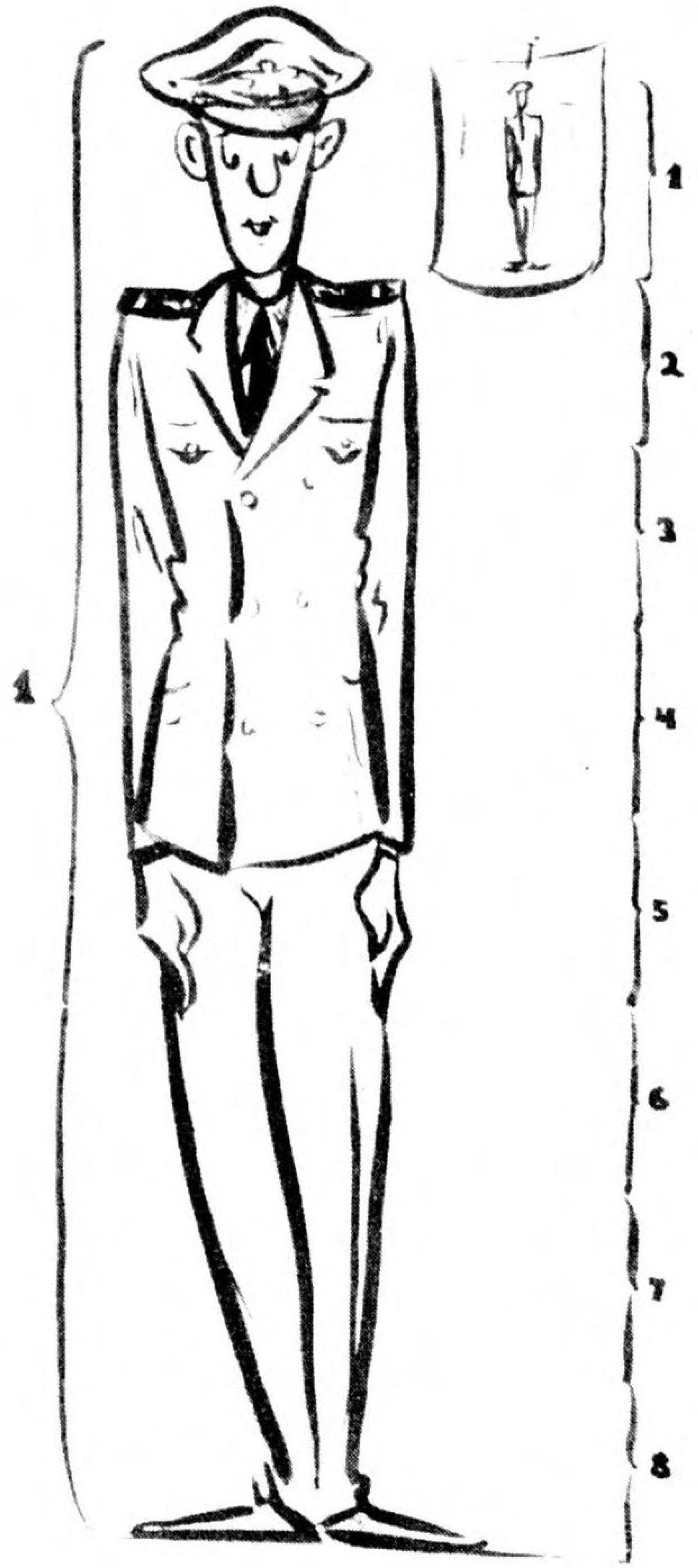


SCALE

REPRESENTATIVE FRACTIONS, ETC.

When the data has been gathered, the time has come to examine the scale of the map. The scale problem is really quite simple, but has a habit of bobbing up at the wrong moment to plague the model maker. The fact that models have vertical as well as horizontal scale should not be confusing, as both are worked in precisely the same way. If there is no exaggeration, a unit of ground surface is equal to a unit of space in the air.

Some maps will say quite frankly that 1 inch of its surface is equal to 8 miles of actual territory. No problem here. It is when the scale is stated as a representative fraction that some people run into difficulty. It should always be remembered that the fraction, say 1/40,000 or 1:40,000, means that any one *unit* on the map's surface is equal to 40,000 similar units on the earth itself, without regard to feet, inches, meters, or miles. Very good, but how can this figure be converted into solids? How big a lump on the model board should be made for a mountain 4,400 feet high?

1 inch on the map = 40,000 inches of the real thing.

$$1 \text{ inch on the map} = \frac{40{,}000}{12} = 3{,}333 \text{ feet}$$

of the real thing.

Therefore the lump representing the mountain will be $\frac{4400}{3333}$ or 1.32 inches high, and we can see that we are working in a fairly small scale.

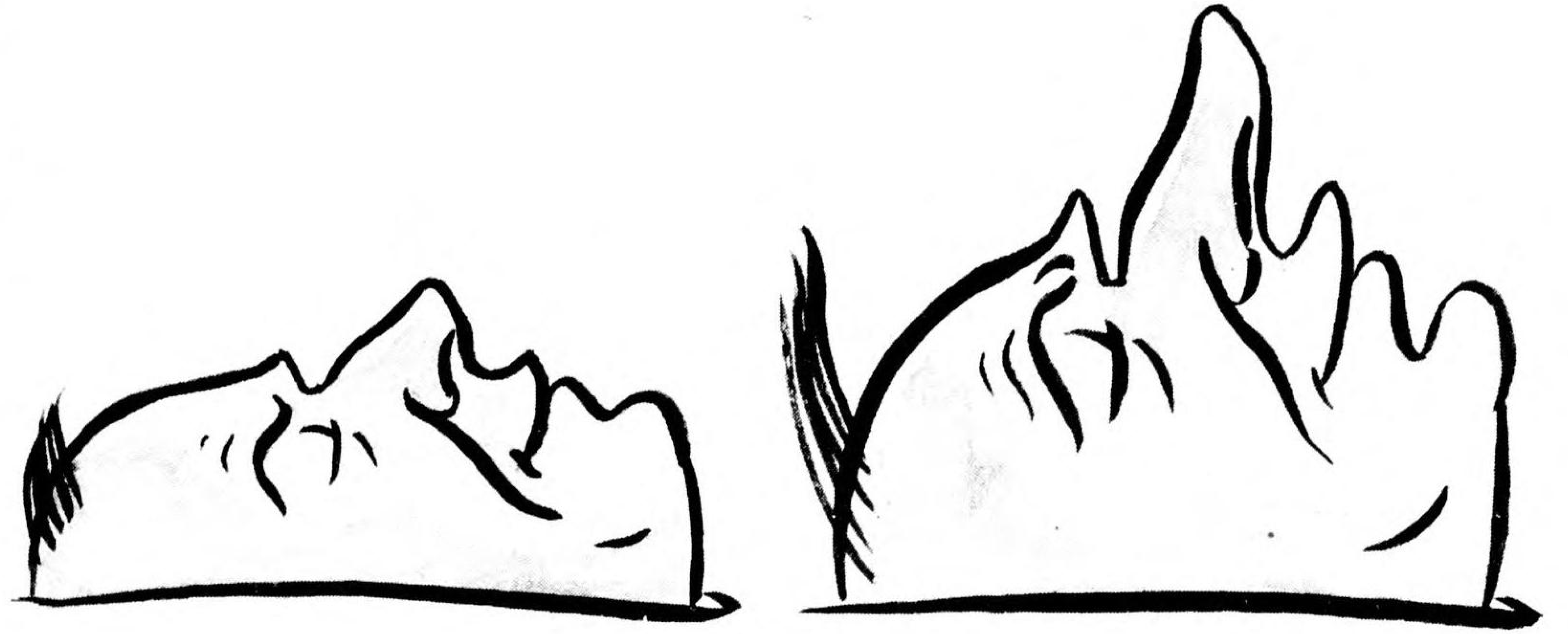
SCALE FROM COORDINATES ALONE

Occasionally you will have to use a map that gives neither a bar scale nor a representative fraction. The scale must then be figured from coordinates alone. As an example of this, suppose you must make a model in 10 hours for a surprise attack on a Jap landing field on an island near the Aleutians. The field is fairly well concealed, so the scale must be large enough for identification in average visibility. Your only available data is a Mercator chart whose coordinates are the sole clue to the scale. Looking at the margins of the chart, we find that there are markings for minutes of both latitudes and longitudes. Avoiding the minutes of longitude at the top and bottom of the sheet, we use the latitude marks at the sides, for they are always equal to nautical miles. Measuring them, we find that they are 0.6 in. apart, and we can easily work out the scale.

0.6 inch = 6080 feet

$$1 \text{ inch} = \frac{6080 \times 12}{0.6} = 121{,}600 \text{ inches}$$

Therefore the RF is 1/121,600 (call it 120,000). This scale must be enlarged to be of value for recognition of the immediate target or study of the approaches. If we enlarge it six times $\left(6 \times \frac{1}{120{,}000}\right)$, we get $\frac{1}{20{,}000}$, the minimum for these purposes. This will make the model too large to be done in 10 hours, so we must concentrate on a small area around the target, and count on the chart for recognition of the entire shape. Six square inches of the surrounding area enlarged six times will do the trick nicely.



VERTICAL SCALE EXAGGERATION

Vertical exaggeration should be used only in such circumstances as those described here, and in accordance with naval standards. Landscape seen from heights appears flatter than it really is, so an exaggerated scale on a model seen at only a few feet is doubly confusing. Occasionally, however, a model with convincing relief would be too huge to

MODEL OF KISKA

be handled. This is the time to double or even triple the vertical scale.

German, French, and Jap charts are often in meters, and must be watched for tricks. A contour interval that is stated to be a workable 150 turns out to be a sinister 488 when translated into American. If you are at home in the metric system you may as well keep it that way, but most people find it wiser to convert immediately in spite of the inconvenience of odd figures. The metric conversion table and the scale equivalents table in the back of the book should be a great help in this, especially since the latter includes nautical as well as statute miles, another familiar bugaboo.

Let's take another example which combines a number of these problems. You are told to do the entire island of say Paramushiro, and all you can find is an old German chart—scale of 1/250,000. Metric system, remember. The map must be enlarged at least four times to show the elevation properly. Multiply the RF by 4, which gives you 1/62,500. This merely enlarges the map.

1 inch of model = 62,500 inches of terrain.

1 inch of model = 5,208 feet of terrain (call it 5,200).

Contour intervals are stated on the map to be 100 meters or 328 feet each. How large a contour interval will we make on our model to conform to this? If 5,200 feet of terrain is represented by 1 inch of the model, 328 feet will be represented by $\frac{328}{5,200}$ or 1/16 of an inch. This is the true interval of the contours at this scale, but it is too small to be handled easily and gives too low relief to be worth while. A 4,000 foot mountain would be less than an inch high on the model! To correct this you have two choices, enlarging the map or exaggerating the vertical scale. The map is about 6 feet long already, so the latter choice may be wiser. Double the vertical scale, and 1 inch = 2,600 feet, which makes the interval 1/8 inch. This is a workable interval, accurate enough for its purposes, and showing the characteristics of the terrain with sufficient clarity. The modeler should keep in mind, however, that in measuring horizontal distances on the ground, an inch of the model is still equal to 5,200 feet.

SCALE FROM PHOTOS ALONE

Now suppose you run across a real "stinker." No maps, no charts, nothing but a vertical photograph. What's the scale now, Mr. Edison? Three things are necessary.

1. The average height of the ground in the photograph.

2. The altitude of the plane above sea level.

3. The focal length of the camera that took the picture.

The first can be found with the height finder included in the kit. The last two are usually written on the photo or its negative. If not, they must be obtained from the pilot and cameraman.

"WHAT TO DO?"

These items can be applied to a simple formula:

$$\frac{f}{H-h} = RF$$

which translated means

$$\frac{\text{Focal length of lens in feet}}{\text{Height of plane minus average terrain}} = \text{Representative fraction}$$

If the focal length is $8\frac{1}{4}$ inches, it is converted to $\frac{11}{16}$ foot. Suppose that the plane had been flying at 18,000 feet, altimeter height, and the height finder calls the average terrain 1,500 feet.

$$\frac{\frac{11}{16}}{16,500} = RF$$

$$\frac{1}{\frac{16}{11} \times 16,500} = RF$$

$$\frac{1}{\frac{264,000}{11}} = \frac{1}{24,000} = RF$$

Fortunately, it will be necessary to use this formula only in very unusual circumstances, as the tables in the back of the manual give the answers to practically any pictures taken with a Navy camera.

CANADIAN GRID

Vertical photographs are sometimes impossible to get in combat areas because of the danger of interception or shellfire. In such cases, obliques are used, and a Canadian Grid must be constructed to find the scale. The focal length and depression angle of the camera and the height of the plane must be known first. The angle of the camera is the only one of these that is apt to give you trouble, as it must be the *true* angle as opposed to the *apparent* angle. The depression angle is based on the horizon, but as a man 20,000 feet in the air has a different horizon from one on the ground, the difference between the two (the dip) must be taken into consideration.

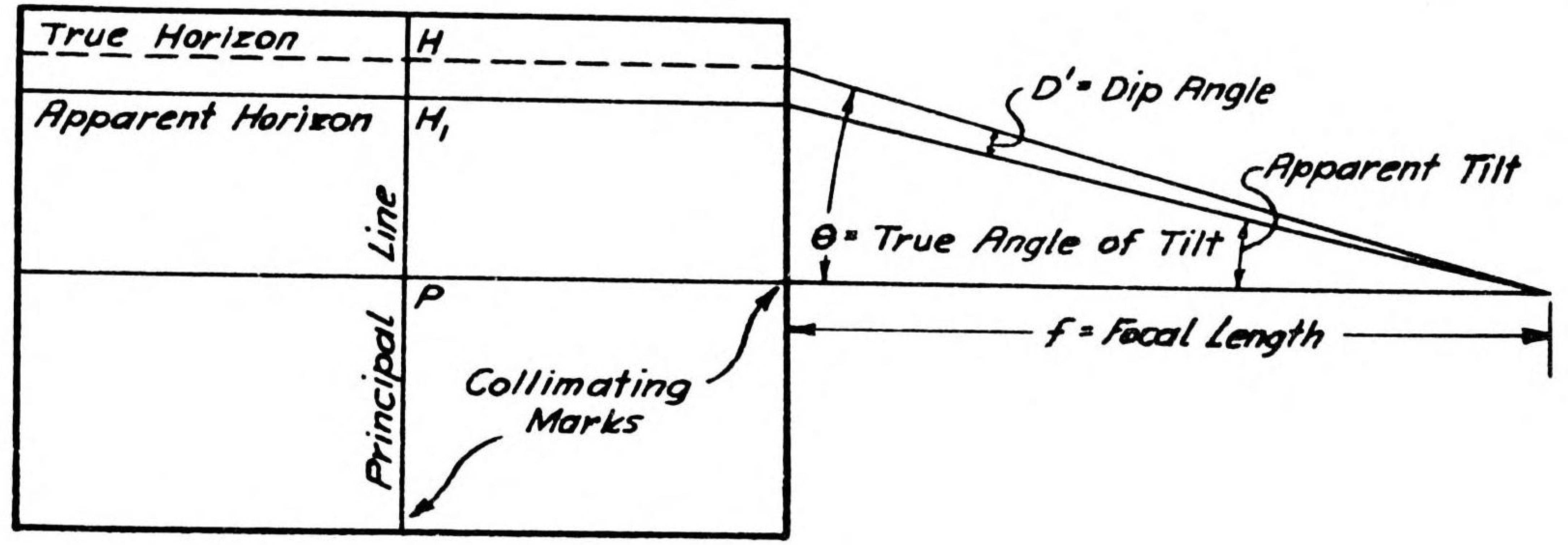
The true depression angle can be found as follows:

Measure the distance between the principal point of the picture (its exact center) and the horizon. Let us suppose that this turns out to be 3 inches, that the focal length is known to be 6 inches, and that the altimeter reading was 20,000 feet. The following formula is applied (tangent tables and curve of dip angles may be found in the back of the book):

Tangent of depression angle = 3/6 inch = .500 = 26°34′.

So 26°34′ is the apparent depression angle. The angle of dip at 20,000 feet may be found by reading the curve table up from 20,000 and across to the left. It is found to be 2°18′. This added to the apparent depression (26°34′) gives the true angle.

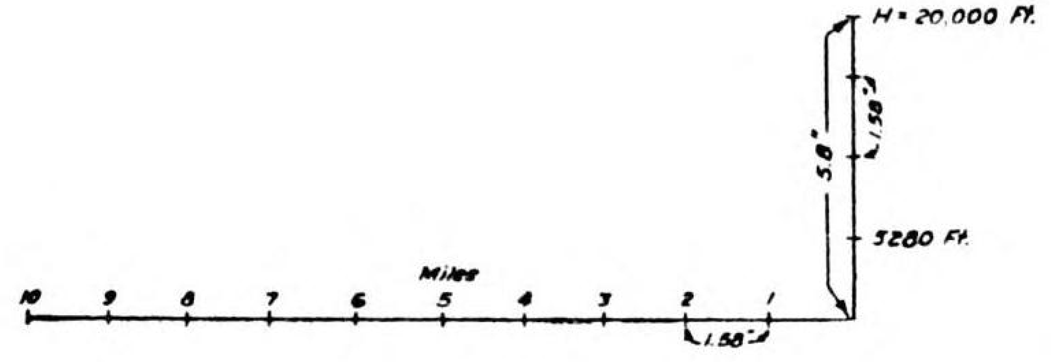
26°34′ + 2°18′ = 28°52′ (call it 29°)



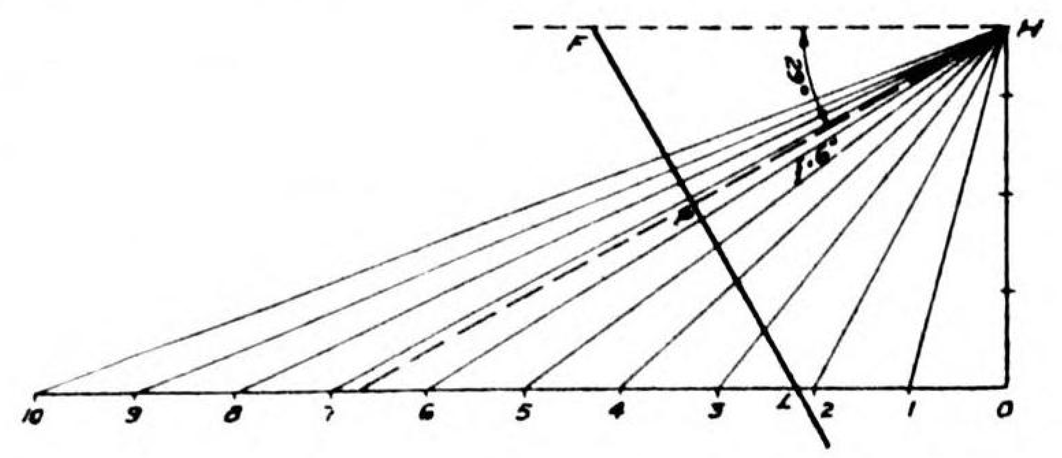
With the angle of depression known, we may begin the grid. Suppose that the height of the plane is 20,000 feet. The scale of the photograph at the isometric center is found by the method outlined on the preceding page for vertical photographs. If the terrain is flat, the scale will be

$$\frac{\frac{1}{2} \text{ foot}}{20{,}000} = \frac{1}{40{,}000} = \text{RF}.$$

On a horizontal, lay out 10 miles at this scale (see tables in back for equivalents). At the zero mark, construct a perpendicular of a length corresponding to the height of the plane in the air.



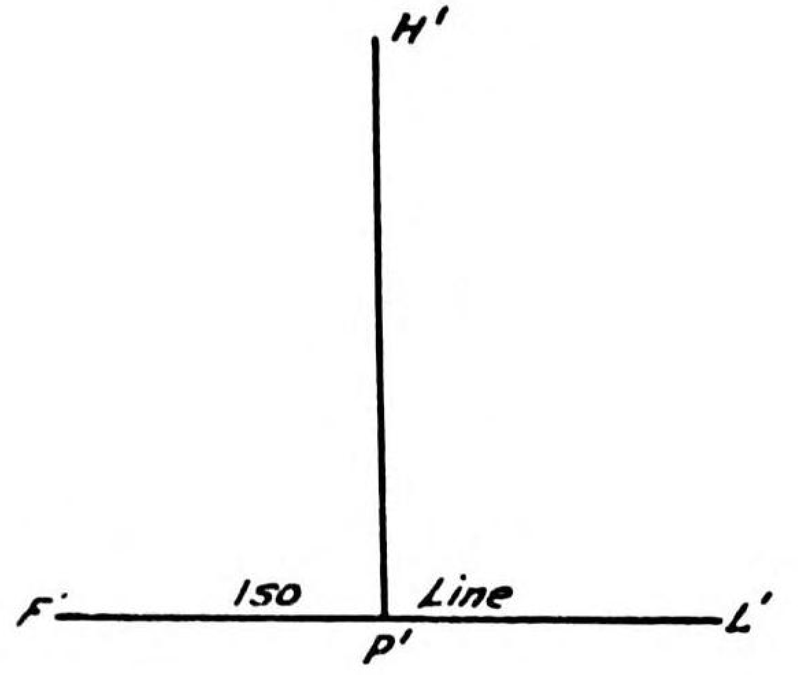
Next, lay out a line from point H at a 29° angle from the horizontal. At a point, a distance from H equal to the focal length (6 inches), construct a perpendicular to the line.

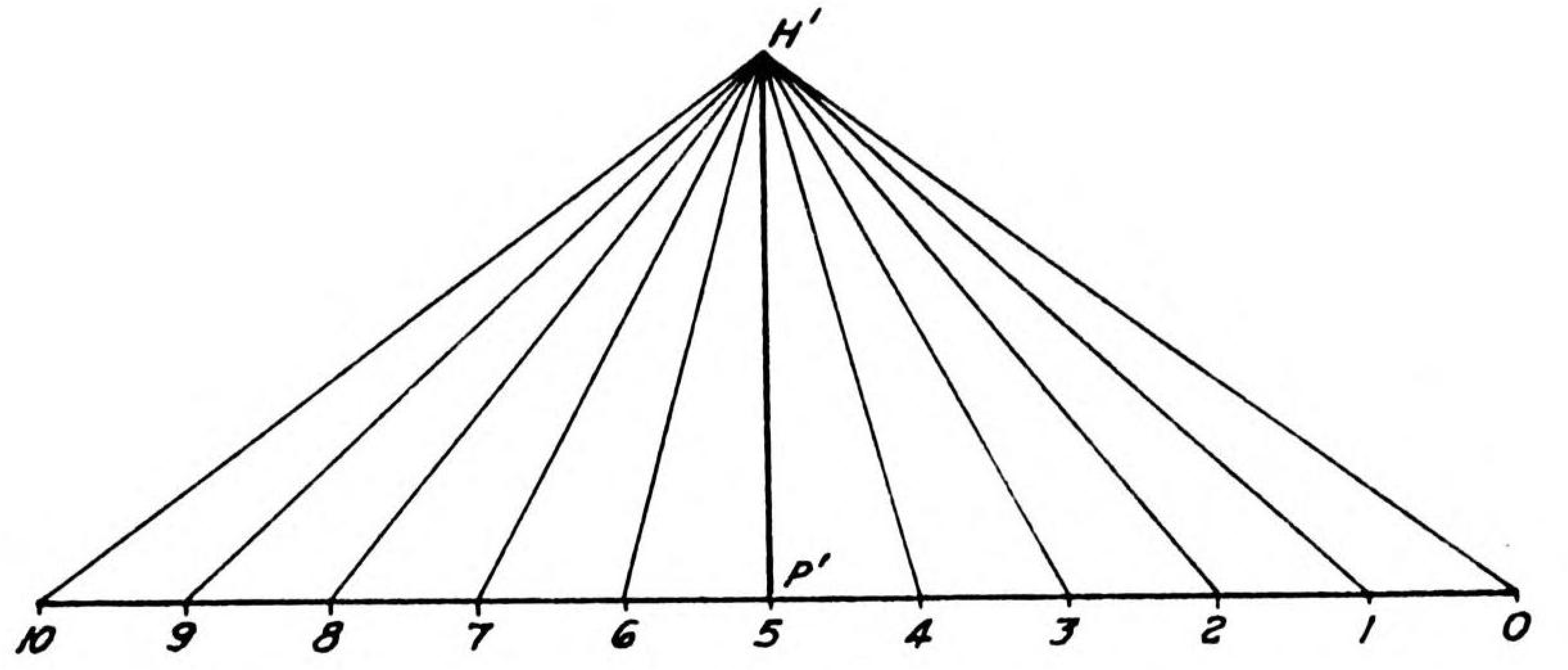


Then connect H through FL with the mile markers at the base.

On a piece of tracing paper, trace the lines FL and the perpendicular PH. The line F′L′ will be the isometric line of the photograph, the line at which the scale is 1: 40,000. Turning the paper, place this line along the original base line and connect H′ with as many mile markers on each side of the perpendicular as is desired for horizontal coverage. The horizontals are now the only element lacking. They may be found by moving the diagram so that H′P′ coincides with H and the zero marker, and marking the spots where the radial lines underneath cross the original FL line. When lines parallel to the iso line have been drawn at these points, the grid is complete.

Where the under radial line passing through the 1 mile mark intersects with FL will be 1 mile distant from the vertical position of the plane along the ground, and thus out of the picture. The 2-mile intersection will be 2 miles distant, etc., to the horizon which is the apex of the grid. When this apex is placed on the true horizon of the photograph, the grid will show square-mile areas thus giving a valuable guide to sizes and distances throughout the

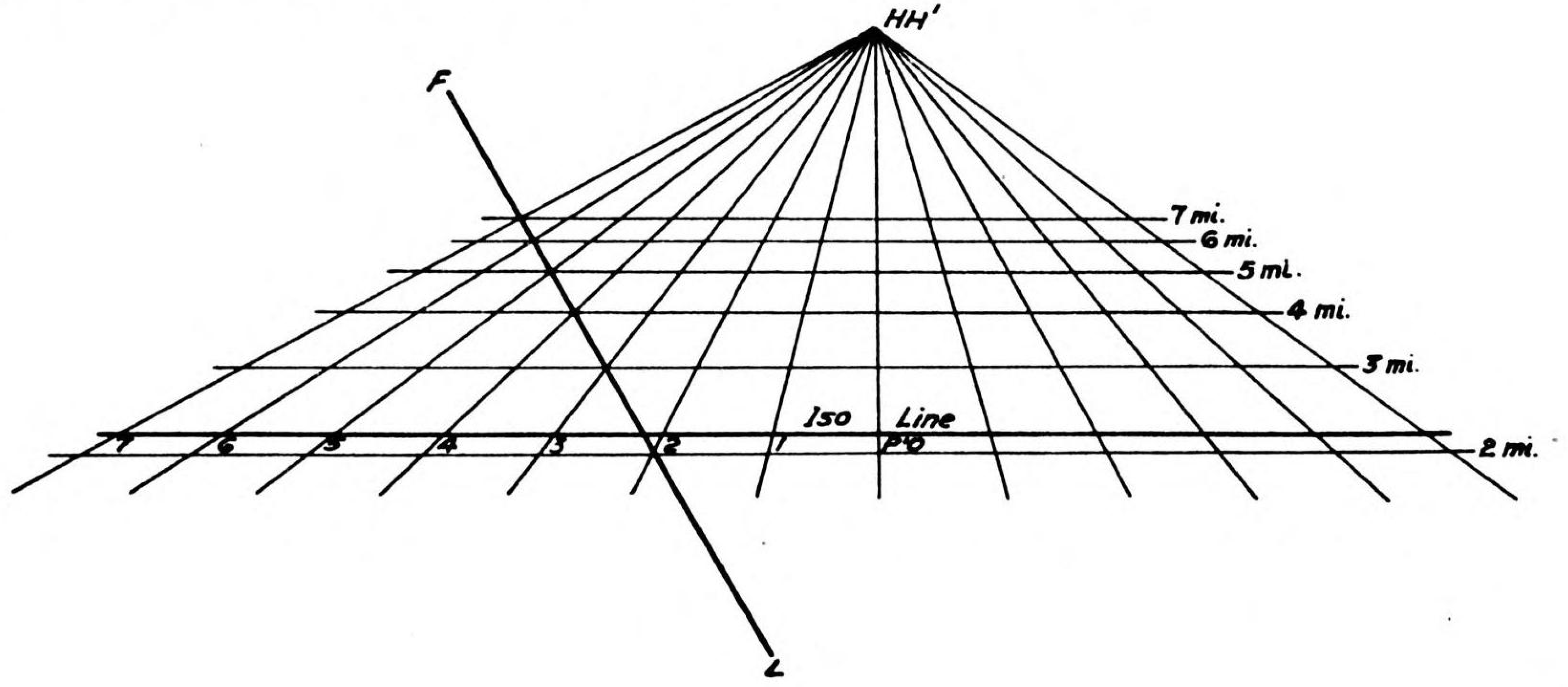




picture.

This is not the only method of preparing a Canadian Grid, but it is one of the easiest and involves less mathematical calculation than others.

Scale by Comparison.—If no maps or data are available, a fairly good scale may be determined by comparison with objects of known size in the picture. Automobiles are roughly 16 feet long, stories of buildings are generally about 10 feet high, etc. Careful inspection of shadow lengths and checking with a proportional divider will result in a useful if not scientific scale. This, of course, is for *emergencies* only.



ENLARGEMENT.

WHEN the scale has been determined, it is time to draw the map contours. A tracing is generally made so that the original will not be marked up. Tracing paper or plexiglass may be used, the latter being marked with a glass crayon and wiped clean after each map. If India ink is preferred, it is advisable to rub the surface lightly with whiting so that the liquid will stick.

FLASHLIGHT PROJECTION

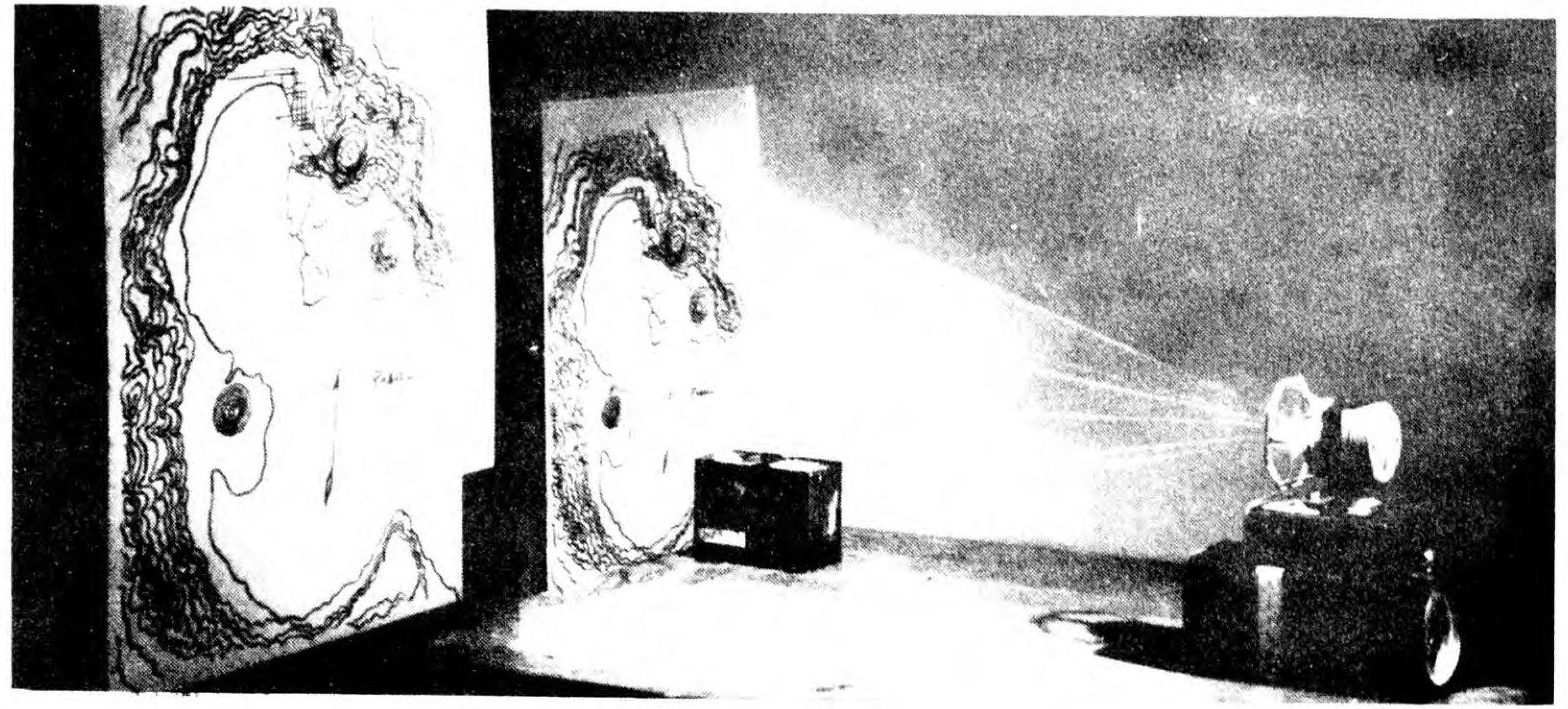
A direct tracing will generally be too small for an effective model and must be enlarged. The simplest and quickest way of doing this is by projection, and a method of constructing a home made balopticon is included in another section. If no electricity is available, the same thing can be done with the flashlight projector in the kit. The tracing is made on a sheet of plexiglass, which is placed between a flashlight (without lens or reflector) and a large sheet of paper. The tracing is thus cast on the paper and may be made larger or smaller by moving the flashlight forward and back.

GRID

If for some reason no flashlight or plexiglass can be obtained, you must fall back on a method as old as Egypt. It takes a good deal longer, but does the trick in the end. On the tracing a grid of equal-sized squares is drawn. Quarter-inch squares are recommended, as larger ones are less accurate when blown up. On another piece of paper the squares are reproduced in exactly the same proportion, but larger. It is a good plan to number the corresponding squares on each grid to avoid confusion while working.

PANTOGRAPHS

Another means of enlarging is the pantograph. Its draw-back is that it must be moved around to cover large areas.



THE SKELETON CONTOUR

WHEN the enlargement has been made, the actual model can be started. There are at least five ways of converting the contour lines to solid form, and all have something in their favor. The selection will depend on the attendant circumstances.

CARDBOARD METHOD

The cardboard method is one of the very best. It is quick, accurate, and easy to do, and it employs an almost universal material. Navy supplies are packed in hundreds of variations of this material, and the model maker should be able to find the perfect size, type, and thickness for his particular problem at any base or outpost. The contours may be drawn on it with carbon paper or by the ancient method of pouncing, i. e., pricking the surface on the lines and rubbing chalk dust over the perforations so that the outlines are marked on the under sheet. The cardboard is then cut to the pattern with an ordinary penknife, and glued or nailed together. The result is a sturdy foundation for modeling. Vertical scale may be controlled by a proper selection of cardboard. Thus, a level of 1,500 feet can be made by 6 thicknesses of 1/8-inch cardboard following contours of 250-foot intervals, or by 4 of these and one 1/4-inch thickness of 500-foot intervals. If your only cardboard fits a 300-foot interval, and the map contours are 200 feet, you can interpolate between the map lines with sufficient accuracy.

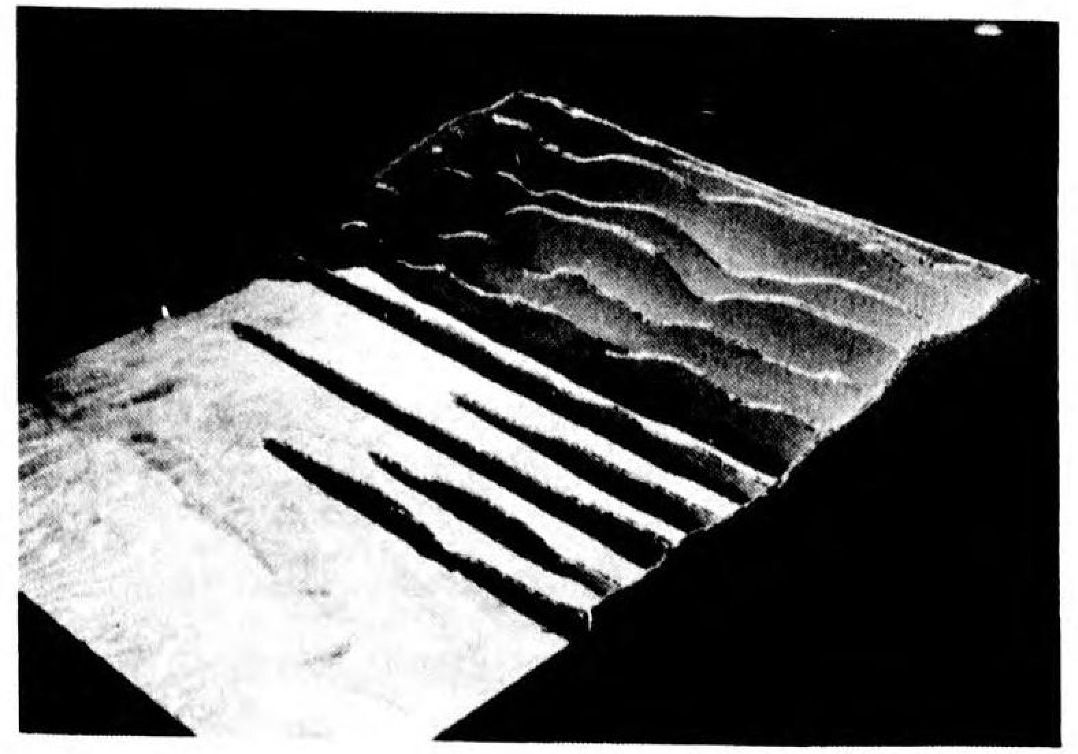

WHITTLED CARDBOARD CONTOURS

STICK METHOD

Space and weight requirements are severe in the field, and there may be times when the materials needed for the cardboard method would be out of place. The peg or strip method may be used instead. A simple box of the required dimensions is packed tight with clay or loam to form the base of the model. On this the tracing sheet of contours is firmly fastened. To get the proper contour heights, sharpened twigs or sticks are pushed through the papers into the clay or loam. The use of a calibrated guide for cutting a number of sticks at once is recommended as a time saver. When the contours have been formed, a filler is packed between the sticks, and the model is ready for final covering, texturing, and coloring.

STRIP METHOD

Perhaps you would prefer the "strip" method. When the contours have been traced on a board, strips of metal foil or heavy paper are cut to a width corresponding to the level of the contour. The strips are then bent to conform to the contour lines and secured upright with tacks, nails, tape or glue. When all the contours have been made in this manner, the empty spaces are filled in and covered to complete the model.

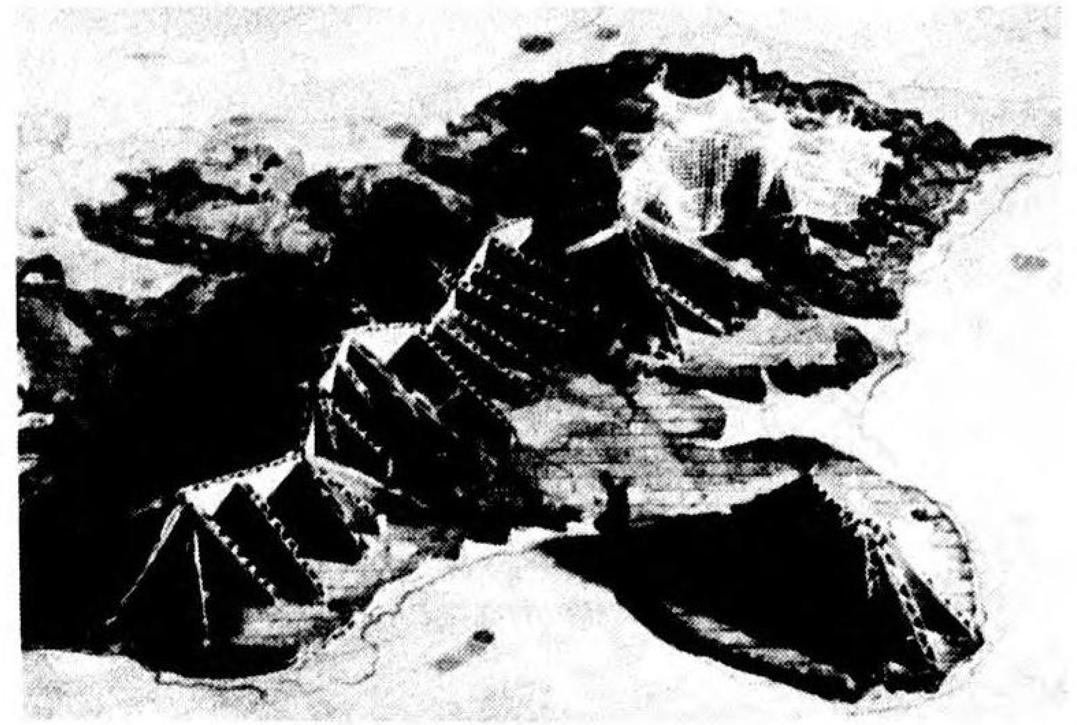


PROFILE METHOD

The "profile" method is not used as often as the others, but has its own merits for special circumstances. It is like the "strip" method, except that the strips are laid in parallel lines instead of curving with the contours. This means that a profile must be cut on each strip to conform to the heights of the contours which pass directly beneath it. The advantage of this method is that the material used need not be flexible, and that the filler may be taken out of the sides after being used as a mold, thus leaving a featherweight paper model with a strong supporting base. The disadvantage is that the uprights are apt to leave parallel ridges on the finished product.

STARFISH METHOD

When dealing with large scale models of mountainous country, the "starfish" method is sometimes used. This is a member of the "profile" family, but utilizes the ridges to indicate typical mountain formations. The strips are cut and set up as in that method, but converging upon a point instead of parallel. On small scale models, the constant process of measuring and cutting the triangular sections takes too long to be of great value; but in scales of 1/5000 or larger, it is as quick and accurate as any, and may be combined readily with the flat carboard method.

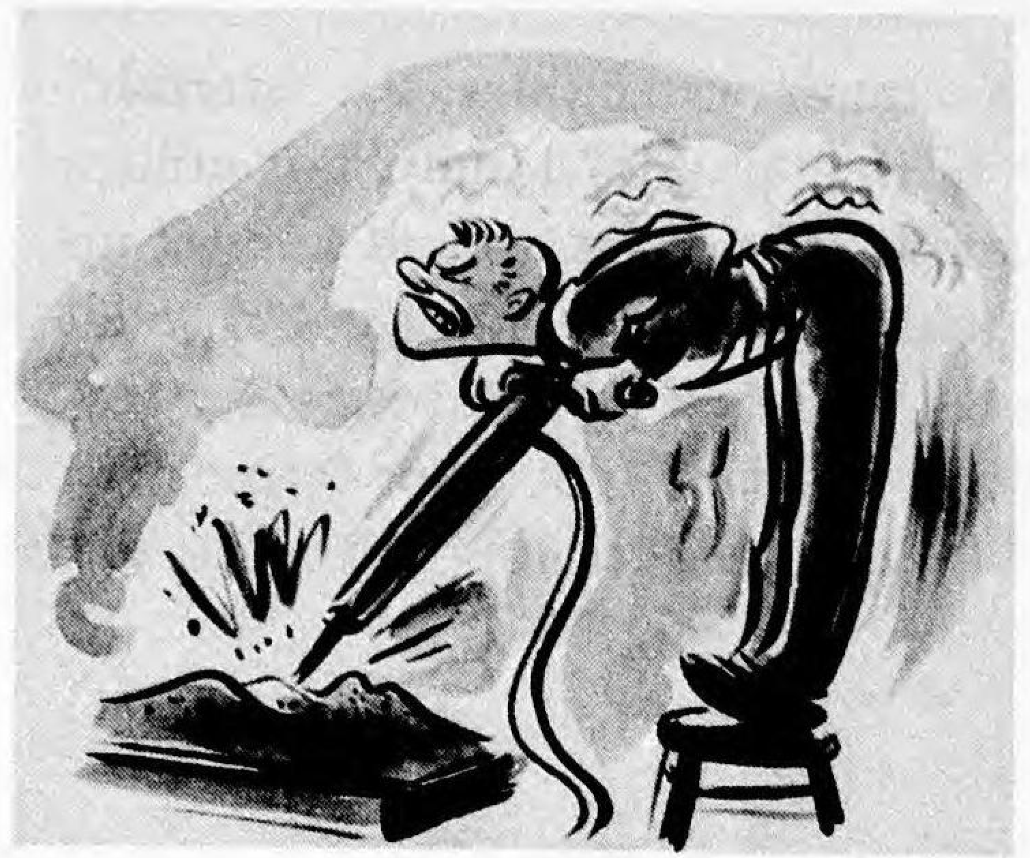


COVERING THE CONTOURS

WHEN the solid contours have been formed, the model is ready for covering and finishing. The material used should

TOO SOFT!

be plastic enough to be worked into any shape and should hold that shape until it dries. It should set quickly, but not so quickly that the final touches cannot be done freehand. The recipe should not be too soft nor too hard. It must not crack from shrinkage nor crumble from too little binder, and it should stick to any surface without the aid of a screen or mesh. There are many mixtures that will



TOO HARD!

answer to these qualifications, but the best for our purposes is probably the one made with P. V. A. None of the following formulas are foolproof, as all depend to some extent on the exact type of material used and the conditions under which it is used. Thus flake glue in chips acts differently from the same glue in pebble form, and one kind of P. V. A. will dry much faster than another. Experimentation may show the need for a change in a formula that has been found adequate in the past.

P. V. A.

Polyvinyl Alcohol is a polymerized resin produced by the DuPont Co. Being water soluble, it lends itself readily to field model making processes. Its value is in its portability and versatility, as only 1 percent by weight of the P. V. A. powder is required to bind any material such as sand, earth, sawdust, paper pulp, etc.

It mixes well but requires vigorous agitation in the beginning. An egg beater is fine for this, but a stick will do if the powder is slowly sifted and stirred into the water.

1 part P. V. A.
1½ parts water.

Stir until lumps are well broken, and add

1½ parts water

When the solution is well mixed, apply heat to a temperature of 160° to 180°, preferably in a double boiler. (The mixture will not be spoiled by boiling.) Stir occasionally while mixing, and skim off extra lumps which rise to the surface.

To mix with sand or other material, place the substance in a pan and pour a small amount of P. V. A. over it. The P. V. A. does not mix immediately and must be stirred in a little at a time until it has thoroughly permeated the mixture. A few trials will show you what the proper amount is. The contour base should be sized with a clear coat of P. V. A. before the mixture is placed on it, but it is not necessary to wait for the size to dry.

FLAKE GLUE

If no P. V. A. is available, an equally good mixture may be made from flake glue, as follows:

2 parts stock glue
2 parts water
Melt slowly and add
1 part fibre
3 parts whiting.

Stir these to a fairly thick but wet mixture and add the filling material—sifted sand, fine earth, or any other suitable substance. Mix thoroughly until it becomes the consistency of a good brick mortar.

The stock glue mentioned here is prepared by placing a handful of dry flake glue in a pan, and covering it with approximately three times its volume of cold water. After it has soaked at least 2 hours and is swollen twice its original size, it should be slowly melted over hot water in a double boiler and set aside for use. *DO NOT LET IT BOIL OR STEAM!* In this stage it is carpenter's glue. As it cools, it will jell, but don't add any water to it. Warm it over and it will thin out by itself. Keep this preparation just as M. Gaspard at your favorite restaurant keeps a thick soup stock for all sorts of dishes. It can be used in nearly every stage of the model making.

"A RED-HOT SALESMAN"

FIBRE

The fibre used in the recipe may be any fine material like paper pulp, cellulose cotton, hair clippings, or plant fibres. Newspaper, toilet paper, or cellulose cotton should be soaked and ground until they become a smooth mass. Care should be exercised in selecting the material, as a very coarse material on a small scale landscape will be as out of place as a pickax in a pincushion.

WHITING

Whiting is employed to make mixtures smoother and more workable. It may also be used for white undercoats in making water effects or submarine features, a procedure that is advised wherever time permits.

1 part stock glue
1 part water

Melt slowly and add

2 parts whiting

Stir and strain through a cloth to remove lumps. Apply to the surface while the mixture is still warm.

There are many fine materials at advance bases, but you may have to use a little persuasiveness to get them. If you were a red hot salesman in peacetime you may be able to get some cement from which a good plaster can be made.

2 parts stock glue
1 part water

Melt slowly and add

2 parts cement

Pour thin sand and earth into the mixture until it has reached the proper consistency.

A fairly durable plaster can be made by mixing a resin emulsion paint with sand and water until it has become a workable consistency. The paint is soluble in water, and can be obtained (if

no one is watching) from the Sea Bees Camouflage Units.

Boiled corn starch can be useful, too, if properly used.

1 part corn starch
10 parts water

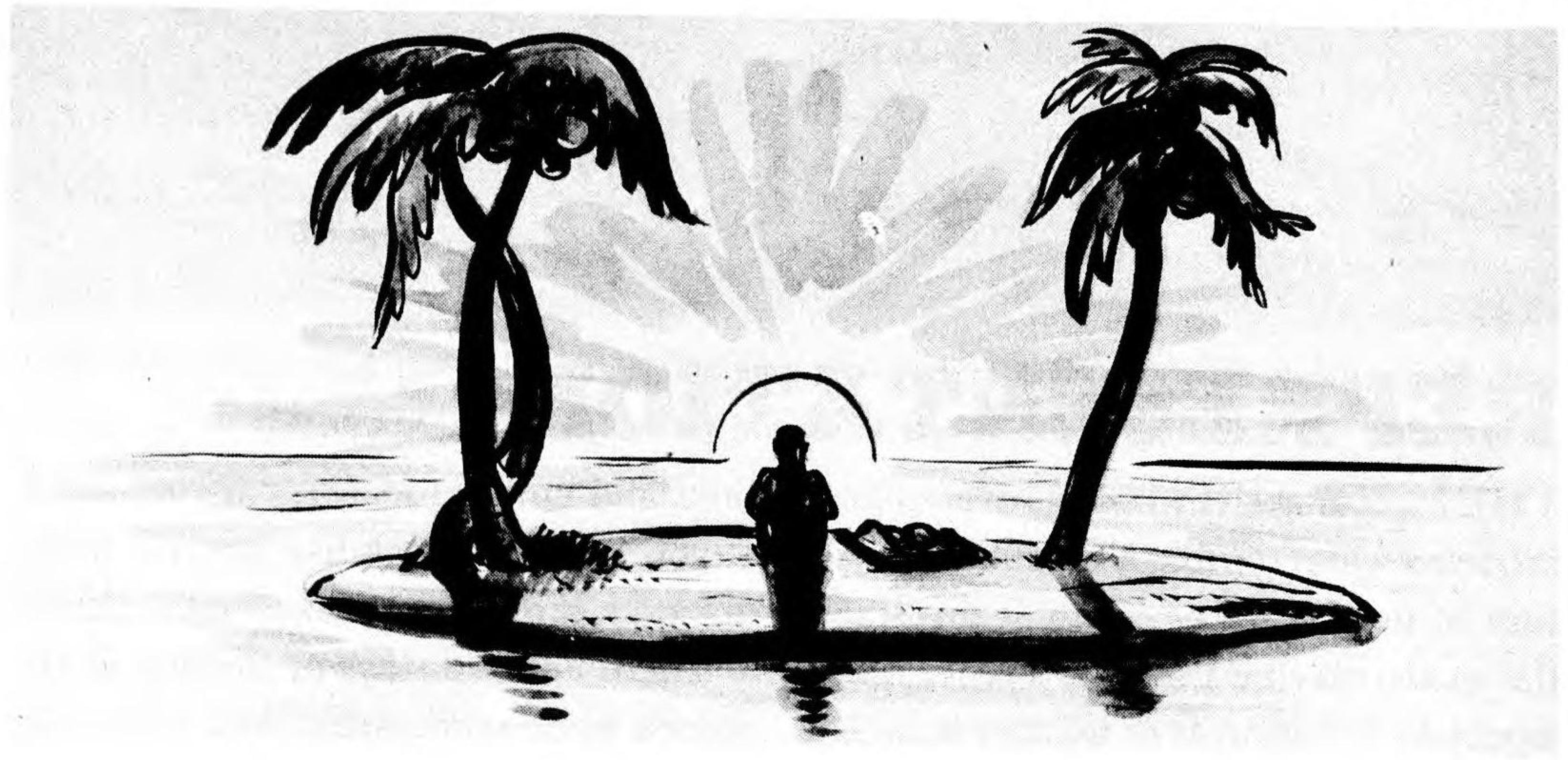
Heat and stir the mixture until it boils, and add sand. This dries slowly, but forms a crust in about an hour. By the next day it will have set very hard.

Even syrup and pancake molasses can be used in a pinch.

1 part cement
⅔ parts sugar syrup or molasses
3 parts sand

Heat the mixture well while stirring. The syrup makes the cement set quickly, and increases ease of manipulation.

These are only a few of the mixtures which can be made by an ingenious selection of common materials. The modeler should always be alert to the possibilities of familiar and unfamiliar substances he may find around him, for he never knows when he may run out of materials or have his kit destroyed. In such a case he should be able to "live off the land" until his stock is replenished.



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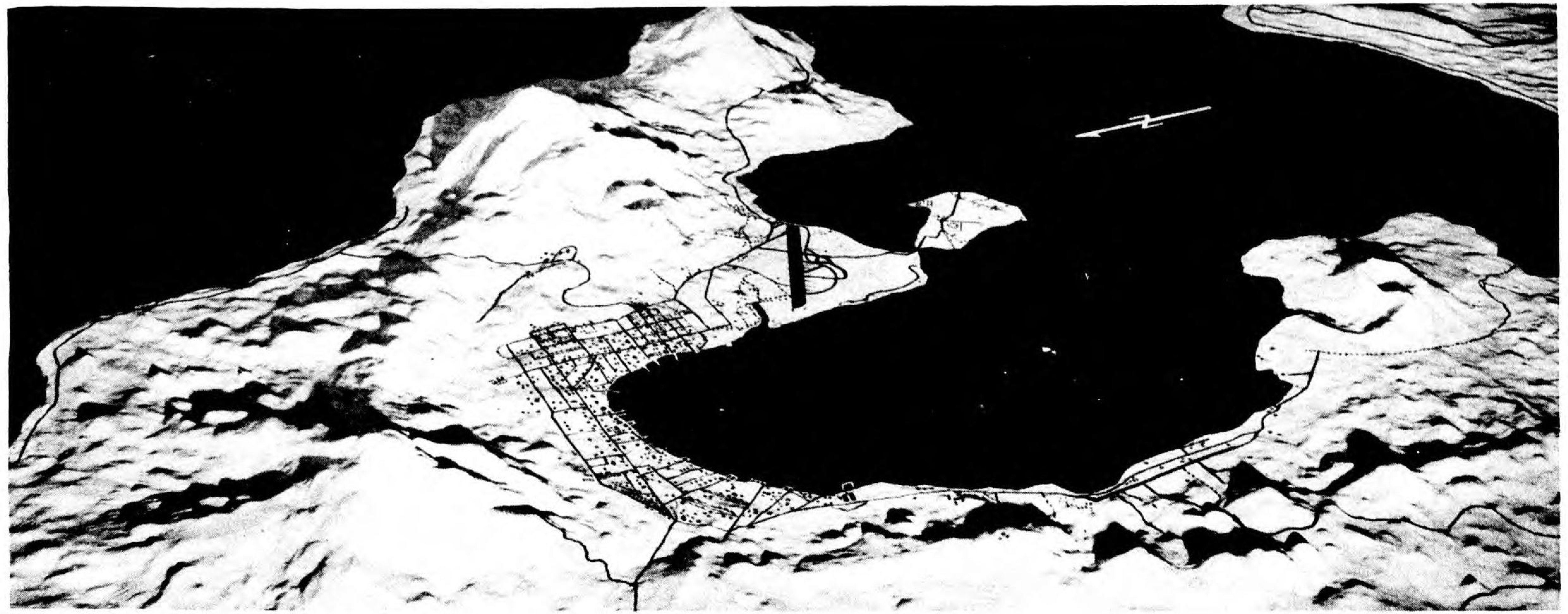


REPRESENTATION

THE contour skeleton when covered and modeled will resemble a simplified sculpture of the landscape. Even at this stage the model may be useful as a relief map, especially if diagrams of military installations and cultural features are indicated. If you want it to look like the real thing, however, it must be textured and colored.

There are two ways of looking at the objects to be represented, and both have their places. A town may be regarded as a collection of individual buildings, and each one modeled and placed exactly as it is, or it may be seen as a generalized pattern. For large scale models designed

for the study of troop movements or direction of artillery fire, the former is almost essential because of the minute accuracy involved in a close-up rendition.

Where quick recognition of main topographical features is all that is necessary, however, it may be better to consider the town as a pattern. Certainly it is a great deal quicker, and for high altitudes may actually appear more truthful, as it subordinates distracting detail. Cultural features such as towns, factories, docks, roads and farmlands are usually so similar wherever they are, that they may be symbolized by a few lines and colors, or by a stamp or pattern wheel. Similarly one may generalize to a certain extent about the texture and color of the whole terrain.

But be careful! after all, the pilot wants to *recognize* his objective.

TEXTURE

Although we are treating them separately in this manual, texture and color are really interdependent as they are usually applied at the same time. For the average model maker, unskilled in the manipulation of paint, a method lifted straight from the enemy is advisable. It is called Bon Seki, and in spite of its Nipponese background is a very quick, easy,

BON SEKI METHOD

and realistic way to texture and color a model. Precolored grains of materials are sifted or ladled onto a sticky surface to represent the effects of nature. Instead of the carefully chosen sands of the Japs, however, the materials used are those found everywhere. Coffee grounds, dirt, moss, cinders, sawdust, filings, and other such make fine reproductions of nature when properly applied. The light and shade effects caused by the use of a tangible substance produce a realism not afforded by the smooth surface of a painted model. Great care must be taken, however, that the chosen texture and color fit the scale. For extremely small scales the powdered pigment itself may be coarse enough.

One of the greatest values of this method is that it avoids the problems of the painter. Brushwork, media, handling, the rendering of tones and transitions, are largely eliminated. Only the water, the final details, and the corrections are applied with a brush. This is not to stop a painter from using his talents, however. On certain problems his skill will be very valuable, particularly in dealing with lightweight models which may be shipped by air. In this case a surface that is textured with ground materials is more apt to be damaged than a smoothly painted one. In addition he will be more familiar with such color problems as are treated in the following pages.

The color problem is really a simple one for the Landfall modeler. It boils down to this. He must try to match his color to the hues of nature and to the scale of his model. If he is unfamiliar with the use of color, a brief discussion of its background may help.

COLOR

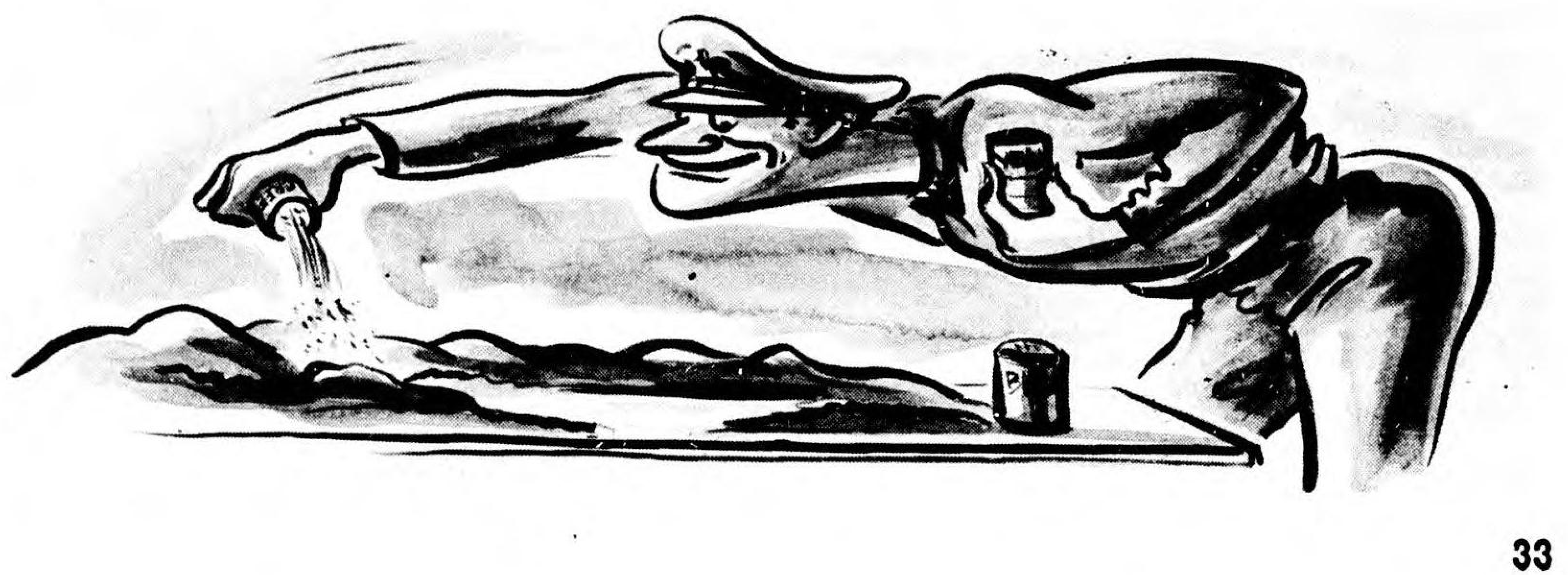
To begin with, color is light. When only colored rays of light are considered, all colors in the spectrum added together make white. You are doubtful? Hold a prism to the sunlight so that the rays are cast on a wall and you will see that same light broken into its component parts, the colors of the rainbow—violet, blue, green, yellow, orange, and red. If all objects and materials reflected all the colored rays of light striking them, the entire world would be as white as the paper this is written on. Fortunately, however, most substances *absorb* some of the rays, leaving the rest for us to see as their colors. Thus a lemon reflects only the yellow rays to the eyes; a ripe apple reflects mostly red rays. The brown stem of the apple reflects some of the red, some of the blue, and some of the yellow. Black, being the absence of light, is also the absence of color, and the black type on this page is absorbing all rays.

Pigments do not respond to the same laws as light. If pigments representing the colors of the spectrum are mixed, they do not make white but a muddy black. This is because the dry powders that make the colors are only reflecting agents and not the rays of color themselves. Three pigments are the basis for the colors of the rainbow. They are *red, yellow,* and *blue,* and are called the primary colors.

Red and blue make *purple.*

Red and yellow make *orange.*

Blue and yellow make *green.*

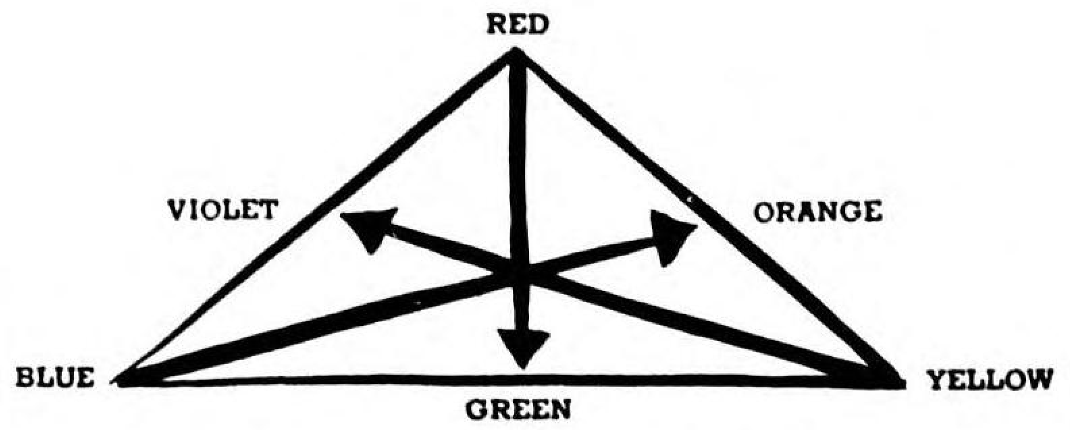


	VIOLET	BLUE	GREEN	YELLOW	ORANGE	RED	BLACK
WHITE	LIGHT VIOLET	LIGHT BLUE	LIGHT GREEN	LIGHT YELLOW	ORANGE PINK	PINK	GRAY
VIOLET	VIOLET	BLUE VIOLET	MUDDY GRAY	GRAY	BROWN	DEEP RED	DARK VIOLET
BLUE	BLUE VIOLET	BLUE	GLUE GREEN	GREEN	GRAY	VIOLET	BLUE BLACK
GREEN	MUDDY GRAY	BLUE GREEN	GREEN	YELLOW GREEN	BROWN GREEN	BROWN GRAY	DARK GREEN
YELLOW	GRAY	GREEN	YELLOW GREEN	YELLOW	LIGHT ORANGE	ORANGE	GREEN BLACK
ORANGE	BROWN	GRAY	BROWN GREEN	LIGHT ORANGE	ORANGE	ORANGE RED	OLIVE BLACK
RED	DEEP RED	VIOLET	BROWN GRAY	ORANGE	ORANGE RED	RED	DEEP RED BROWN

The above table shows what happens when pure spectrum colors are mixed. It must be considered as true only in the most general way, as there is a vast range of colors and tones which cannot be described in words. Much depends on the exact proportion of color and of white in the mixture. For instance, a brown may become gray if less red and more white are used, and a single impure color will cause many of the combinations to turn to mud.

Purple, orange and green are secondary colors because they are made by a mixture of primaries. They are sometimes also called color complements. When placed next to certain other colors they tend to increase their intensity. For example, green and red when side by side show off at maximum brilliancy and must be watched carefully in a terrain that we want to be subdued. These combinations may be found easily by means of a simple color triangle.

If the primary colors are placed at the corners of a triangle in any order, and the colors from their mixture put between them, arrows from the primaries will point directly to their color opposites, the color complements,



ATMOSPHERE

The more we continue with our mixing, the closer our colors approach the neutral hues of nature. The reason that we see so few strong colors in the landscape is that *atmosphere,* composed of tiny particles of dust and moisture, is over and around everything on the earth.

The color of atmosphere is pale blue. Mountains seen close at hand may be a strong shade of yellow green, but from a few miles distance they appear blue or blue green. The effect is more noticeable in localities where the atmosphere is thickened by such weather conditions as mist or haze, but even in the extreme clarity of the desert, distant objects take on a bluish tone compared with those near by. To look at the problem from another angle, blue is prohibited in field camouflage for any purpose. Even in small amounts it is very noticeable from the air, because of the already pronounced blueness of the atmosphere. The opposite procedure will hold true for the modeler, as *his* landscape must be viewed from only a few feet away.

Landscape takes on the *tone* of atmosphere as well as the color. As it recedes from the eye, more and more air comes between the object and the observer, and contrasts are accordingly lessened. Objects which are naturally darker than the atmosphere become lighter and vice versa, until the whole terrain is fused into an opalescent harmony. Don't be guided for tone by high altitude photographs. In order to bring out the detail with maximum clarity they are filtered and printed with greatly exaggerated contrasts. The modeler can find the detail from these photographs, and restore the landscape to its true color.

You can't learn to swim on a sofa, and you can't learn the tricks of color except by actual experimentation. As good a way as any is simply to splash on a piece of paper or smear powdered colors together without trying to represent anything. Notice how one color can be blended with another so that the dividing line is impossible to find. Observe how colors that have red or yellow in them tend to advance as compared to others that are mixed with white, blue, or green. See how bright blue may be softened with a pinch of red, and how black may "kill" a brilliant color. How many shades of brown can you make? How many kinds of off-white and gray? Have you tried spraying thin colors with an atomizer? A few hours of this sort of practice will teach you more about the effects of color and the knack of getting these effects than will days of reading about it.

Color may be opaque or transparent. If it is transparent one should be careful of the background on which it is painted, as it will of course show through, influencing the color on top. Even opaque colors and those mixed with sand will look different on white than on brown or blue. The main use of transparent colors comes in the rendition of water. If you want to make it look like the kind you can jump into you must give it some kind of a gloss, because water is a reflecting surface. To indicate underwater features like shoals and reefs an extremely transparent series of oil and varnish glazes must be used. Thus:

1. Thin varnish with turpentine to a workable consistency and mix with dry colors.

2. On a pure white background indicate the underwater pattern, and let it set fairly well.

3. Glaze over this with colored varnishes matching the tones of the water.

(South Pacific shoal and reef water are light green, deep water a darker blue).

4. If necessary, let it dry and apply a coat of clear varnish.

To sum up, we include a list of general suggestions which may be of value to the inexperienced colorist.

1. Study the scale of the model carefully before deciding on the tone or hue of the landscape. At 1/1,000 objects will be nearly their natural color. At 1/40,000 the entire terrain will approach a monotone.

2. If you are in a hurry, make the model *general*. Two or three colors will make a workable diagram of the color features of most localities.

3. In mixing pigments, judge them as much as possible in their powder form. They will darken when the water is added, but will come back to the original color when dry.

4. Don't waste paint by mixing too much. A little color goes a long way.

5. Avoid *raw* colors. They must be refined with other colors to be convincing. Remember that light contains *all* colors.

6. Mix your color as directly as possible. If you want a blue green, start with blue, not yellow. At high altitudes start with gray and tint to the desired color.

7. WHEN IN DOUBT, MAKE IT NEUTRAL! No color at all is better than one which creates a vivid *false* impression in the mind of the pilot. Be sure, however, to accent in color those landmarks which are outstanding, such as beaches, cliffs, rivers, large buildings, and airfields.

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EDITIONS

MOST of your work will be concerned with originals, but there may be many occasions when you'll want two or three copies of the same model. On a carrier, for instance, one might be used in the captain's quarters, another in the ward-room to be studied at leisure, and a third in the ready room for actual briefing.

To make these one must first make a master mold. This may be built up over the contours in the methods already described. When the model has reached the stage of simple sculpture without texturing or coloration, it is allowed to harden, and is then ready for the covering shell. The mold must be firm enough to resist pressure, and smooth enough so as not to adhere to the covering material. Plaster, because of its fine qualities for handling and drying, is considered the best material for the master mold, but plasteline and even a sand compound have been used successfully. These are positive or "male" molds. For a negative mold to be used as a matrix for casting, it is advisable to use some such device as the "Relief Register," discussed in a later section dealing with special instruments.

MOLDED PAPER—FORMULA

For the relief map itself, some light plastic material must be pressed down on the master mold and shaped to resemble it. It must come off the mold without shredding or tearing, and should hold its shape indefinitely thereafter. For this purpose, molded paper is highly recommended. It is far less bulky and susceptible to shock than is plaster, and is preferable to ordinary papier mâché because it dries much faster and can be used with either a "male" or a "female" mold.

When the original model has been prepared in plaster, or a sand mixture, a large sheet of paper (preferably Byron and Weston No. 70 molding paper) is thoroughly soaked in water. The excess water is then squeezed out, and the

paper pressed down on the model. After the entire model has been covered and the paper tamped down smooth, a mixture of 50 percent plaster and 50 percent whiting is prepared. A small amount of dextrine glue is added to the water, and the final mixture applied to the paper with a brush. When the paper has been covered with the plaster solution, another piece of damp paper is tamped down on top, thus laminating the two layers together. After 20 minutes to three-quarters of an hour, the paper will have set stiff enough to be removed from the model. If a piece of mosquito netting is stuck to the back of the shell, it will be much more durable. The same plaster solution may be used as a paste. After the paper cast has dried, it may be painted or textured in any way desired.

If no plaster is obtainable, the following recipes may be used. Both have yielded satisfactory results.

FLOUR METHOD

1. Grease surface of model with lard or oil before covering with one layer of wet moulders paper (using pieces approximately 5 by 10 inches). Work wet paper well into detail on the model, pounding with a stiff brush.

2. Grease surface of moulders paper with lard or oil before placing two layers of tissue paper over moulders paper (first layer dry, second wet).

3. Place convenient sized strips of cloth on table, paint flour paste on both sides, and lay tissue paper on one side of it. Put strips of cloth on model with the tissue next to model. Work well into detail of model with fingers.

4. Sprinkle with sand immediately until completely covered. Brush off excess and sprinkle with talcum powder.

5. Place hot pebbles or hot coarse sand on entire area (1/8 to 3/4 inch deep) to bake flour. Remove pebbles or sand after 10 to 15 minutes. If surface is not hardened, repeat the baking process.

6. Place cold pebbles on model for 20 minutes while cooling. The weight of the pebbles will keep the model from warping.

7. Paint with shellac and burn off alcohol. If sprayed with shellac instead of painted, burning off alcohol may not be necessary.

8. Mount copy on same sized board as original and proceed to color.

REMARKS

1. If model is simple and is not made of glue or other sticky mixture, it is not necessary to cover it with moulders paper. One layer of tissue may be sufficient.

2. The talcum powder and sand will prevent the pebbles from sticking to the flour.

FORMULA FOR FLOUR PASTE

1 part flour, 3 parts water. Bring to boiling point.

SUGAR METHOD

The technique to be used for making copies of terrain models with the sugar method is the same as that used with the flour method with the following exceptions:

1. Dip cloth into sugar solution rather than painting it on.

2. Leave hot pebbles or hot sand on the model for about 30 to 45 minutes in the hardening process.

FORMULA FOR SUGAR BINDER

Add enough water to sugar to make a thick paste. Boil mixture slowly until the sugar dissolves into a clear liquid.

MAEDIN WATER

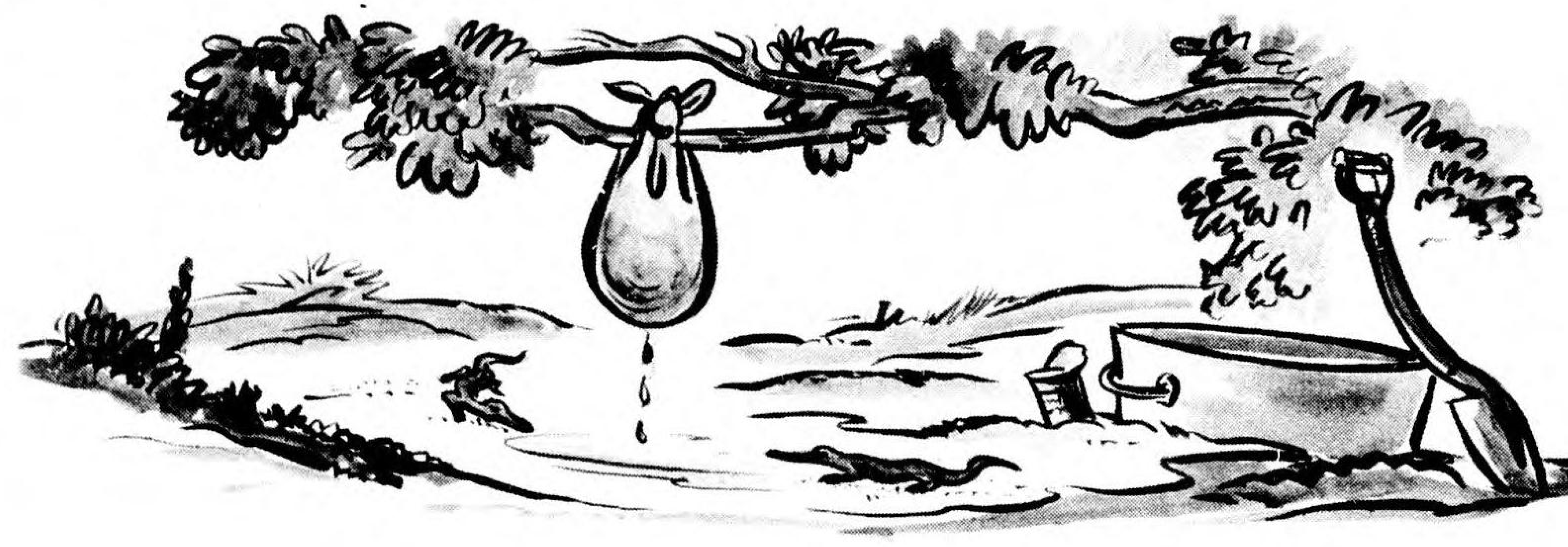
Here is a vehicle for dry color that will flow in a ruling pen as the glycerine retards the natural speed of drying:

9 parts water
1 part alcohol
1 part LePage's mucilage or glue
1 part glycerine.

TO MAKE DRY PIGMENT

1. Take any highly colored earth or clay found by digging through the topsoil. Reds, browns, yellows, and occasionally dull green are usually found this way.

2. Crush the earth into as fine a consistency as possible and place in a large tub or pail filled with water. Stir the mixture until the water is well colored. Filter the water through paper towels or fine cloth. Let the towel or cloth and the residue dry, then dust the residue into containers. This will produce a fair quality of earth color. However, to produce a good quality, it must be washed several times.



LIGHTING

Three things should be considered in lighting the model for briefing or photography, and all will vary with the time and type of the intended attack. These elements are:

1. The angle of the light.
2. The intensity of the light.
3. The color of the light.

Angle.—The angle of the light must be carefully planned to coincide with the direction of the sun at the time of the attack, as light from the other side will change the appearance entirely. A low angle light is sometimes very effective,

DIFFUSE LIGHT

POINT SOURCE LIGHT

but one should remember that such lights as low south and north will not be found in temperate climates. If in doubt as to the position of the sun at various times of day, ask a navigator or aerographer.

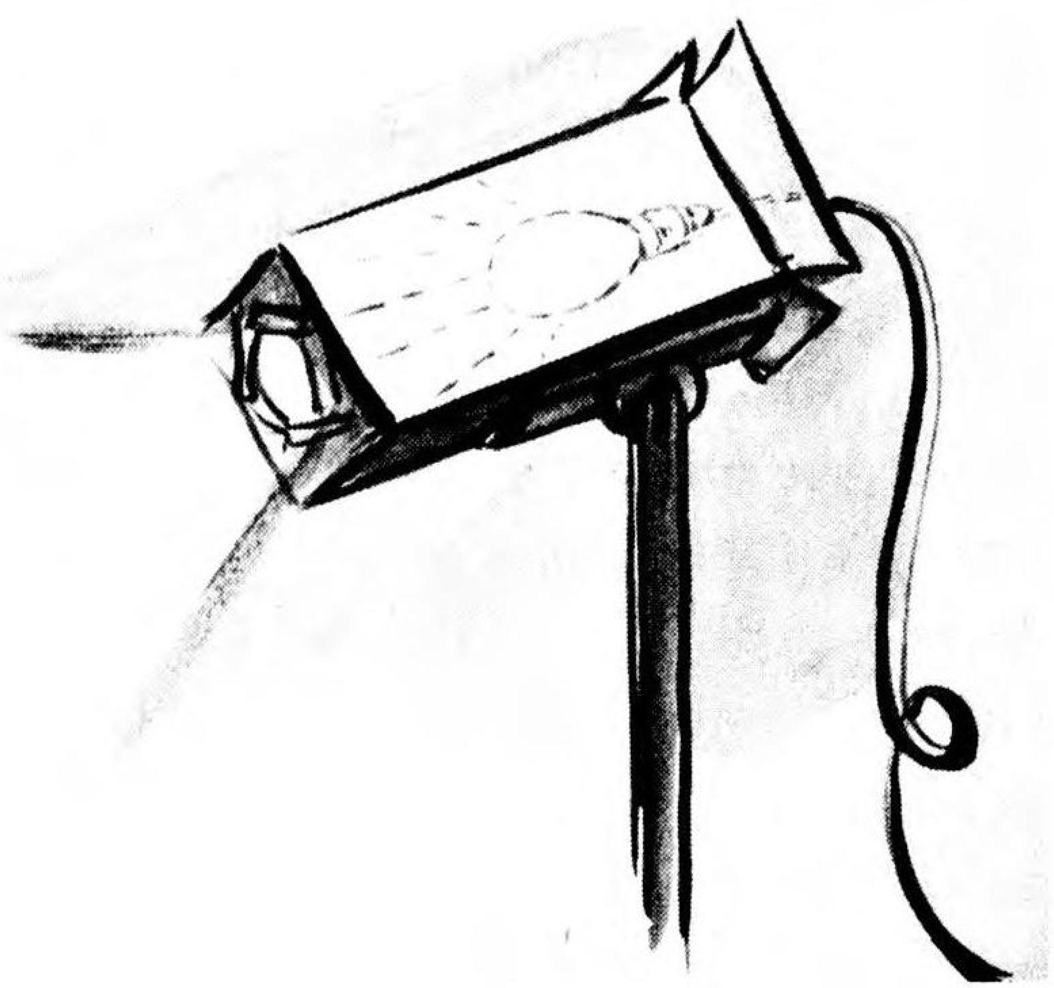
Intensity.—Intensity of light will vary with weather conditions and time of day. There are two main types of light, diffuse, and point source. Diffuse light produces little effect of relief, texture, or depth. It does not reveal or dramatize the model to the fullest extent, but is not to be despised as it gives the quality of an overcast sky, light through fog, and starlight.

Point Source.—The second type of lighting, point source, casts sharp shadows and produces effects of strong relief and vigorous texture. It resembles sunlight, and is the most useful light for our purposes, as it shows up the details most forcibly. Strong artificial light or natural sunlight should be balanced with a reflector on the other side so that the observer can see into the shadows. White cardboard or a white wall will serve the purpose adequately. If the lighting is artificial be sure that it is far enough away from the model so that the light is spread evenly over it. The light source *should not be nearer the model than four times the distance across it.* A simple way of showing the effects of changing light is to put the model in a darkened room and slowly open the door.

Colored Lights.—Color will vary somewhat with the time of day, but the modeler can resolve his color problems into three filters.

1. The plain frosted bulb for broad daylight with a tissue paper filter for effects of overcast.
2. Amber for sunrise and sunset.
3. Blue for moonlight and night effects.

Lumarith will be included in the kit to be used for filters, and an effective spot light can be made from a 100-watt bulb enclosed in a small cardboard carton that has had a hole cut in one end. The filters may be pasted on with scotch tape to cover the hole. A rough stand for the spot should be made to facilitate handling.



DISPLAYING THE MODEL

UNTIL the pilots and briefing officers become familiar with the use and interpretation of models, much will depend on how you display them. It is very hard to fool the human eye, but that is what you must do, to some extent at least, if you are to make a man believe that an area 4 feet square is similar to what he will see 10,000 or 20,000 feet in the air.

Outside of representation, two problems arise in displaying a model. The first is a physiological one. The human eye is a lens. When it is viewing distant objects, the shape of the lens is nearly round, and as the objects get closer and closer, the muscles of the eye adjust the lens to a flatter shape which records the decreased distance. This pull of the eye muscles immediately telegraphs the position of the object to the brain, and makes it difficult for the observer to believe that a near object is far away.

The other problem is caused by stereoptic vision. At close range we see objects from more than one angle owing to the spacing of our eyes. This of course gives us our sense of three dimensions. The further away we get, the less this angle operates until at 300 to 600 yards all stereoptic vision is destroyed. We see light and shade and interpret these into three dimensions, but we do not receive a true tactual image.

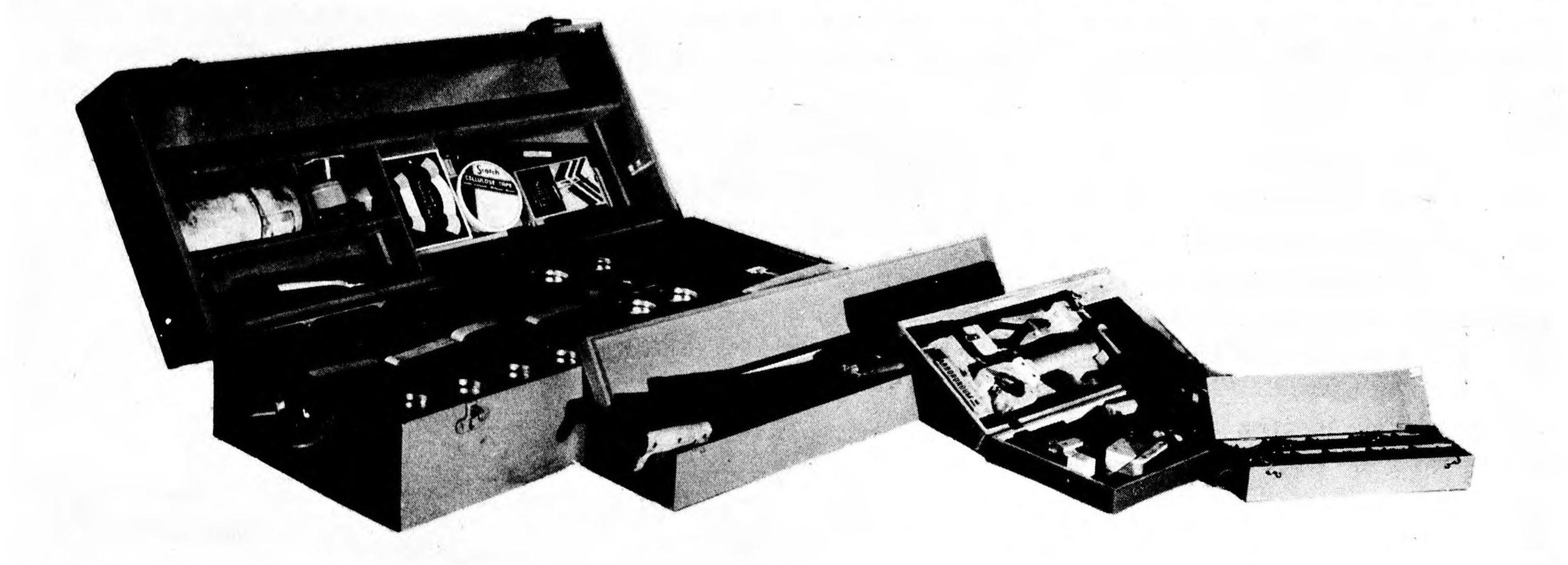
Although you should be aware of these problems, there is no need to let them bother you. With the aid of a concave lens, reducing glass, or binoculars the eye may be fooled into believing that the model is far away. The main thing is to use a viewing box, a dark room and a spotlight, or simply a curtain around the model so that the observer will be prevented from comparing the scale of the model with familiar objects nearby.

THE KIT

MODEL making can be an elaborate process requiring a Hollywood laboratory equipped with miraculous instruments, or it may be nearly as simple as a child building sand castles. Some stations have all sorts of materials and experts to handle them. Fine; they should be welcomed with open arms, but not expected. The Marines do a grand job with a crew of men and a jeepful of goods, but reporting aboard a *carrier* with a retinue like that would be quite a test of one's popularity. Your rule must be "the simpler the better," because the chances are that all you'll have will be your kit, your brains, and whatever materials you find around you. And that's all you need.

CONTENTS OF KIT

With the kit and a change of linen you're all set for a 3 months' jaunt to Lobeckland or anywhere else. You may



wish you had the Marines' jeep when you come to carry it, but wait! Inside there is a light detachable section to take with you when the local Duchess asks you down for the week end. There is a drawing board and two other sections containing nails and tools for making a raid on the Seabees or rummaging among discarded supplies. One becomes a judge of choice trash in this business, for this is one of the main sources of supply. Everything which can't be found in the field will be found in the kit if its absolutely necessary. Tracing paper, tape, dry colors, instruments, and materials ranging from pine oil to ceresine wax are included, but there have been no duplications and many items will have to serve two or more purposes.

As developments arise and reports come in from the field, the contents of the kit may be changed. In its present state it has been used under difficult conditions and found not wanting. Even without the kit it is possible to make useful models.

Remember that you can make a relief with anything that will hold together, and that any relief is better than none. (The model used in taking Guadalcanal was made of nothing but green blotting paper.)

GEOMORPHOLOGY

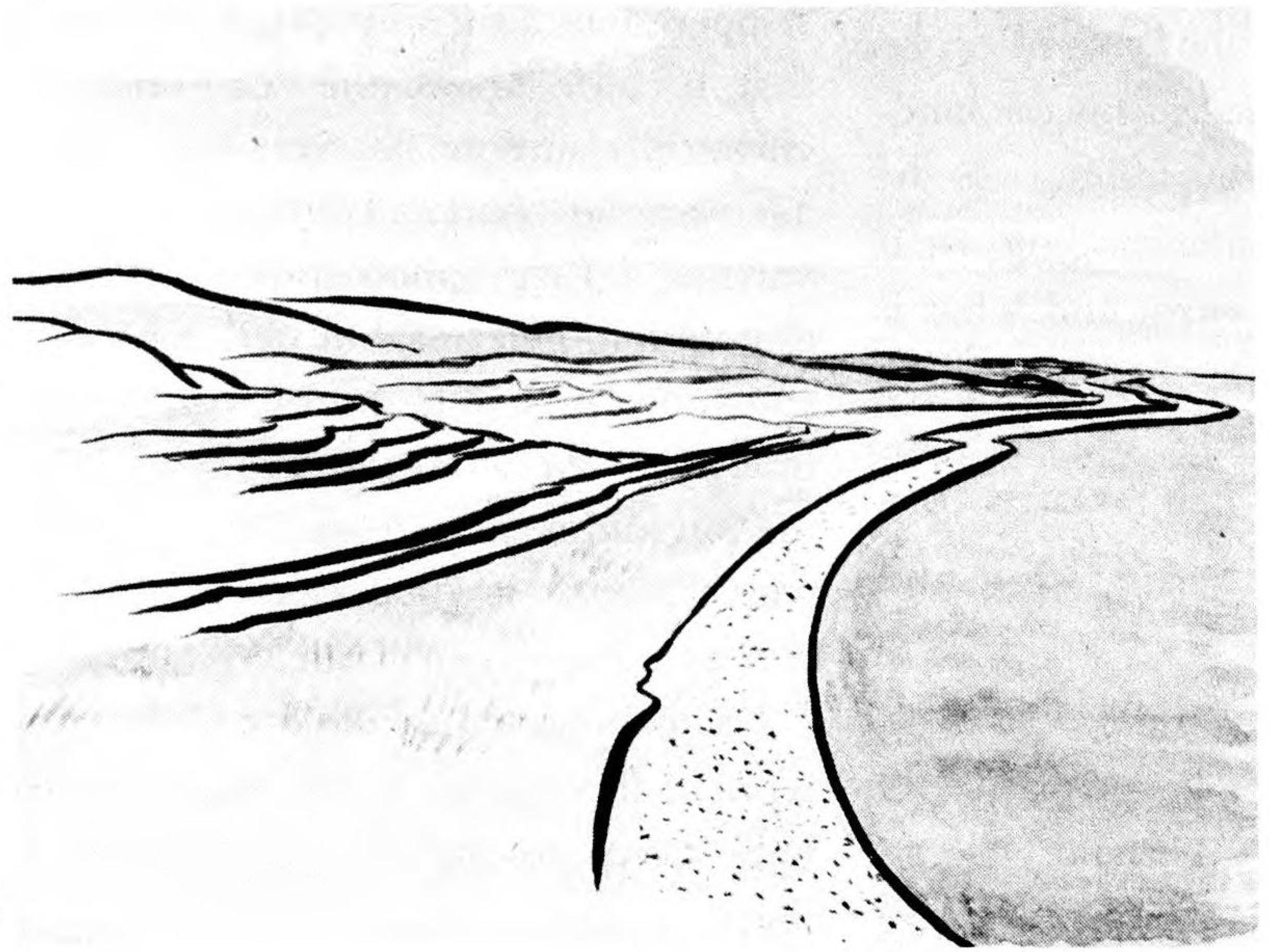
GEOMORPHOLOGY is a five-dollar name for the study of landforms, their origin and development. It can be of great help to you in three ways: (1) In understanding and interpreting maps and landscapes. (2) In teaching pilots and observers what to look for in the landscape and how to describe it to you afterwards. (3) In estimating the probable character of unknown terrain. If you know that the earth started as a spinning ball of molten material, which has been slowly cooling off, undergoing surface and interior disturbances during the process, you have the basis of explanation for all the varied forms the landscape takes. And if you follow out the line of reasoning, understanding what has happened to the earth and what is still going on, you can explain it to someone else clearly, logically, and dramatically so that he will also understand it and be able to remember it vividly and accurately.

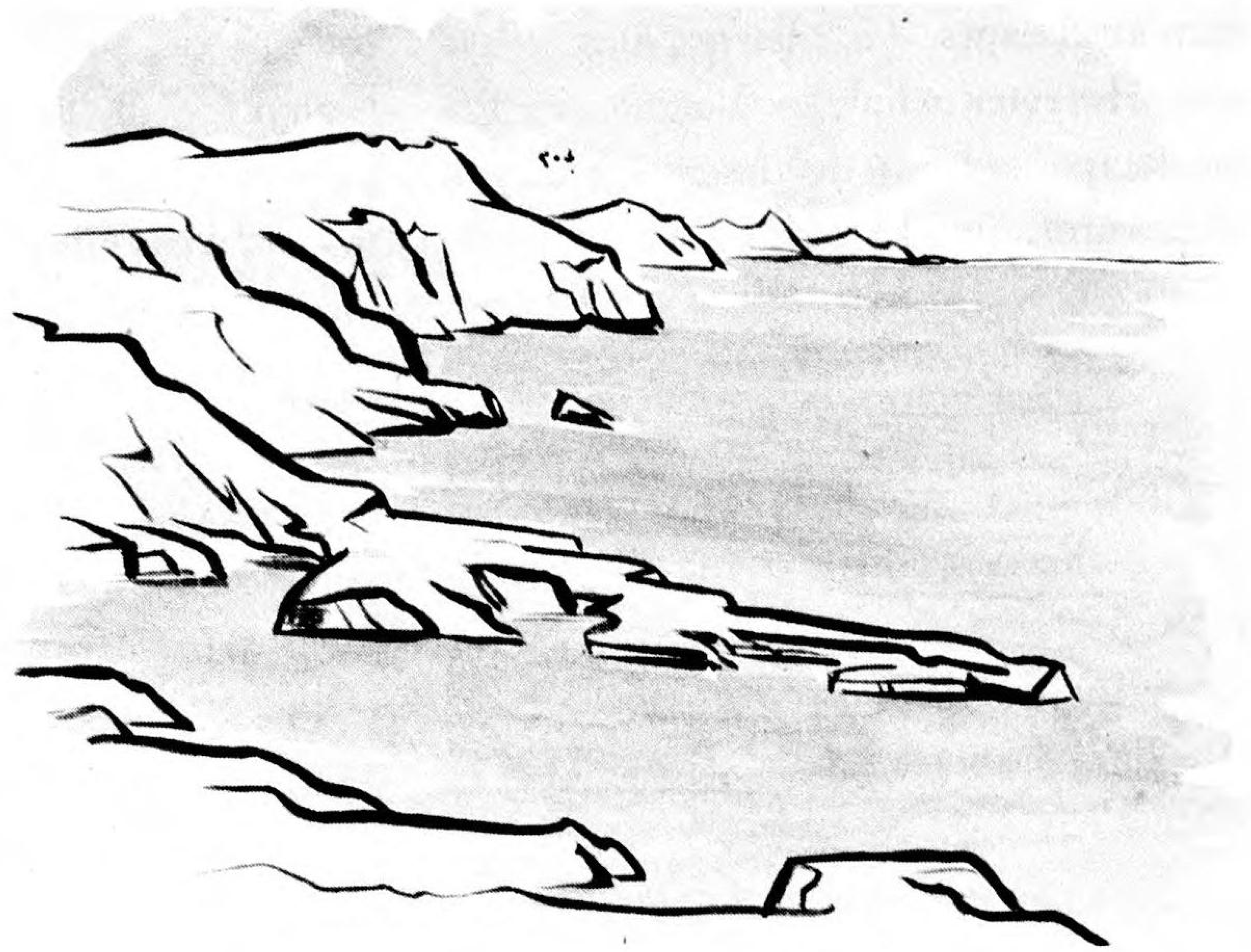
The third point is just as important. Many combat areas are inadequately covered. A chart of an island will go blank a few miles inland, or a short way up the coast from a populated area. With a knowledge of Geomorphology you can judge quite accurately what the unknown sections look like by studying the known sections. Suppose for instance, the skipper plans a surprise attack on a place that because of weather conditions or enemy precautions has very poor coverage—an old chart, a couple of spot elevations, a foggy photograph, a native's description, perhaps, but nothing else. If you know the habits of the earth, you can interpolate between the scraps of information and come out with a probability which stands a good chance of being correct.

Following is a brief outline of the main types of formations in the order of their importance to naval combat information.

SHORELINES

Two main types are prevalent: Uplifted coast and drowned coasts. When a landmass is uplifted the sea recedes and you have a smooth gently curving shore, often with stepped terraces showing previous shorelines. When a landmass is depressed, the sea rushes into the valleys and you have a ragged coast with many harbors. The ends of the landmass may be cliffy because the pounding of waves eats off the ends of the land. Offshore bars and lagoons caused by currents characterize the low uplifted coast; bays, fiords, and cliffs characterize high drowned coasts. Norway, Borneo, and the Inland Sea of Japan have drowned coasts; the islands of which Sumatra and Java are part, Sumatra, Timor, Buru, Ceram, and Formosa have upheaved coasts.





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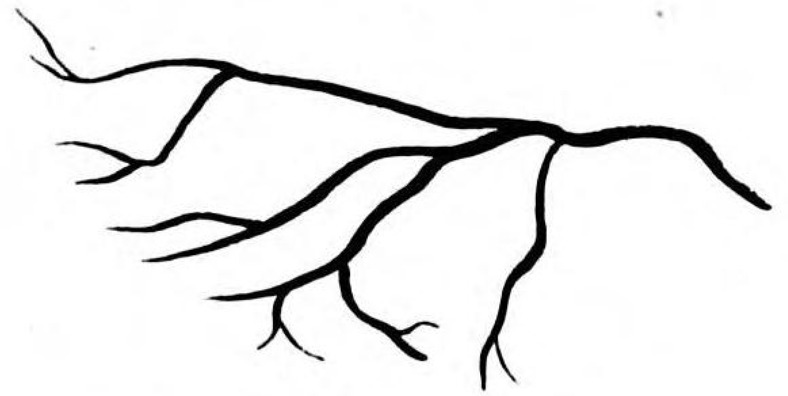
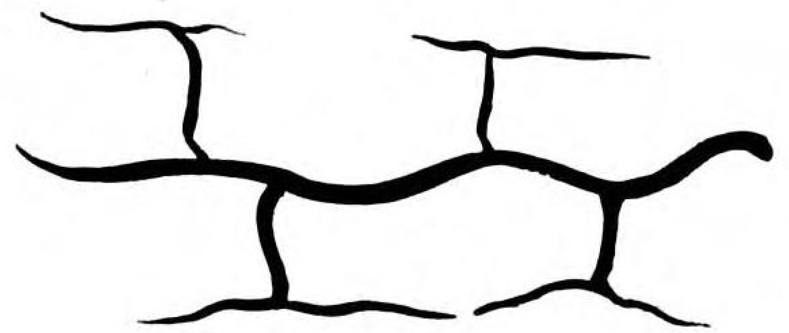
DRAINAGE

Of great importance to the aviator is the pattern of water as it runs off the surface of the earth to the sea. Remember when he is more than 1,000 to 2,000 feet above the earth he no longer sees relief below him, but the gleam of a watercourse or the scar of a dried-up stream reveals the character of the land below. He can follow the narrowing of the watercourses and know he is going further from the coast; their pattern will tell him whether terrain below is hilly or flat. A braided, sinuous watercourse will occur only on flat terrain while the straighter the course and the more numerous its feeders, wet or dry, the more rugged the land below. Wandering or meandering drainage, and the branched or treelike drainage are the two most common types; two other types of pattern are important—trellis drainage where tributaries enter the main stream at right angles, and radial drainage which radiates from a volcano or a dome. Next to the heaving of the earth and the work of currents, drainage produces the greatest changes in coastlines by forming deposits called deltas. Delta drainage is usually braided and meandering unless deposited near high land or canalized by man. Drainage flows toward sea level and forms an almost invariably continuous link between highland and coast. Its directions are often sufficiently definite to enable a flier to generalize his direction over long stretches of terrain. Thus the main drainage pattern of China and Indo China is west toward east, those of Luzon, north toward south.

Wandering Drainage



Branched Drainage



Trellis Drainage

Radial Drainage

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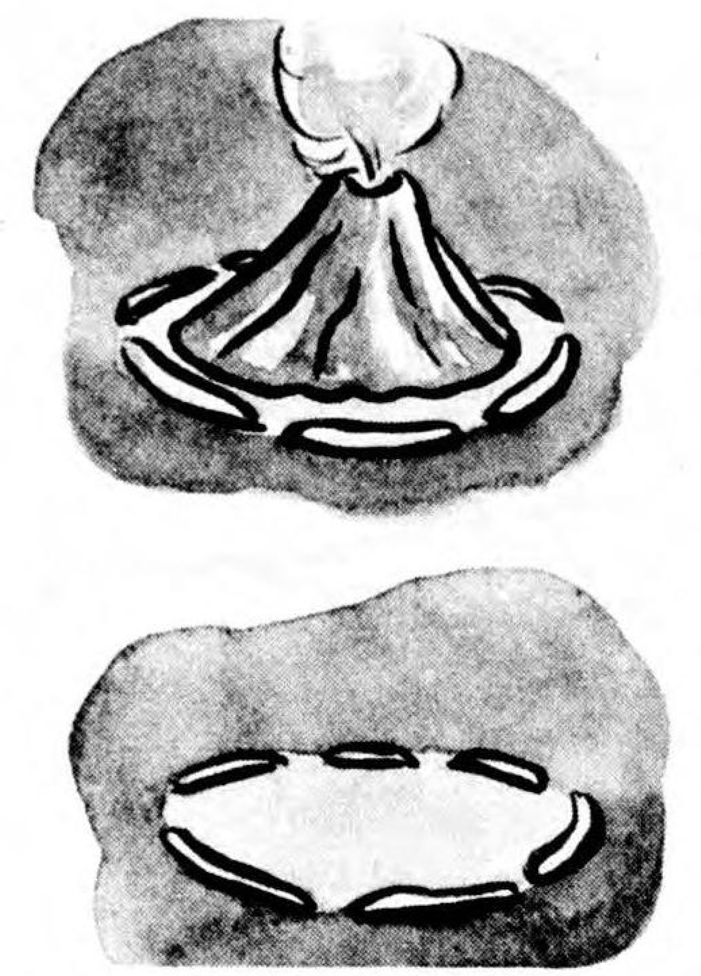


OCEANIC ISLANDS

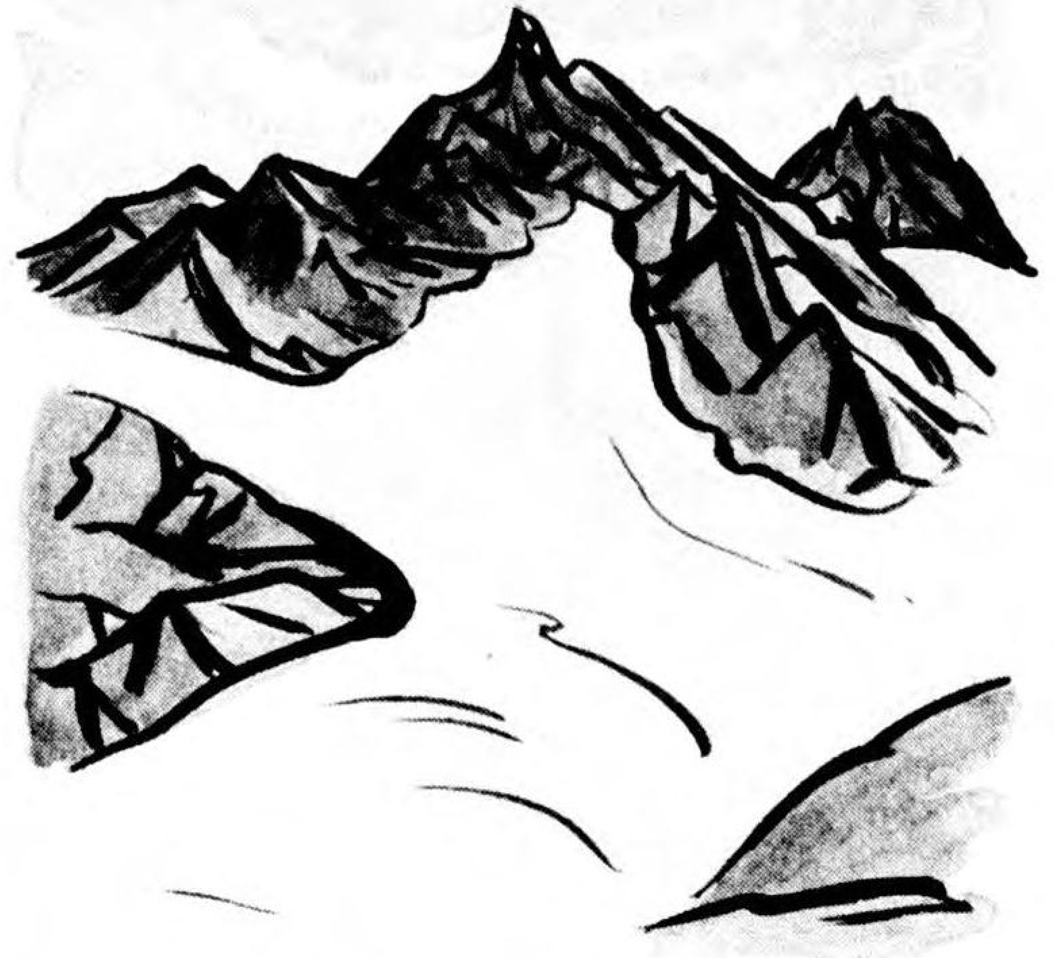
Large island masses are formed in the same ways as continents but many of the smaller Pacific groups are atolls formed by coral-building animals and are unlike the great land masses. Theories conflict, but it is for our purpose accurate enough to describe atoll building as follows: A volcano pushes up like a boil through the smooth Pacific; around its cone the coral building animals proceed to make a ring. A day comes when the volcano explodes blowing off its entire top, the ocean rushes back in and only the ring of coral remains above water. Wake Island and the island of Truk are outstanding examples of the atoll.

VOLCANIC MOUNTAINS

Much of the terrain you will deal with is volcanic in origin. The general character of the landscape may be harsh and abrupt because of the violent action of the gases causing the formations. On the other hand, beautifully symmetrical peaks with gentle curves may be developed as is the case with Mount Fujiyama of Japan. The mountains themselves will be dome shaped or conical and may be surmounted by a crater. Gullies, formed by rainfall drainage, will lead from the summits to the low country. In northern climates the surrounding areas will be barren of trees and the prevailing color will be the dark grays and browns of lava. In tropical areas, however, the lowlands will be covered with dense vegetation. Volcanic formations are common in the Aleutians, Japanese Islands, the Philippines, Java, and in Southern Italy.

BLOCK AND FOLDED MOUNTAINS

Among the most common mountain formations are those caused by cracking of the earth's crust and upheaval of long masses of rock often tilted in blocks hundreds of miles long. Similarly pressures in the earth's crust will heave upwards strata of rock much as a deck of cards will buckle when pressed at both ends. The variety of internal structure is enormous but the external appearances concerning us are the long straight ridges often paralleled in multiple which become characteristic from the air. Such pressures may form domes, but dome mountains are apt to be indistinguishable from rolling mountains unless betrayed by exaggerated radial drainage. Faulting, or cracking of the earth's crust, however, is distinguishable from the air. As much of the land form of Japan is bounded by faults, such as the Fossa Magna, it is worth while to be on the lookout for such formations. Faulting and block or folded mountains are typical of the nonvolcanic part of the topography of Japan, Luzon, Mindinao, Timor, Celebes, the Moluccas, New Guinea, while the whole of Formosa has the character of a tilted block sloping from the high side on the Pacific toward a lower coast in the direction of China.

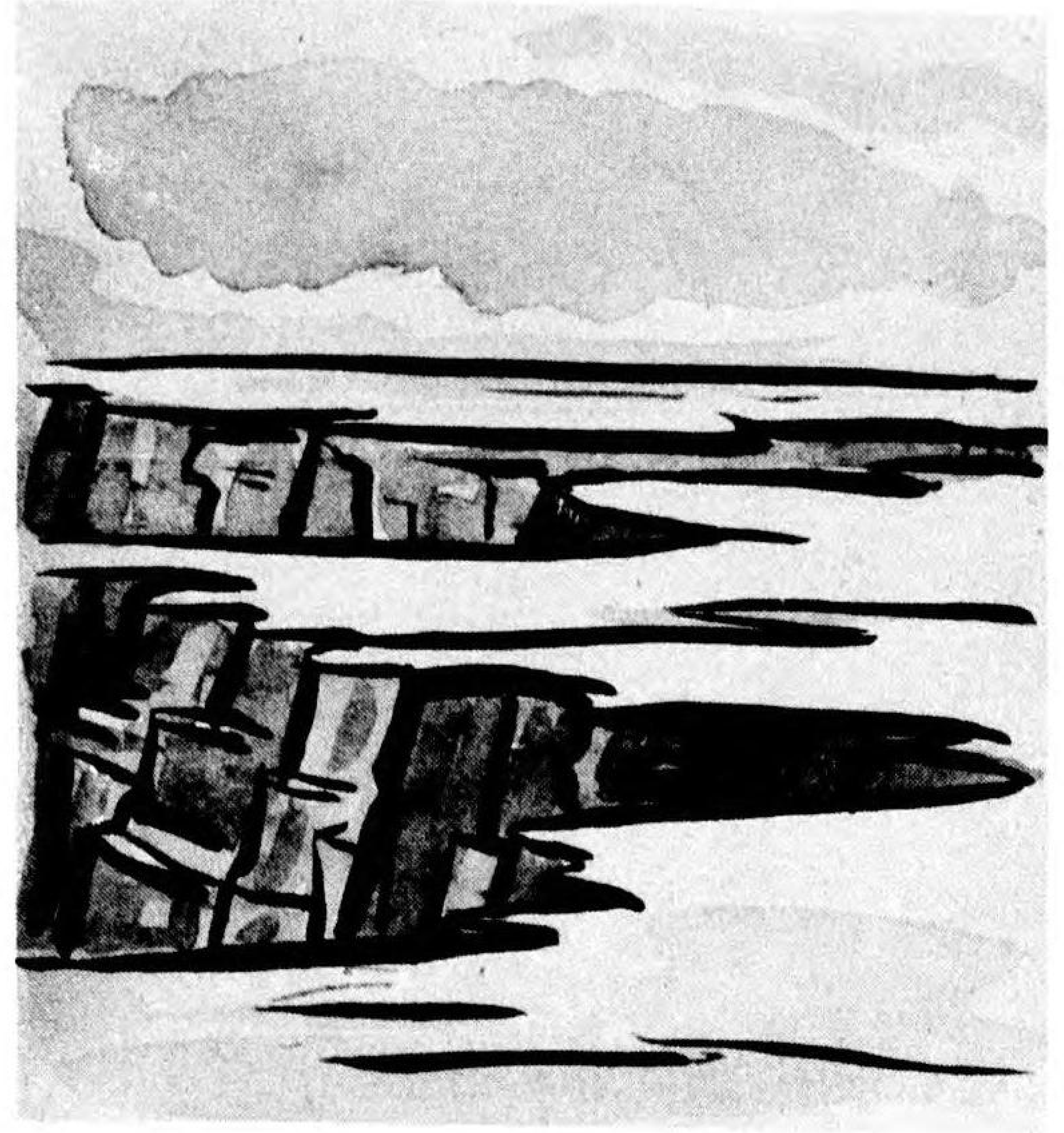


SHARP MOUNTAINS

Here drainage, frost, and glaciers come into action causing deep canyons, gorges, and in high altitudes, "cirques," which are the circular nicks made by glaciers forming like frozen tear drops on the peaks and sliding downward. The sharp horns and ridges are the result of glacial action. Such action is not confined to the north but occurs wherever the altitude preserves snow. These processes may carve sharp detail in mountains of any type. Surprisingly enough tropical New Guinea reaches altitudes of 13,000 feet and is snow-capped. Formosa, Sumatra, Timor, Tibet, Norway, Northern Spain, and Southern Germany, all have mountains of this type.

SMOOTH MOUNTAINS

As an area becomes old the action of watercourses, frost, wind, and vegetation wears it down. Sharp mountains are smoothed into rounded forms with relatively low relief. Streams begin to cut sideways, forming wide valleys and gentle slopes. In humid regions where weather plays a dominant part, this type of land formation is typical, and usually is covered with heavy vegetation because of the rich soil. Any type of mountain will become smooth when long subjected to erosion under proper climatic conditions. Rolling mountains are found throughout the South Pacific flanking or leading up to the higher mountains.



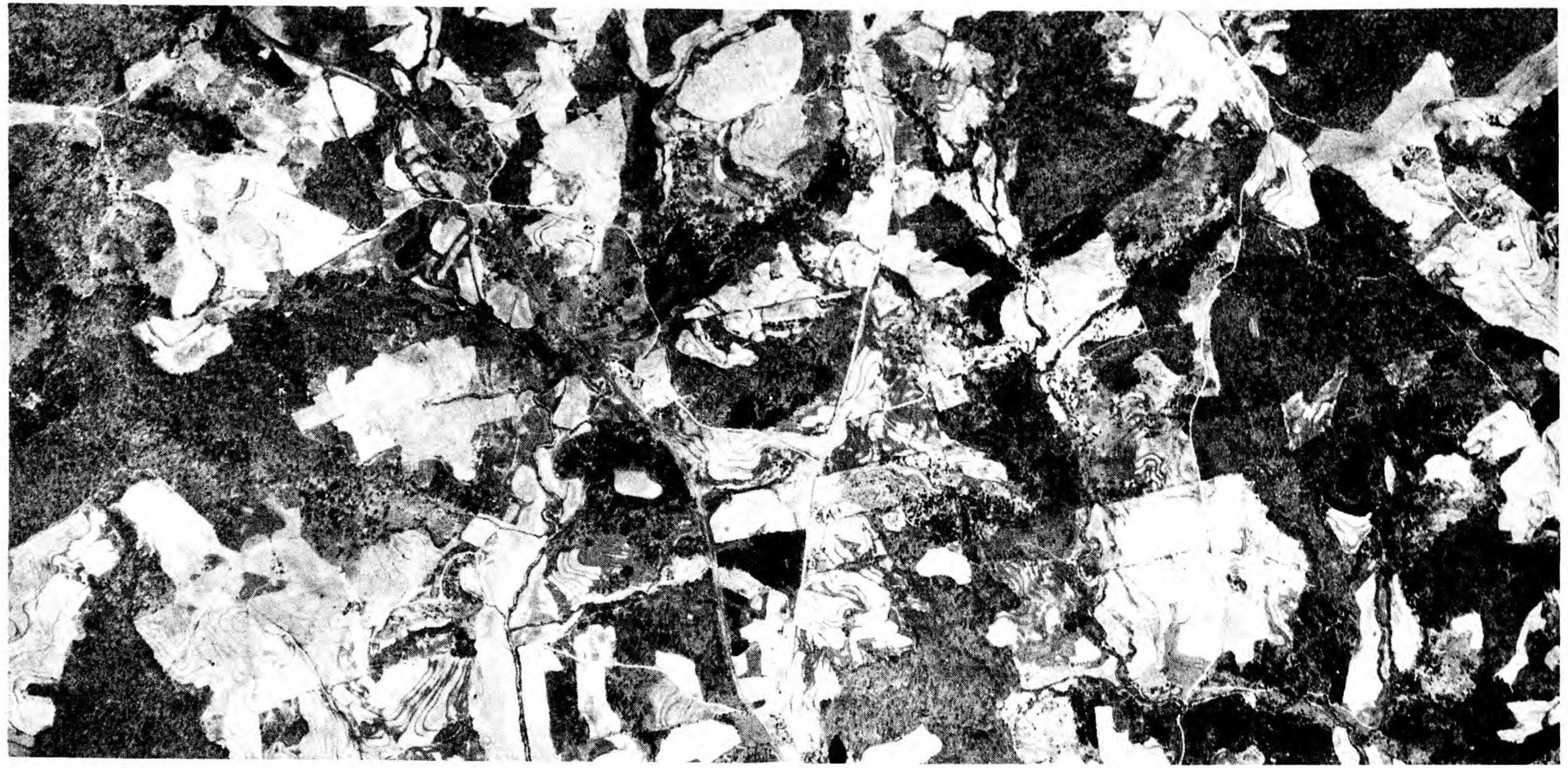
PLATEAUS

Plateaus are flat tablelands cut through by stream channels causing gorges and valleys. They may be distinguished from plains by the great amount of relief between the upper flat area and the bottoms of valleys or adjacent plains. As erosion proceeds, the flat areas will gradually be destroyed, but the summits of the divides, having the same elevations, appear flat from a distance. As the original surface becomes destroyed by the action of the streams and other elements, the land mass assumes the character of rugged or rolling landscape. Plateaus occur prominently in Eastern Burma, West and Central Borneo, Central and Northern Luzon, and Tibet in China.

PLAINS

Plains are the final result of time upon a landscape. The streams have become sluggish and meander slowly with a side-cutting action that eventually eliminates all obstructions. The terrain is thus monotonous, lacking in character and relief, a flat table which may stretch for hundreds of miles, ending in deltas built up by the river sediment.

LAND USE PATTERNS



AERIAL VIEW—FIELD PATTERNS

IN MOST parts of the world man has interfered with the process of break-down of the earth's surface sufficiently to leave extensive marks. Some ten percent of the land area of the world is used for crops, and a smaller percentage for cities, manufacturing, mining, and industry. Clearings are scattered through forest areas, and very few large areas are entirely without the pattern of human occupancy. Temperature, water supply, relief, and soil quality all govern the presence of humanity and the patterns of occupation. The most unmistakable effect of man's activities is usually its simple geometric aspect. The more widespread his activity, the more it is organized into geometric forms of squares and rectangles. Usually primitive cultural patterns are not geometric and take transitional forms. For example, pioneer clearings may follow desirable soil and topography, while settled boundaries are roughed out by a combination of short straight lines approximating natural features and not oriented to the points of the compass or to base lines. This is probably the oldest system of land survey and is called metes and bounds. Pennsylvania from the air shows metes and bounds; while Iowa and later settlements, though also located in rolling country, show Sections oriented to the points of the compass in a great gridiron. Variants of the Section are found where grants were made along natural or artificial boundaries, such as streams or provinçe borders, and the holdings laid off with parallel rectangular boundaries from this base line. This is typical of parts of France, Canadian Quebec, and Spain.

The more modern the land use, the more it is influenced by engineering and mechanics and the more extensive the signs of human operations become. Just as surveying has influenced the boundaries of holdings, so the development of modern transportation and of civil engineering has influenced the pattern of industries, towns, and roads. For example, we are all familiar with old roads which veer and tack around obstacles, and have seen this natural type of road give way to the straight stretches and sweeping curves which slash topography where necessary to make way for speedy transportation. Highly organized society and machinery require a corresponding organization of land use.

AGRICULTURAL PATTERNS

Grain farms are common to temperate zones. The tendency is for them to be rectangular in shape.

Dairy farms are characterized by large buildings set in irregular hay and pasturage areas with a small percentage of the land in grain crops.

Fruit farms exhibit rectangular patterns in long rows of trees often combined with vegetable farming and, in temperate moist climates, with dairying.

Vegetable farms are usually geometric areas, small because of the intensive labor required for cultivation.

Stock ranches are usually found in semiarid grassland regions. Except for a few roads and fences, a small cluster of buildings, stacks of hay or feed, and water holes, there are few visible features.

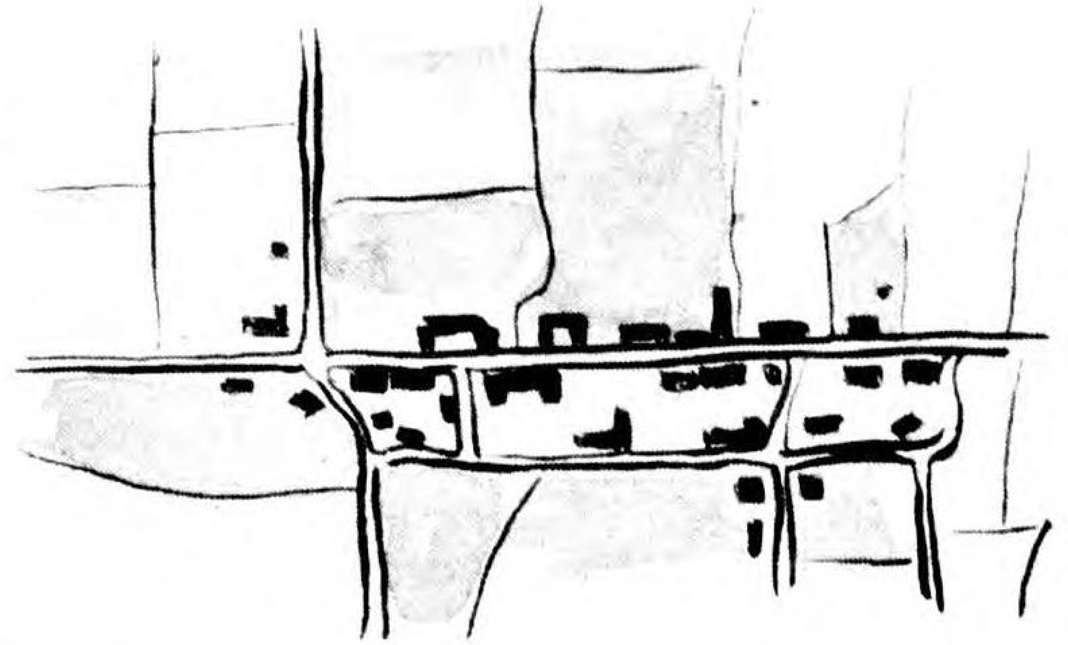
Subsistence farms are developed typically on small areas of arable soil within forested regions. They combine grain and livestock, or fruit and grain characteristics. In Italy the fields of many such farms are bordered with fruit trees.

Plantations generally are found in warm climates where many large farms are devoted to one or two special crops like sugar cane, rubber, bananas, etc. The fields ordinarily are laid out in relatively large blocks. As they may be worked by several hundred or thousand people, their centers often take on the character of towns with subcenters connected by roads.

Settlements.—Since the oldest settlements are agricultural and because of this priority underlie later industrial settlements and cities, an idea of the groupings of agricultural settlements is useful.

Agricultural villages are common in Europe and the Orient and can be seen to some extent in the older portions of the United States. Here the workers live in villages where the houses may parallel the main road or the banks of a stream or canal, and the workers go out to their fields on narrow country roads. At a road or canal intersection the groupings are apt to be quite compact.

Scattered farms in much of the world's newly developed area are found throughout the landscape in the form of isolated

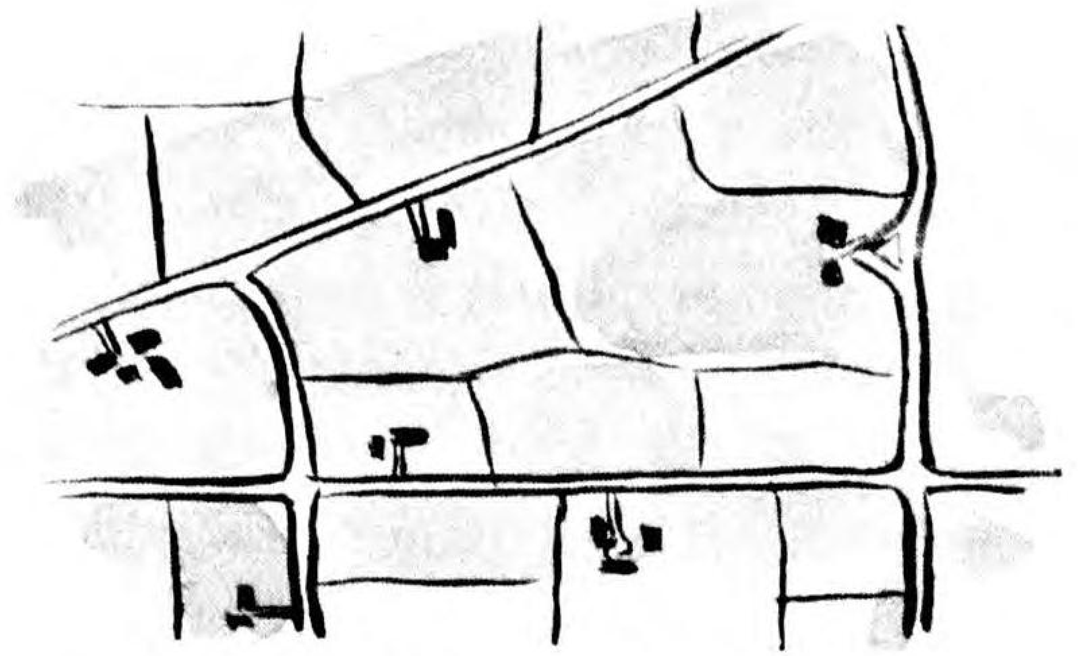


FARM LAND VILLAGE SETTLEMENT

separate sets of buildings and areas of activity. Country villages thus become trading centers. The scattered farm pattern is gaining in much of western Europe over the village pattern, and new scattered farms are appearing throughout England, northern France, Italy, northern Germany, and Greece.

INDUSTRIAL PATTERNS

Next to agriculture and lumbering, the most important influences on the appearance of the earth are industry and communications (roads, canals, railroads,



FARM LAND SCATTERED HOMES

telephone lines). Fishing villages, shipping ports, mining areas, steel mills and fabrication centers, wherever located, have certain universal characteristics. One of the most conspicuous marks is "blight." Certain locations along the Inland Sea of Japan are given over to cement manufacture which throws a white dust over miles of coast line forming outstanding landmarks from the sea or air. The coal mining areas of Pennsylvania and southern Illinois show extensive reaches unproductive of vegetation either because mining wastes cannot support life or because the gasses of industrial processes choke out vegetation or chemically foul the streams and kill plant life. Quarrying and surface mining and civil engineering produce large scale scars on the landscape. These are conspicuous landmarks which usually indicate the presence of nearby towns or cities.

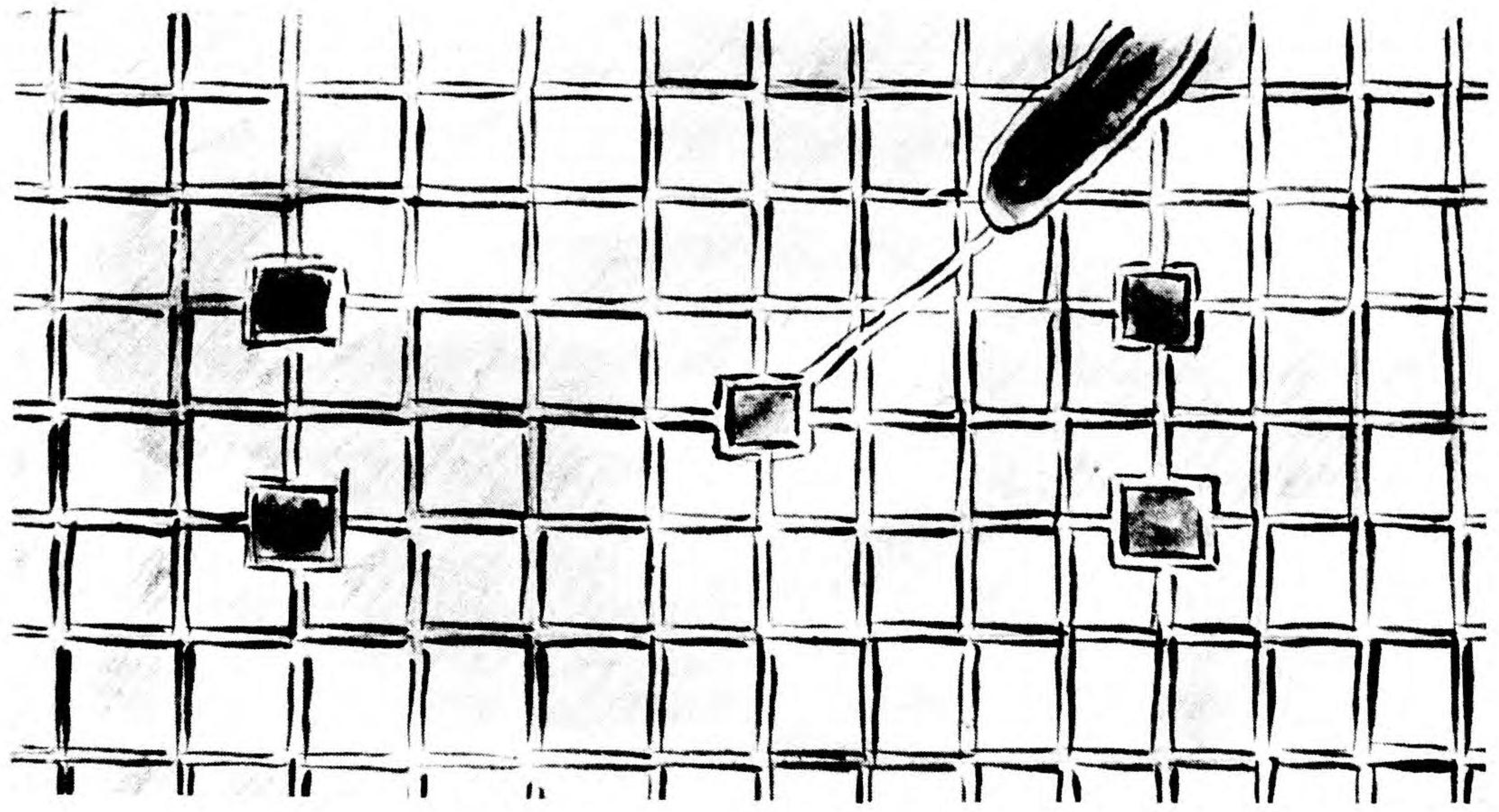
Industrial Locations are normally along streams, adjacent to the waterfront, in low valley land, or in areas where the terrain is fairly level, and where railroads and main highway transportation are available. As viewed from the air, individual industrial structures are usually large in scale and surrounded by considerable open space, creating an entirely different pattern from adjacent residential sections. Where the existence of the city is due to shipping, dock yards and ship-turning basins are usually in the fairly compact area, frequently quite close to commercial and civic centers, and not spread out in a scattered pattern as other heavy industry is apt to be.

Civic Centers and Commercial Districts are easily recognized in the center of urban areas between heavy industry and residential areas by tall buildings, large cathedrals, museums, and similar massive structures. In modern communities such as Yokohama, Paris, and London, these districts are fairly compact, covering but a small percentage of the city area.

Residential Locations of various types of dwellings fall into a fairly uniform pattern; workers' homes adjoin heavy industry, are easily recognized from the air by short compact blocks, and small roof units uniform in size and pattern. In better class residential areas, parks and open spaces are frequent, while the street pattern is more open, following land contours much more clearly than in an area more intensively used.

CITY AND TOWN PATTERNS

Cities and towns have distinct basic patterns. The street plan is the key to recognition of communities all over the world. A knowledge of these basic patterns will provide air personnel with a framework for recognition, observation, and directional guidance to a specific objective. It will tell them whether they can follow a certain street to find their objective or whether it will be necessary to use some other landmark. Equally as important, it will tell them what landmarks to look for and use.



NO. 1

For the model maker, city and town patterns will be derived primarily from aerial photographs. It is important that the basic patterns—main streets and boulevards, big block layouts, and the interrelationship of industrial, commercial, and residential districts—be understood in order to reproduce them clearly and quickly.

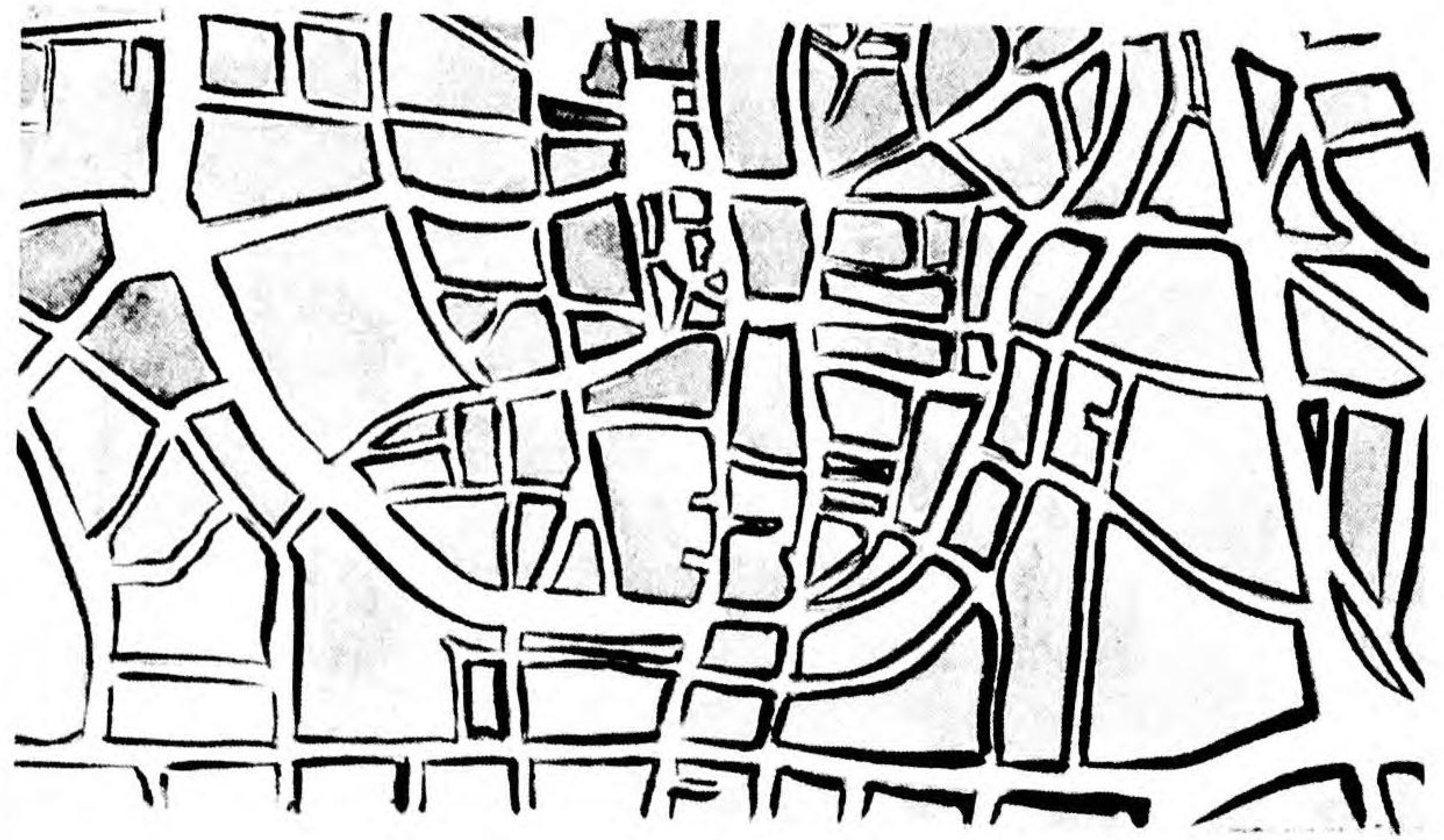
The study of a large number of city plans in America, Europe, and Asia has resulted in classifying them in the following general groups:

1. *Gridiron or Rectangular.*—This is one of the most common and easily recognized layouts. It has been a favorite of civil and military engineers for centuries due to the ease in plotting. Topographical differences are not recognized. Philadelphia, New Orleans, New York, Yokohama, and Hamilton, Bermuda, are typical examples.

2. *Irregular or Haphazard.*—Irregular or haphazard street patterns are typical of older European and Asiatic cities. They resulted from the early meanderings of pedestrian and horse-drawn traffic following the shortest and most convenient ways. The growth of this type of plan from traffic can be observed in any snow covered lot or square crossed by a number of people on foot. Town areas of this type contrast sharply to the regular street patterns frequently found in newer sections adjacent. London, Boston, and Shanghai are cities having this irregular street pattern.

3. *Diagonal or Web.*—The diagonal or web pattern of main streets came into use in fairly modern times. Its definitely planned geometry allows for no topographical differences but was conceived for military purposes. Avenues radiating from a center can be commanded for their length by artillery. Berlin, Paris, Tokyo, and Vienna have clearly defined street patterns of this type.

4. *Fan or Radial.*—Fan or radial patterns are found in seaports and river ports where the commercial activities are concentrated on a comparatively small dock area. The main highways radiate



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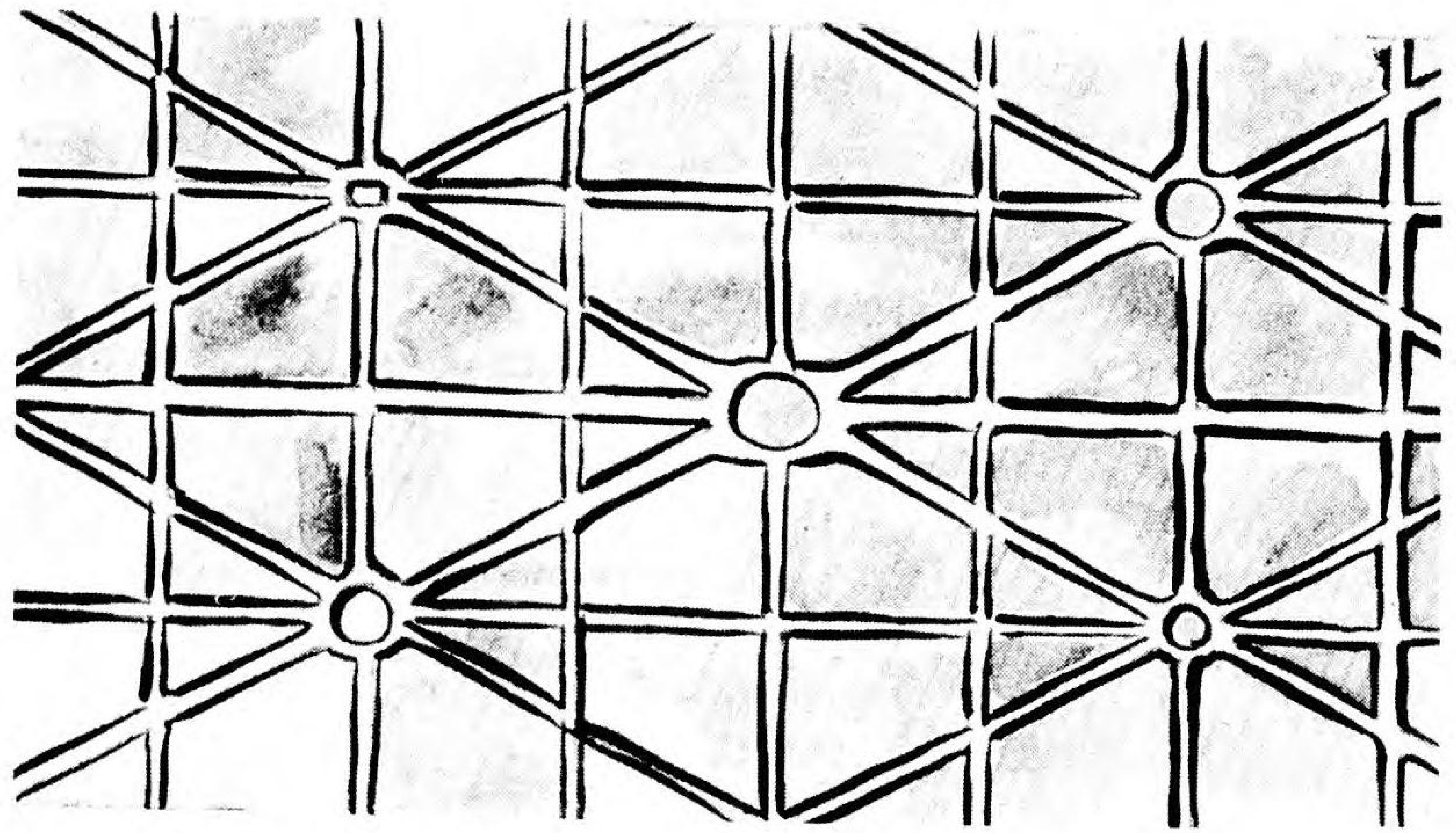

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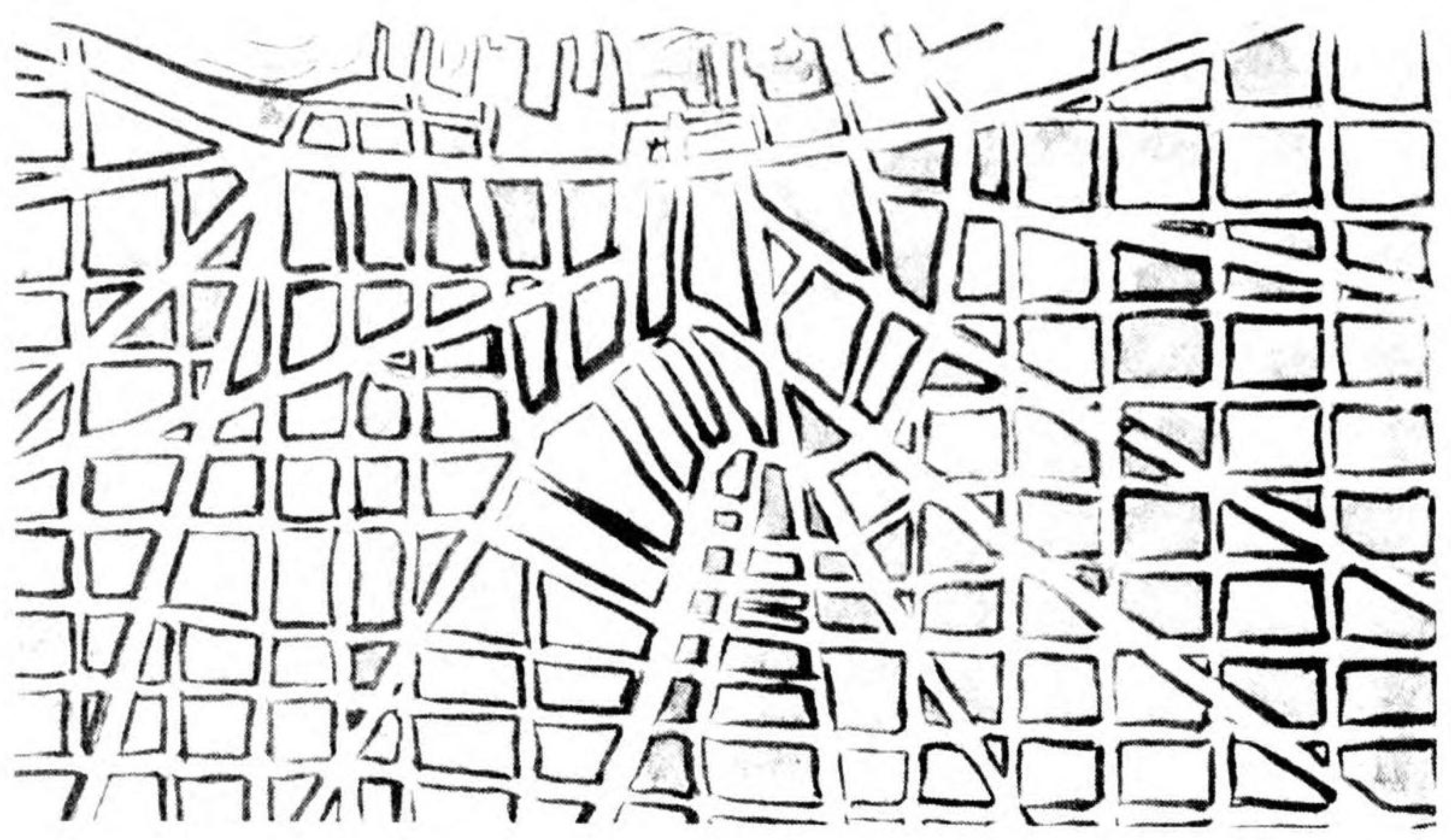

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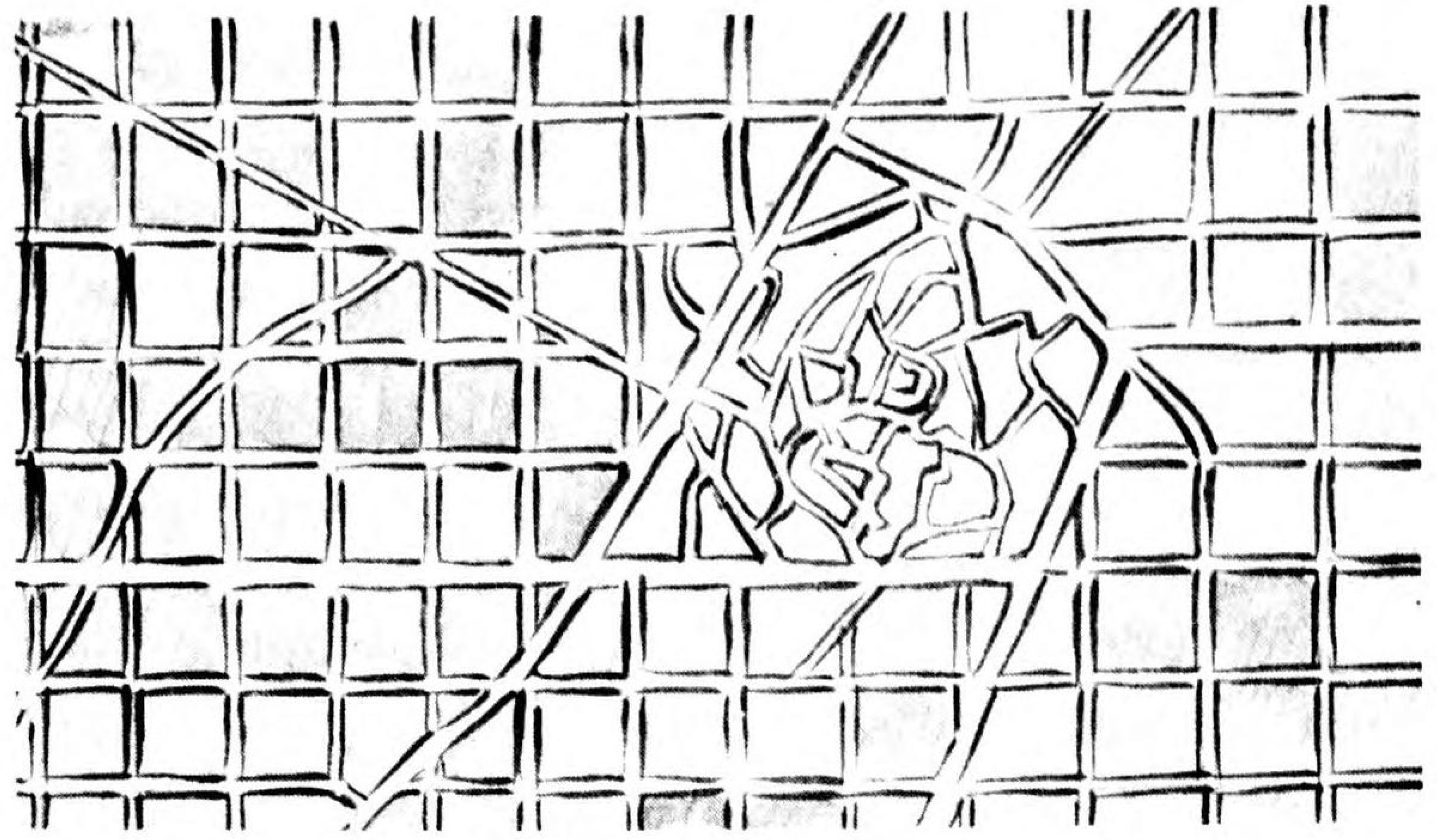


NO. 5

from these centers like the ribs of a fan. Buffalo, San Francisco, Chicago, Osaka, Karlsruhe, Nice, and Bordeaux are easily recognized examples.

5. *Walled Town Type.*—The walled town type of city pattern occurs in old medieval cities where a wall or moat provided protection against attack. Tight space limitations and pressure of growth caused tremendous congestion with many short crooked streets and narrow blocks. This extremely irregular pattern has but little relation to the street pattern outside the restricted areas. A sharp demarcation from the air is presented between the old walled-in area and the more modern sections of the city. Numerous examples of this type of pattern are found in Germany, Italy, China, and Japan. The cities of Nuremberg, Soochow, Peking, and Canton are most typical.

CAMOUFLAGE

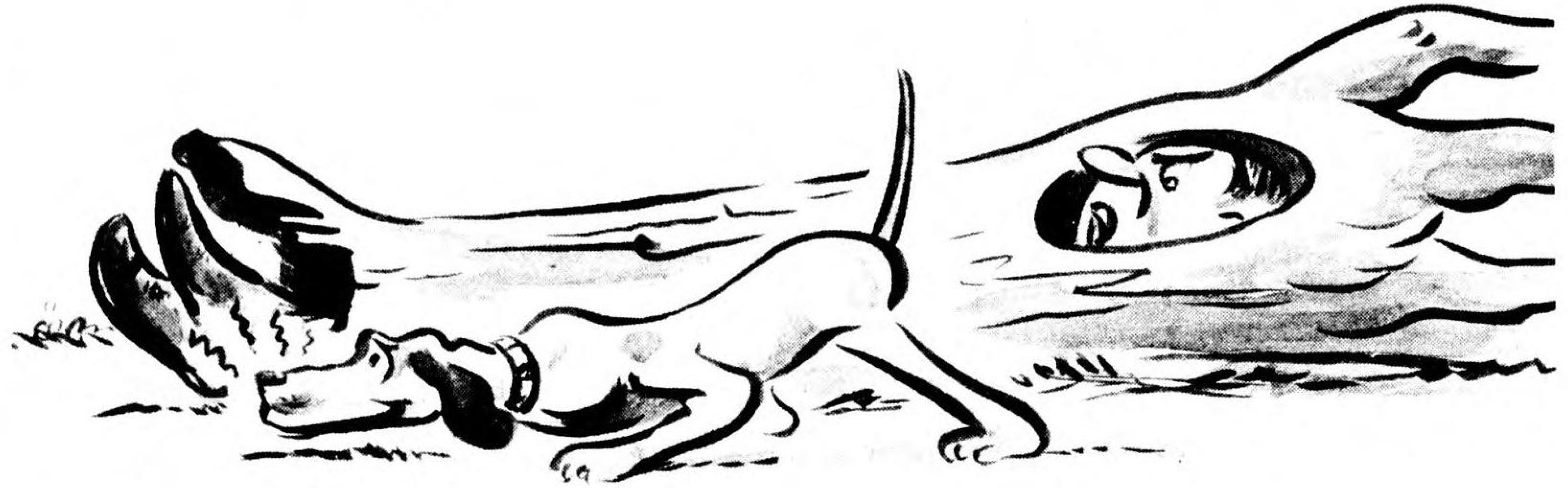
An understanding of the principles and objectives of camouflage will help air personnel see through the deceptions of the camouflage expert.

In urban areas he will attempt to extend the evident formal building patterns adjacent to airports and open areas such as lakes, streams, and parks; while in rural areas the obvious formal pattern of man will be induced to blend into nature.

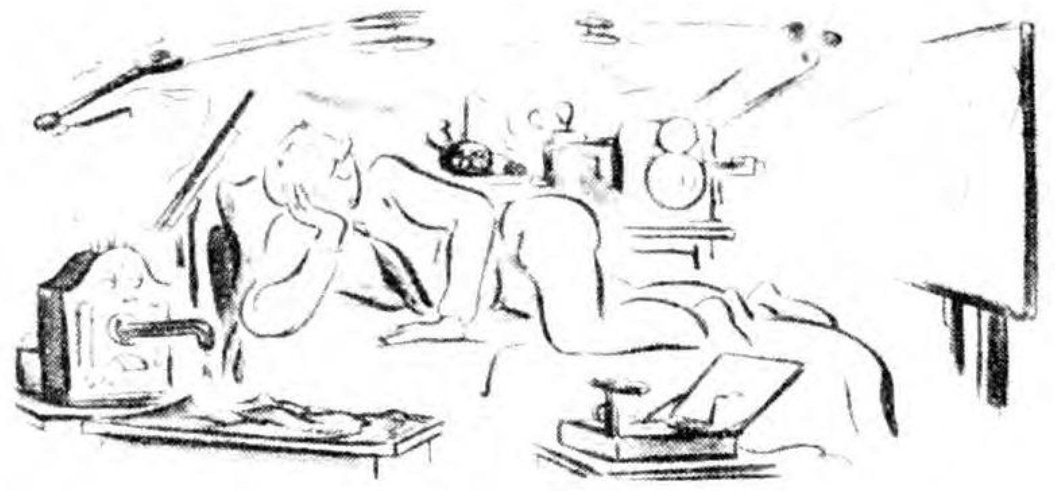
Often an understanding and knowledge of basic city and town patterns by air personnel as well as model makers will aid in the detection of these camouflaged areas.

It is suggested that the modeler acquaint himself as much as possible with other aspects of this subject. Some helpful information may be obtained from the following manuals and bulletins:

1. *Camouflage,* Military Intelligence Service, Information Bulletin no. 13, War Department, Washington, D. C.
2. *Camouflage,* War Department Technical Manual no. 5–267, Supplements 1 and 2, War Department, Washington, D. C.
3. *Recent Overseas Camouflage,* Camouflage Memorandum no. 101, Camouflage Section, the Engineer Board, Fort Belvoir, Va., (mimeographed).
4. *Studies of Housing for a Dispersed Airdrome,* Camouflage Memorandum no. 111, Camouflage Section, the Engineer Board, Fort Belvoir, Va. (mimeographed).
5. *Industrial Camouflage Manual,* Pratt Institute, Brooklyn, N. Y., Reinhold Publishing Corporation, New York, N. Y.



SPECIAL INSTRUMENTS AND DEVICES

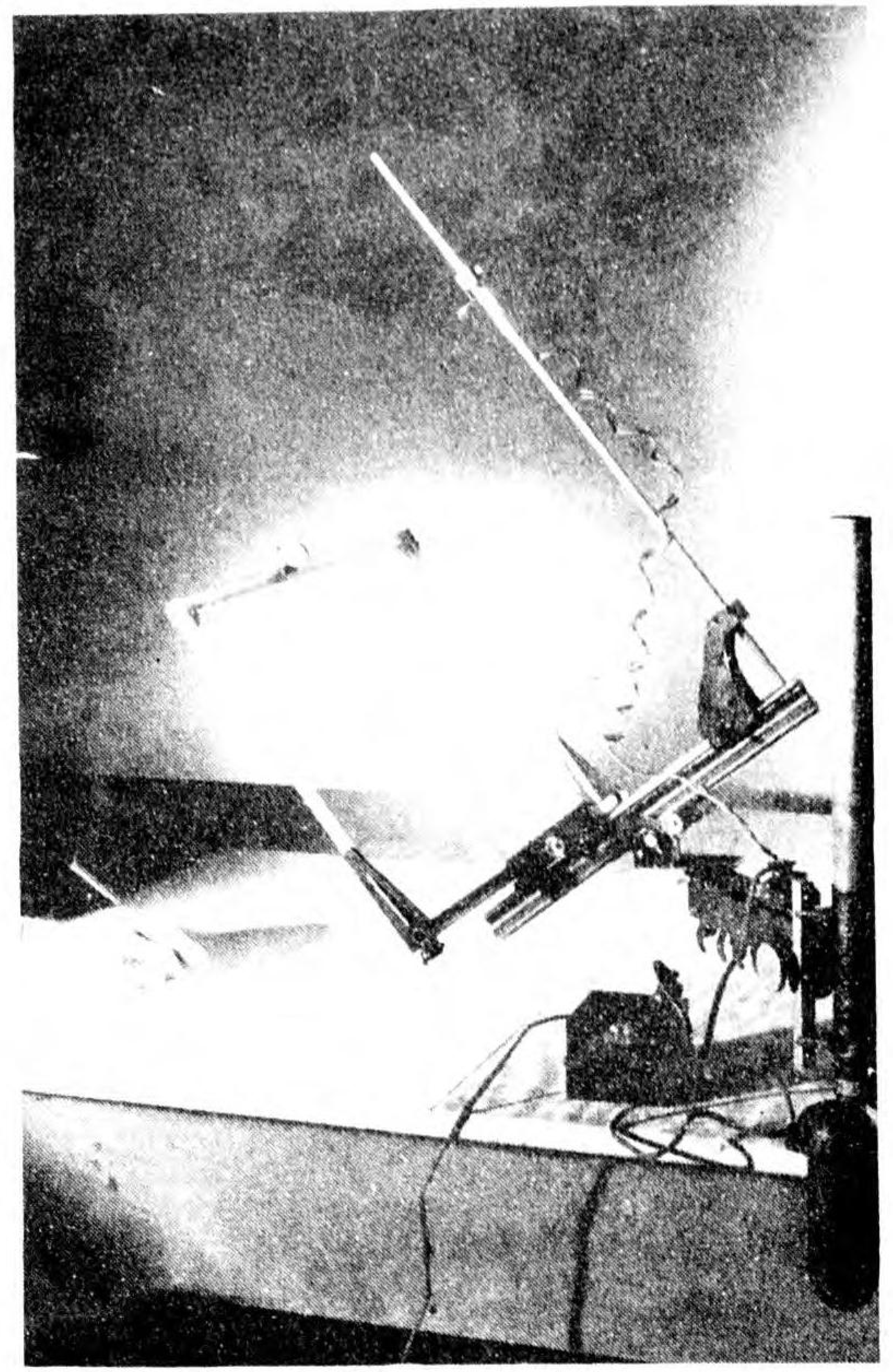


Many devices have been developed to aid the model maker in his work. They apply to almost every stage in the process, but are kept separate because of the uncertainty of their being found in the field, or the unusual circumstances attendant upon their use. At many stations, however, one or more of these inventions are in use, and as time goes on more will be circulated. The scope of this manual does not permit a complete examination of all of them. We will therefore concentrate on the one you are most apt to use, and merely describe the others with the hope that the student will become familiar with them at some future time.

THE PHOTO MAPPER

This device performs all the simpler steps in processing maps and aerial photographs for use in terrain model making. In addition, the Photo Mapper may be used to produce perspective sketches from contour maps, which is the operation shown in the photograph at the right. In this operation, the Photo Mapper is used in the same way that the Flashlight Perspective Projector (described on page 64) is used.

A map, once its image is traced on a sheet of acetate, may be enlarged with the Photo Mapper. This calls for simple projection of the map image, with a flashlight bulb as the light source. The Photo Mapper may also be used to enlarge or reduce maps, using the prism with which the device is equipped.



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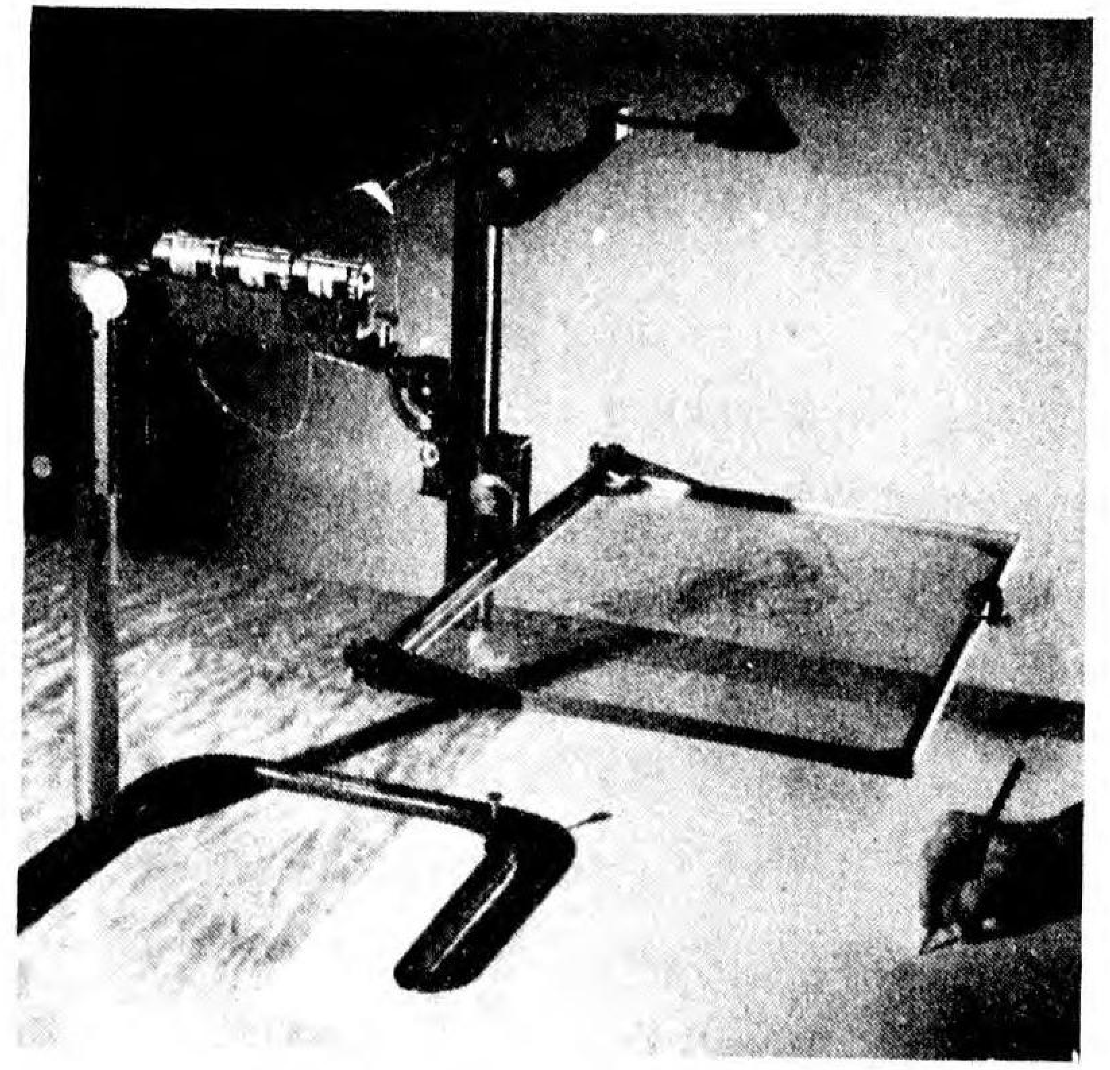
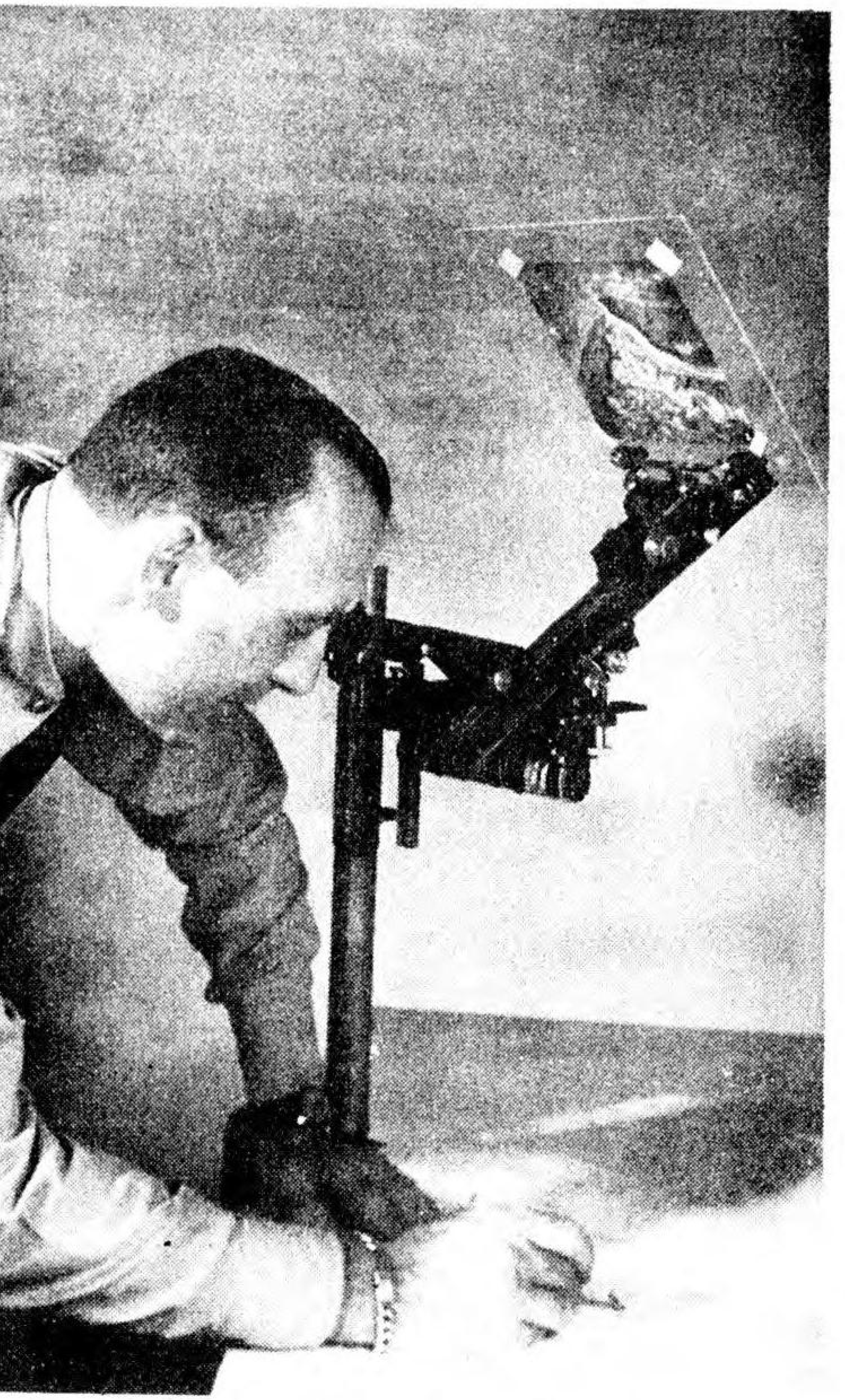


ENLARGING A MAP

The Photo Mapper may also be used with the prism as a sketchmaster, to transfer information from oblique or aerial photographs to maps; to make maps from oblique photos with the Canadian Grid; and to do similar tasks.

Two Photo Mappers may be used with pairs of oblique photographs to produce maps, with elevations, by the so-called Oblique Photo Projector method described on page 67.

The Photo Mapper is packed in a rugged wood kit, and weighs approximately 40 pounds. Each device is accompanied by an instruction manual.



USING THE PHOTO MAPPER
AS A SKETCHMASTER

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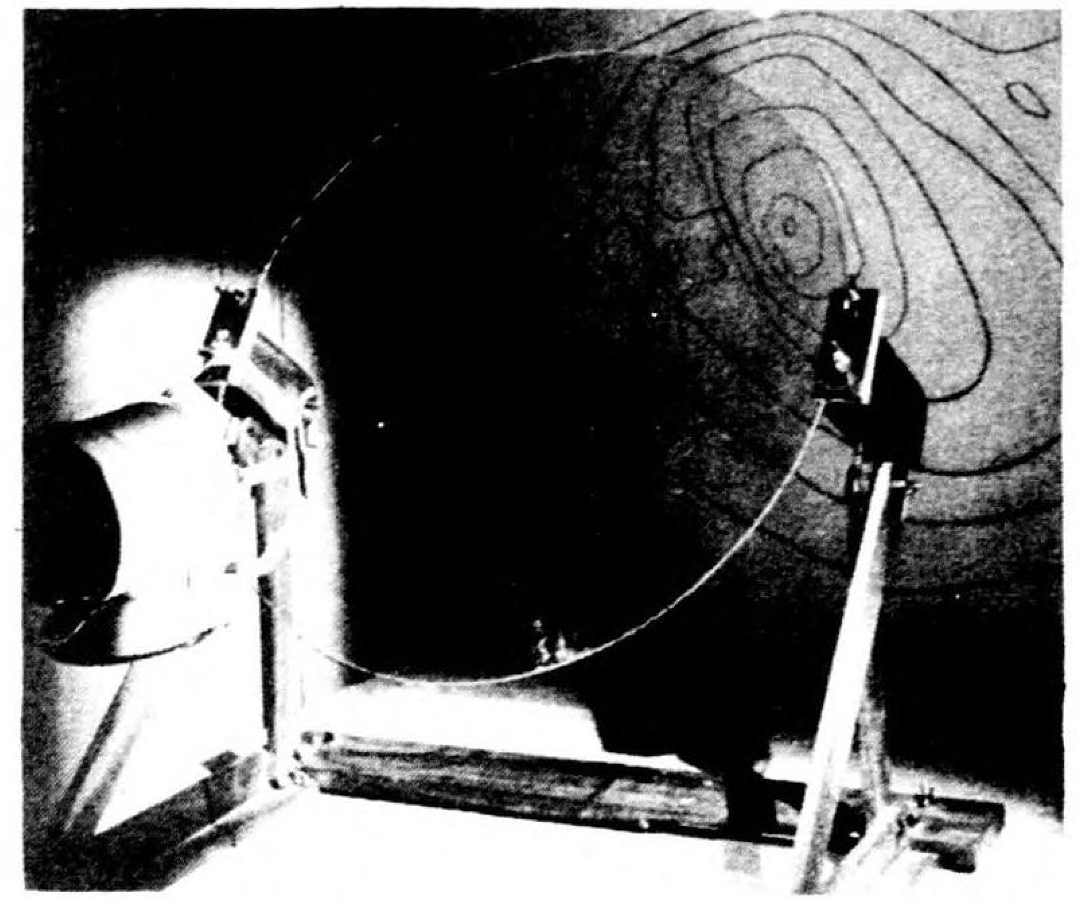
FLASHLIGHT PERSPECTIVE PROJECTOR

The flashlight projector, already mentioned as a method of enlargement, may be turned to another use if the plexiglass

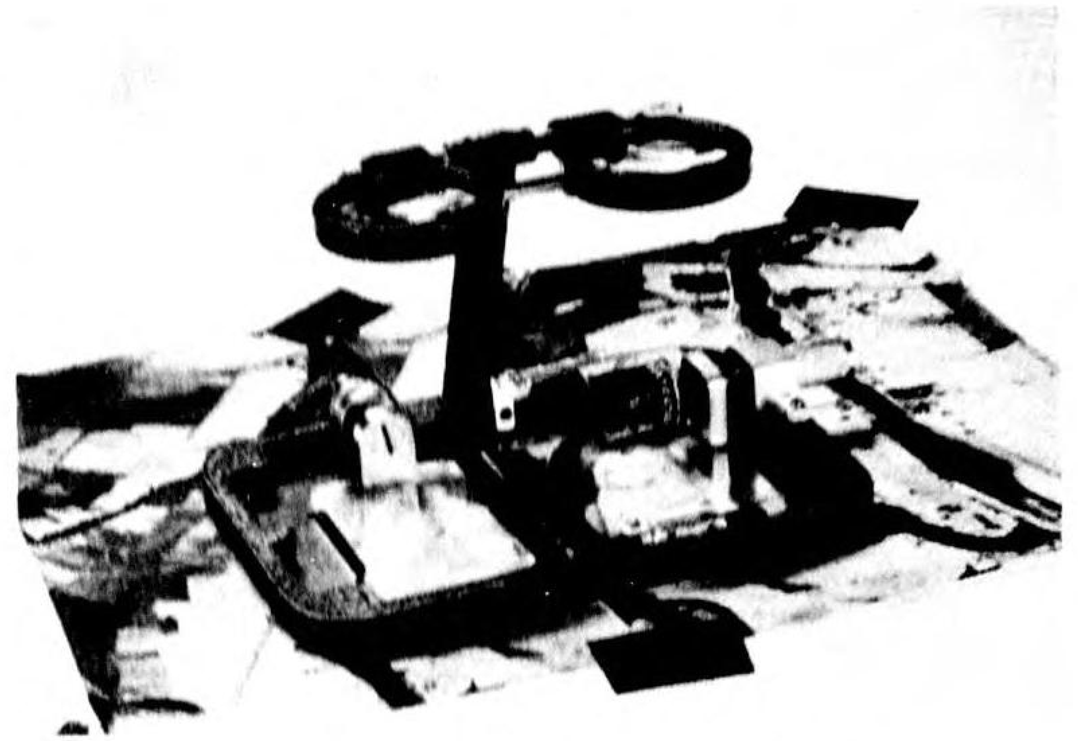


PERSPECTIVE PROJECTOR

is mounted so that it may be tilted at any angle. When the outline of the lowest contour has been drawn, the plexiglass is moved out a distance equal to the desired interval for drawing the next contour level. The process is continued until an accurate oblique of the area is obtained. A calibrated guide is provided to determine the proper interval, and the angle may be adjusted to fit any desired view.

HEIGHT FINDERS

Quite a few instruments have been developed for finding the elevation of terrain from vertical photographs. The Parallax Bar, Abrahm's Height Finder, Austin Height Finder, and Stereo Comparagraph are the best known of these. All operate on the same principle, measuring differences of parallax from stereo pairs, but with varying degrees of accuracy. The Stereo Comparagraph is the most accurate, and has an attachment for automatically drawing contours as heights are found, but the small compact Austin included in the kit yields results



AUSTIN HEIGHT FINDER

with an error of only 1/250 of the height of the plane taking the pictures. It is not necessary to describe its operation, as an individual manual is provided with each kit.

THE BALOPTICON

One of the best devices for enlarging photographs or small maps is the balopticon. If you are not lucky enough to find one at your station, you can make one with some boxes, a lens, and a couple of 100-watt bulbs. If you have no better

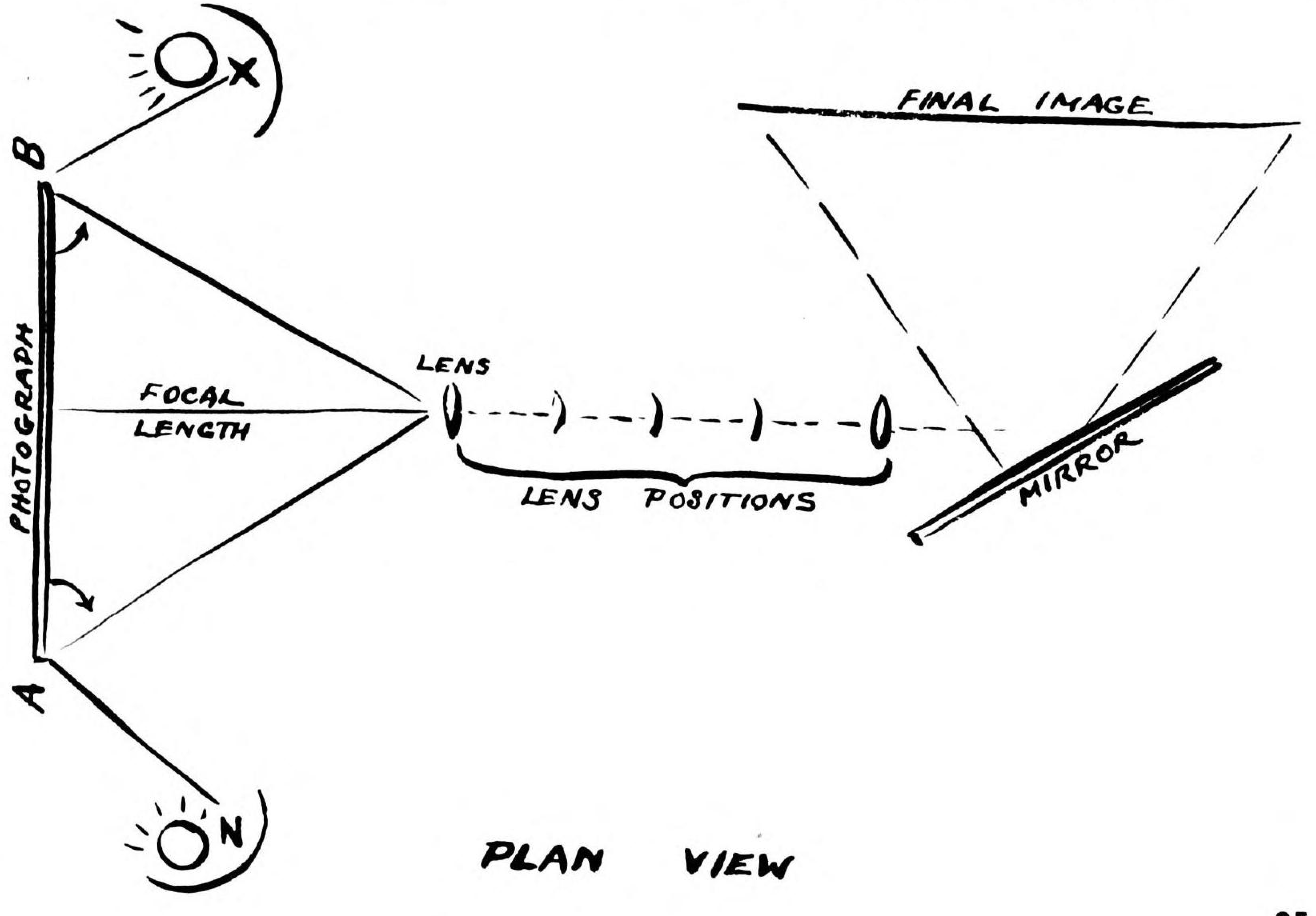
lens, the reading glass in your kit will do nicely if taped so that only the center is actually used.

Directions.—Measure the focal length of the lens by passing sunlight through it and moving it close enough to a wall for the light rays to come to a point. The distance between the lens at this position and the wall will be the focal length.

Next mount the lens, and place it at a distance from the photograph equal to the focal length. In this position the lens will give the maximum enlargement, and as it is moved away from the photo will enlarge less and less until at twice the focal length the image will coincide with the original.

To find the position of the lights, draw lines from the center of the lens to the edges of the photo, points A and B, and measure the angle these lines make with line AB. Construct lines AZ and BX at the same angle. If the lights are placed behind these lines they will illuminate the photo without causing a glare. Lights should be backed with reflectors cut from discarded tin cans.

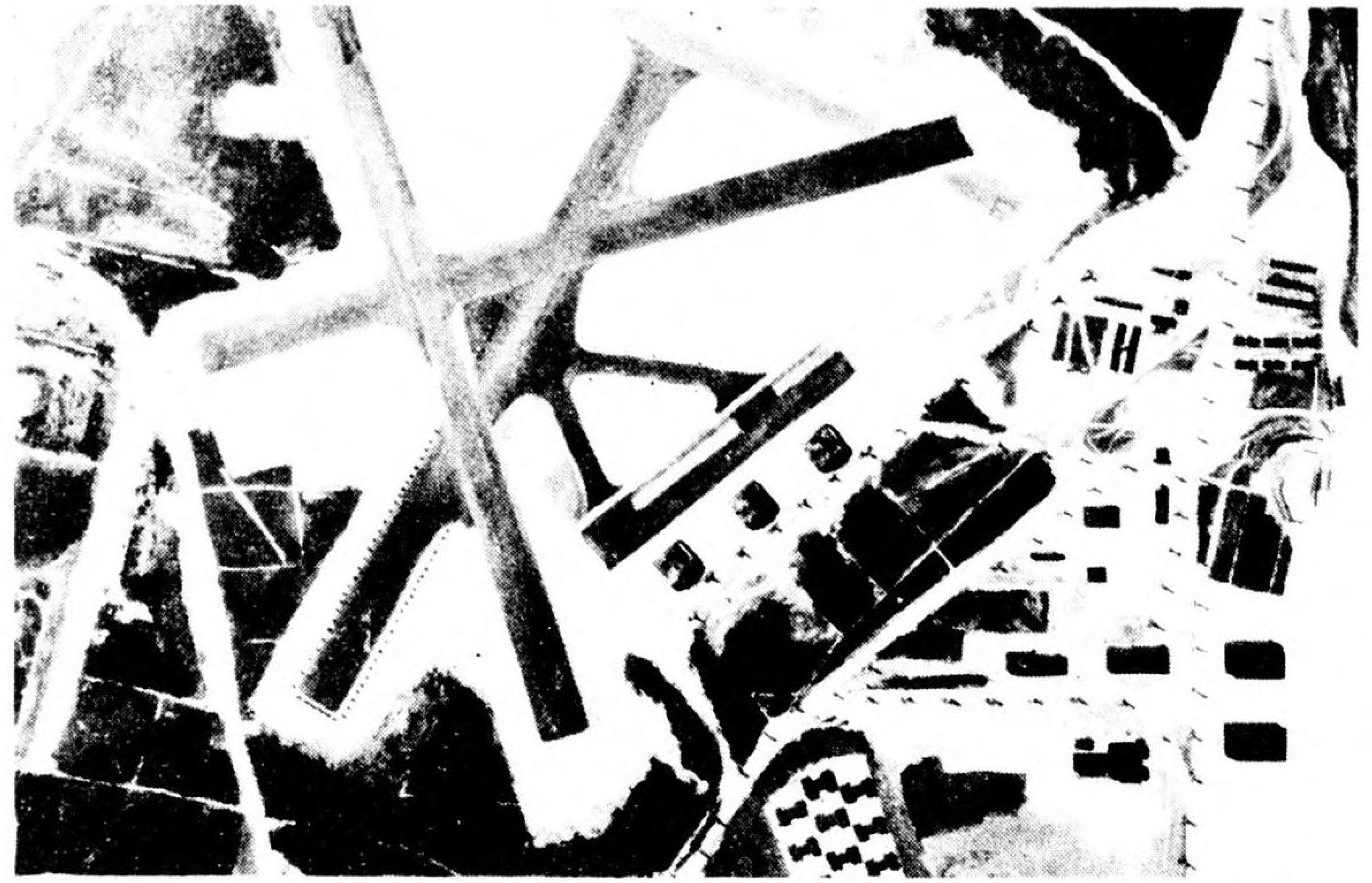
If the whole contrivance is now enclosed, the image will be projected, but in reverse. A mirror placed at a 45-degree angle to the rays will correct this and cast the proper image on the wall at right angles to the balopticon.



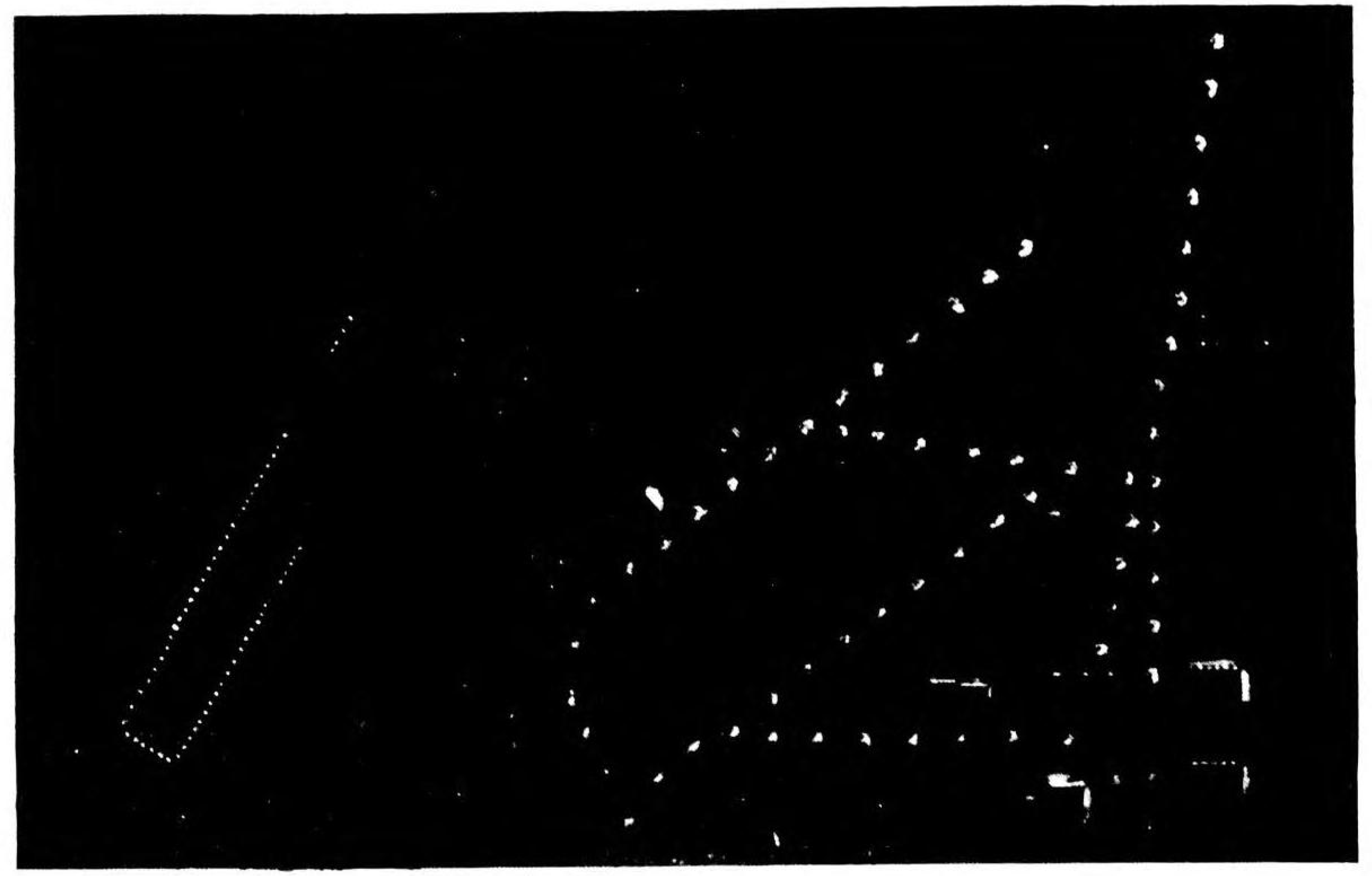
NIGHT LIGHTING

For pilots who are unfamiliar with night flying, it may be desirable to have a model showing the aspect of a particular field at night. This can be done easily with the aid of fluorescent paint and an ultraviolet lamp.

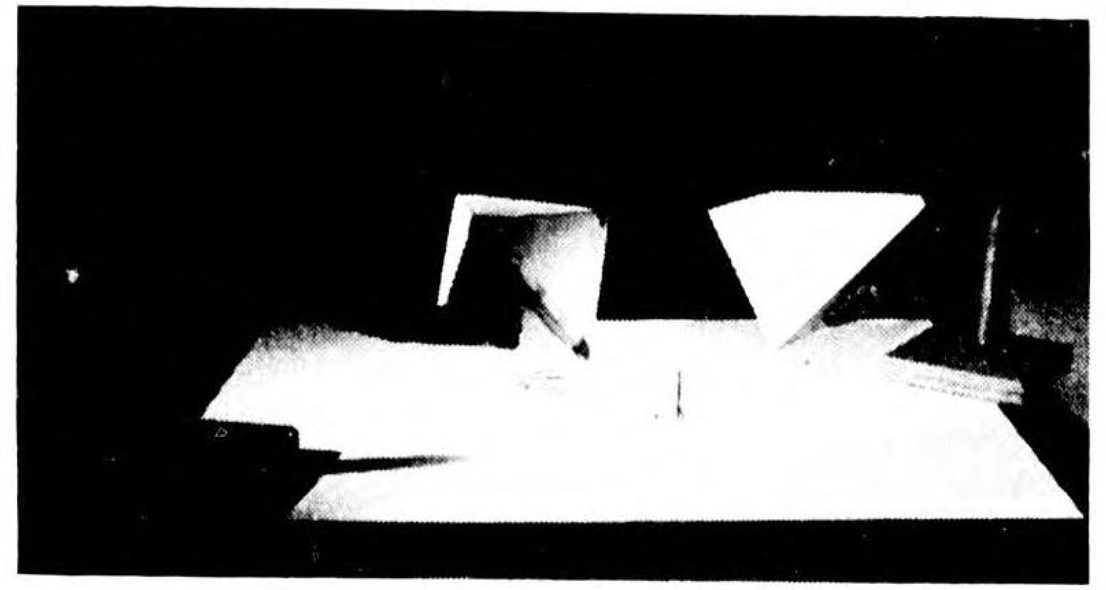
When the model has been prepared at a scale of 1/2400 or larger, ½-inch 20-gauge brads are driven into it to indicate the street lights, runway lights, and miscellaneous lights around the field. Casein white or lacquer white is then used on all surfaces to be lighted as an undercoating for the luminous paint, except where a dim light is required, in which case a gray background is used. After this preliminary coat has thoroughly dried, the final paint is applied, and the model is ready for display. Studied in ordinary light, it will resemble the field seen in daylight, and will familiarize the pilots with the general layout of buildings, hangars, roads, etc. The room may then be darkened and the UV light turned on to show the same scene under night conditions. An ordinary RP 12 cockpit lamp with a 12 V battery will be sufficient for small models, but in most cases the modeler will use a small UV flood that operates on 110 V AC.



BEFORE



AFTER



A careful examination of the field both by day and night is advised in order to get the exact pattern of lights in placement, relationship, and intensity. Effects of spilled light and reflected light may be important to the whole impression, and usually can be reproduced with a little experimenting.

OBLIQUE PHOTO PROJECTOR

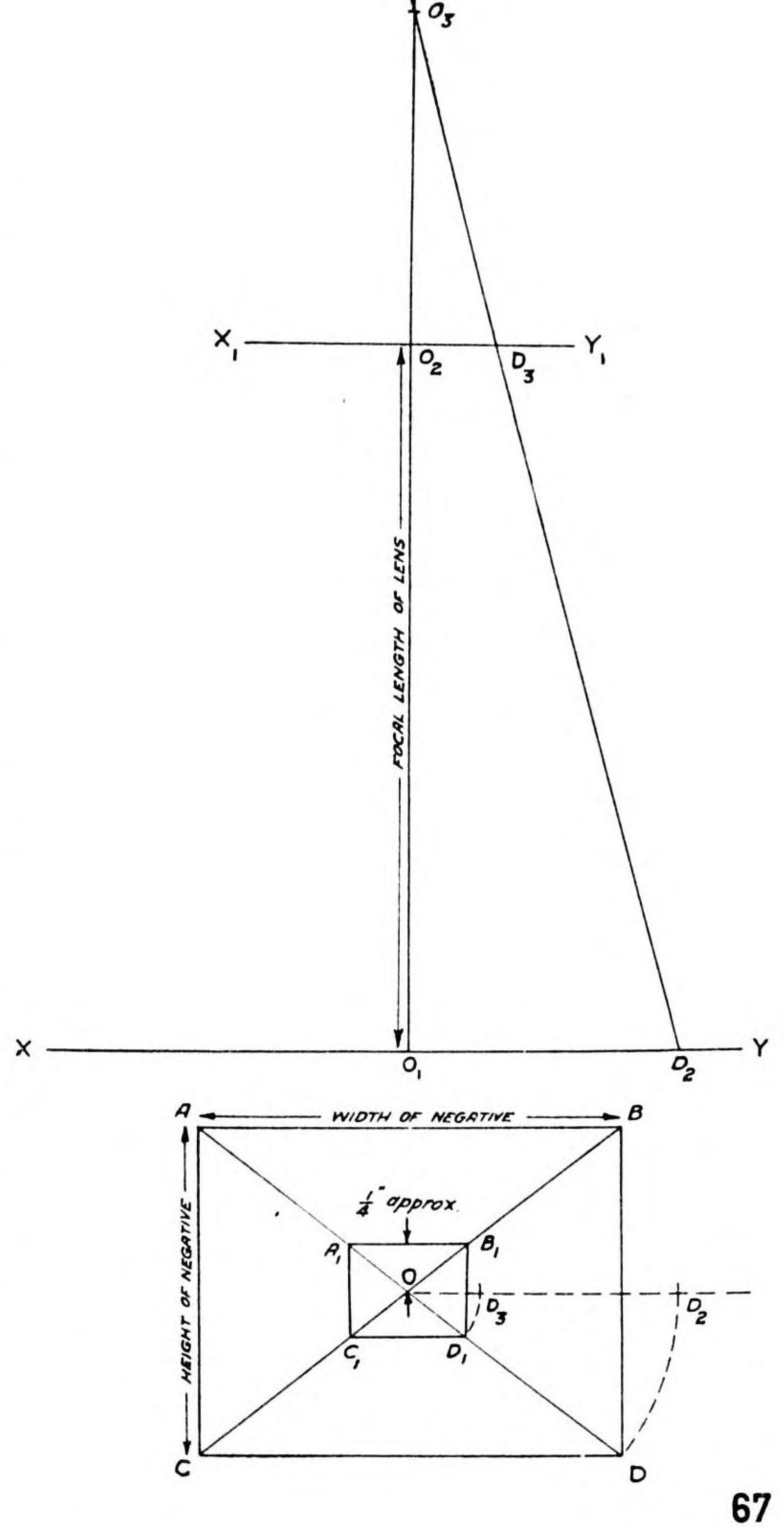
This instrument has been found useful in the field because its construction depends only on wood and cardboard. Maps and charts of South Pacific areas are untrustworthy where they exist at all, and often the only available material on an objective will be oblique photographs, shellfire being too intense for verticals. With two or more of such photographs taken at approximate right angles to each other, a fairly accurate detail map may be drawn and elevations discovered. The more photographs, the more accurate and detailed the results; but two are sufficient. These photos should be taken at an angle of inclination approaching 35 degrees for best results.

Viewing boxes must first be constructed in the following manner.

1. Construct a plan view to full scale with lines AB and CD equal to the width of the original negative. Make lines AC and BD equal to the height of the original negative.

2. Draw in the diagonals and locate the center point O.

3. Construct a line A_1B_1 approximately ¼ inch from O and parallel to line AB. From



this construct the square on rectangle as the case may be, $A_1B_1C_1D_1$.

4. Erect a perpendicular from O. Draw line XY parallel to AB.

5. With O as the center and OD as the radius locate point D_2. Also with O as the center and OD_1 as the radius locate point D_3.

6. Lay off from O_1 along line O_1Z the focal length of the lens. Draw a line X_1Y_1 parallel to XY at this point.

7. Lay off distance OD_2 from O_1 on XY. Lay off distance OD_3 from O_2 on X_1Y_1.

8. Draw a line from D_2 through D_3 intersecting line O_1Z at O_3. Line O_3D_2 will be the radius which will be used for the pattern layout.

With O_3D_2 as the radius inscribe a circle. Also inscribe a circle with O_3D_3 as the radius for the same center point.

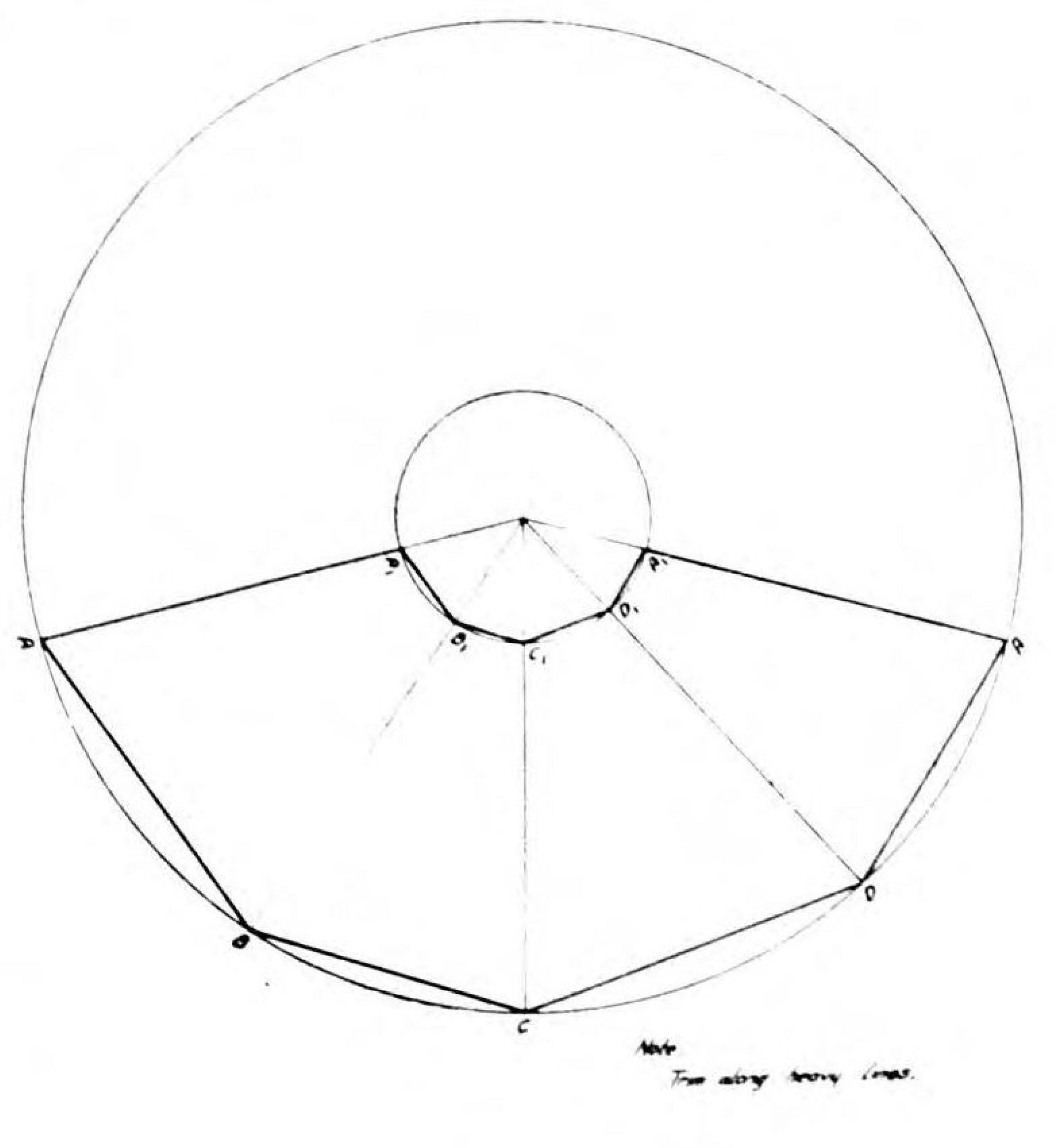
Draw a line from the center of the pattern intersecting the outside circle. From this point lay off a cord equal to line AB. Continue this process for AC, CD, and BD. Connect these points with the center point. Where these lines intersect the inner circle, draw in the cords.

We now have the completed pattern from which the viewing boxes can be made.

Two-ply Strathmore board has been found most suitable for the construction, but any fairly stiff cardboard will suffice. The boxes can be held together with scotch tape. Tape over the apex with a strip of scotch tape and make a pinhole ($^1/_{16}$ to $^1/_8$ inch) in the exact center. The entire interior should be painted black. (India ink or water color is suitable.)

It is suggested that the two interior lines in the pattern be scored slightly with a knife for ease in bending.

Processing of Photographs.—If photographic facilities are available, have a diapositive (positive transparency) made of each photograph. However, the chances are that these services will not be at hand, and it will be necessary to proceed as follows:



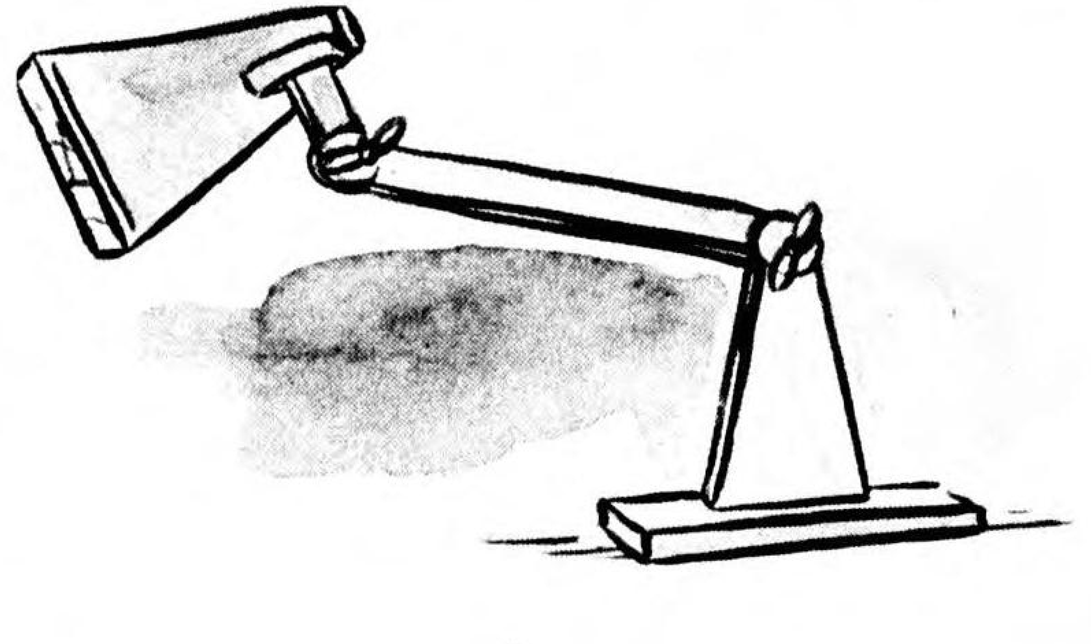
Make an ink tracing of the main lines and features of the photo on clear acetate (celluloid). Next locate three points, all in the same horizontal plane, clearly visible on each photograph. Connect these points with straight lines forming triangles. It is recommended that the legs of the triangle be so selected that one leg runs approximately horizontal in one transparency and another leg does the same in the other transparency.

Acetate of approximately $^1/_{16}$-inch thickness has been found to be most suitable. Acetate thinner than this tends to buckle and will distort the projection. If a thicker acetate is used, the weight becomes too great for a box of light cardboard such as is recommended. If diapositives are used, they should be placed between two thin sheets of glass or acetate so that the diapositive is held flat at

all times. After this procedure is completed, the diapositive or tracing is secured to the base of the pinhole box by scotch tape or any other convenient means. The pinhole boxes are now ready for use.

Method of Use.—Stands similar to the one pictured in the sketch should first be constructed to adjust the viewing box. If vertical photos are available, have an enlargement made and mounted on the work surface. Then set the boxes around this so that all the contours and features in the same plane as the work surface coincide. This is done by raising and lowering, tilting, and moving the boxes. If no photographic facilities are available an enlargement by grid or projection will do as well. The use of a vertical eliminates the necessity for drawing and lining up triangles.

If no verticals are to be found, proceed as follows: On a sheet of tracing paper draw a rough diagram of the subject as it appears in the oblique photographs, being sure to keep the size down to arm's length if possible. Next, locate the three points, on the rough tracing, which were



marked on the photo and connect them to make a triangle.

Now, line up the triangle in the viewing box with the one on the tracing as closely as possible. Draw this triangle on a fresh sheet of tracing paper. Repeat the operation with box No. 2, and continue with fresh sheets of tracing paper until both triangles coincide. The map is now ready to be drawn, and the position of the boxes should be marked so that they may be returned to the correct position if they are moved.

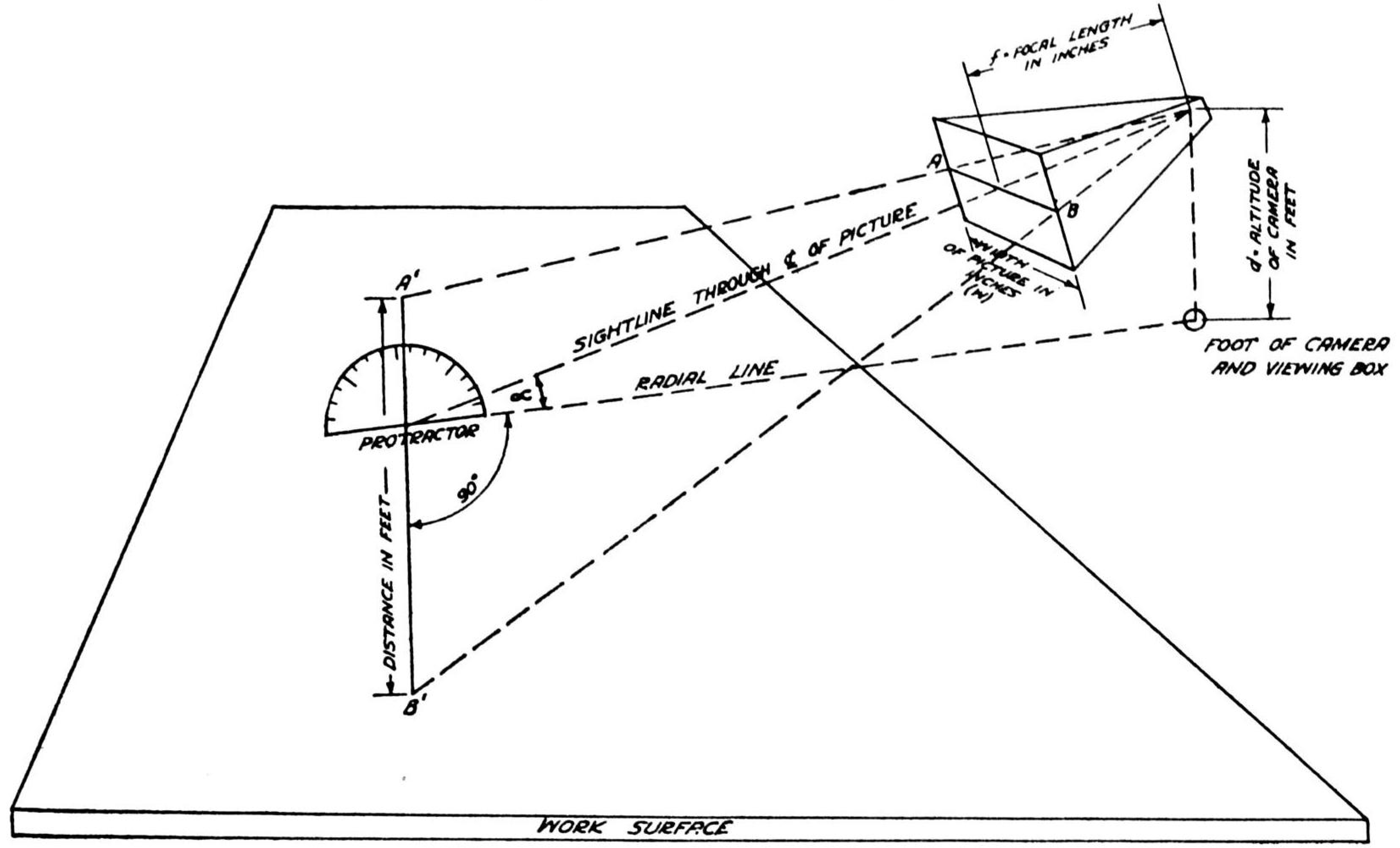
When all points in the plane of the work surface have been located it is time to start on the elevations.

Locate a point directly below the pinhole of each viewing box. This will be known as the "foot," and all lines coming from it will be known as radial lines. Sight a line through the diapositive and mark where it intersects the work surface. Draw a line from this point to the foot of viewing box No. 1. Repeat the process for box No. 2. The intersection of these lines will be the true location of the desired point on the plan. Continue this process until you have enough reference points to complete the plan.

Scale.—If no maps are at hand from which to find the scale, it may be found by means of a Canadian Grid, or as follows:

Sight a line through the pinhole of the viewing box and the center point of the diapositive or tracing, and measure the angle it makes with the work surface, by placing the center of a protractor at the desired point and reading the angle direct. Next, project the extremities of the horizontal center line of the diapositive onto the plane of the work surface. Call this line "X". We can now set up a proportion. "X" is to the width of the diapositive in inches as the altitude of the camera in feet is to the focal length of the lens in inches times the sine of the Alpha.

Solving the proportion, we will have "X" equal to the actual number of feet on the ground. Now, measure the length of line "X" as projected on the plan (in feet or fractions thereof), divide this into the value we found for "X" on the ground, and we have the proper representative fraction for the drawing. When this is converted to a scale of inches to feet, a vertical scale can be made for direct readings of elevations.



SCALE FORMULA

$$\frac{\text{Distance in feet } A'B'}{\text{Width of diapositive in inches}} = \frac{\text{Altitude in feet}}{\text{Focal length in inches} \times \text{Sine Alpha}}$$

TABLES

PRINCIPAL MOUNTAINS AND THEIR HEIGHTS

Mountain and Country	*Height in feet*
Aconcagua, Argentina	22, 834
Albert Edward, Papua	13, 222
Ancohuma, Bolivia	21, 490
Apo, Phillipine Islands	9, 610
Ararat, Turkey	16, 916
Blanc, France-Italy	15, 781
Carstensz, Papua	16, 404
Ceachuca, Bolivia	19, 407
Chardonnet, France	12, 373
Charles Louis, Papua	18, 000
Chimborazo, Ecuador	20, 702
Copiapo, Chile	19, 947
Cuzco (Ausangate), Peru	20, 187
Demavend, Iran	18, 605
Dente Blanche, France	14, 318
Dent Parassee, France	12, 137
Elbrus, Soviet Union	18, 468
Etna, Sicily	10, 755
Everest, Nepal	29, 141
Fairweather, Alaska-Canada	15, 399
Falso Azufre, Argentina-Chile	22, 277
Forel, Greenland	11, 286
Fujiyama, Japan	12, 395
Godwin Austen, India	28, 251
Grand Teton, Wyoming, U. S.	13, 747
Hekla, Iceland	5, 105
Hood, Oregon, U. S.	11, 253
Illampu, Bolivia	21, 276
Illimani, Bolivia	21, 282
Incahuasu, Argentina-Chile	21, 720
Jungfrau, Switzerland	13, 671
Kanchanganga, India	28, 146
Kaufmann, Soviet Union	23, 386
Kinabalu, Borneo	13, 451
Lassen, California, U. S.	10, 453
Logan, Canada	19, 850
McKinley, Alaska	20, 300
Matterhorn, Switzerland-Italy	14, 780
Mauna Kea, Hawaii	13, 784
Mauna Loa, Hawaii	13, 680
Mont Blanc, Italy	15, 780
Monte Rosa, Italy-Switzerland	15, 217
Mustagh Ata, Turkestan	24, 357
Olympus, Greece	9, 730
Orizaba, Mexico	18, 541
Pelee, Martinique	5, 200
Pikes, Colorado, U. S.	14, 109
Pili, Chile	19, 850
Popocatepetl, Mexico	17, 840
Quincy Adams, Alaska	15, 560
Rainier, Washington, U. S.	14, 408
Rocca Dell 'Argentera, Italy	10, 617
St. Elias, Alaska-Canada	18, 008

RESTRICTED

RESTRICTED

Mountain and Country	*Height in feet*
San Jose, Argentina-Chile	20, 067
Semeru, Java	12, 060
Shasta, California, U. S.	14, 161
Tengri Khan, Soviet Union	23, 622
Tocorpuri, Bolivia-Chile	22, 163
Ushba, Soviet Union	15, 409
Vancouver, Canada	15, 700
Vesuvius, Italy	4, 102
Weisshorn, Switzerland	14, 804
Wetterhorn, Switzerland	12, 166
Wheeler, Nevada, U. S.	13, 058
Whitney, California, U. S.	14, 496
Wilhelmina, Papva	15, 584
Wrangell, Alaska	14, 005

SNOW LINES

	Feet
Bolivian Andes, west side, near Equator	18, 500
Bolivian Andes, east side, near Equator	16, 000
Chilean Andes, Latitude 33° South	12, 800
Mexico	14, 800
Teneriffe, Latitude 33° North	13, 000
Himalayas, north side, Latitude 28° North	16, 700
Himalayas, south side, Latitude 28° North	13, 000
Caucasus Mountains, Latitude 40° plus North	8, 300–14, 000
Pyrenees Mountains, Latitude 40° plus North	6, 500
Alps, Latitude 46.5° North	9, 000
Norway	5, 000
Lapland, Latitude 70, North	3, 000
Alaska	5, 500
Greenland, Latitude 60°–70° North	2, 200
Siberia, Cherski Mountains, Latitude 65° North	8, 500
Siberia, Kamchatka Peninsula, Latitude 55° North	7, 000
China, Yunnan Plateau, Latitude 25°–30° North	15,000–18,000
Papua, Nassau Range, Latitude 4° South	14,500–15,000

PRINCIPAL LAKES AND THEIR AREAS

Name	Approximate area in square miles	Approximate altitude of surface	Approximate maximum depth in feet
Caspian, Asia	170,000	−85	3,200
Superior, North America	31,200	602	1,008
Victoria, Africa	26,000	3,800	240
Aral Soviet Union	25,050	160	1,200
Michigan, United States	22,500	581	870
Huron, North America	22,320	581	700
Nyassa, Africa	14,200	1,500	2,300
Baikal, Soviet Union	13,000	1,700	4,700
Tanganyika, Africa	12,000	2,700	2,100
Great Bear, Canada	11,200	390	270
Erie, North America	9,960	573	200
Winnipeg, Canada	9,400	710	70
Balkash, Soviet Union	8,600	900	80
Ontario, North America	7,240	247	738
Chad, Africa	6,000–40,000	900	8–20
Titicaca, South America	3,200	12,500	700
Dead Sea, Palestine-Transjordan	360	−1,268	1,300
Garda, Italy	189	215	1,135
Chelan, United States	85	1,079	1,500
Como, Italy-Switzerland	60	650	1,340
Crater, United States	25	6,239	2,000

HEIGHT (IN FEET) ABOVE GROUND AT WHICH THE EARTH WILL APPEAR THE SAME SCALE AS A MODEL VIEWED FROM VARIOUS EYE HEIGHTS

Viewing distance (height of eye above model)	SCALE OF MODEL 1/1,000	1/2,000	1/3,000	1/4,000	1/5,000	1/6,000	1/7,000
1 inch	83	167	250	333	417	500	583
2 inches	167	333	500	667	833	1,000	1,167
3 inches	250	500	750	1,000	1,250	1,500	1,750
4 inches	333	667	1,000	1,333	1,667	2,000	2,333
5 inches	417	883	1,250	1,667	2,083	2,500	2,917
6 inches	500	1,000	1,500	2,000	2,500	3,000	3,500
7 inches	583	1,167	1,750	2,333	2,917	3,500	4,083
8 inches	667	1,333	2,000	2,667	3,333	4,000	4,667
9 inches	750	1,500	2,250	3,000	3,750	4,500	5,250
10 inches	833	1,667	2,500	3,333	4,167	5,000	5,833
11 inches	917	1,833	2,750	3,667	4,583	5,500	6,417
1 foot	1,000	2,000	3,000	4,000	5,000	6,000	7,000
1 foot 1 inch	1,083	2,167	3,250	4,333	5,417	6,500	7,583
1 foot 2 inches	1,167	2,333	3,500	4,667	5,833	7,000	8,167
1 foot 3 inches	1,250	2,500	3,750	5,000	6,250	7,500	8,750
1 foot 4 inches	1,333	2,667	4,000	5,333	6,667	8,000	9,333
1 foot 5 inches	1,417	2,833	4,250	5,667	7,083	8,500	9,917
1 foot 6 inches	1,500	3,000	4,500	6,000	7,500	9,000	10,500
1 foot 7 inches	1,583	3,167	4,750	6,333	7,917	9,500	11,083
1 foot 8 inches	1,667	3,333	5,000	6,667	8,333	10,000	11,667
1 foot 9 inches	1,750	3,500	5,250	7,000	8,750	10,500	12,250
1 foot 10 inches	1,833	3,667	5,500	7,333	9,167	11,000	12,833
1 foot 11 inches	1,917	3,833	5,750	7,667	9,583	11,500	13,417
2 feet	2,000	4,000	6,000	8,000	10,000	12,000	14,000
2 feet 1 inch	2,083	4,167	6,250	8,333	10,417	12,500	14,583
2 feet 2 inches	2,167	4,333	6,500	8,667	10,833	13,000	15,167
2 feet 3 inches	2,250	4,500	6,750	9,000	11,250	13,500	15,750
2 feet 4 inches	2.333	4,666	7,000	9,333	11,667	14,000	16,333
2 feet 5 inches	2,417	4,833	7,250	9,667	12,083	14,500	16,917
2 feet 6 inches	2,500	5,000	7,500	10,000	12,500	15,000	17,500
2 feet 7 inches	2,583	5,166	7,750	10,333	12,916	15,500	18,083
2 feet 8 inches	2,667	5,333	8,000	10,667	13,333	16,000	18,667
2 feet 9 inches	2,750	5,500	8,250	11,000	13,750	16,500	19,250
2 feet 10 inches	2,833	5,666	8,500	11,333	14,166	17,000	19,833
2 feet 11 inches	2,917	5,833	8,750	11,667	14,583	17,500	20,417
3 feet	3,000	6,000	9,000	12,000	15,000	18,000	21,000
3 feet 1 inch	3,083	6,166	9,250	12,333	15,416	18,500	21,583
3 feet 2 inches	3,167	6,333	9,500	12,667	15,833	19,000	22,167
3 feet 3 inches	3,250	6,500	9,750	13,000	16,250	19,500	22,750
3 feet 4 inches	3,333	6,666	10,000	13,333	16,666	20,000	23,333
3 feet 5 inches	3,417	6,833	10,250	13,667	17,083	20,500	23,917
3 feet 6 inches	3,500	7,000	10,500	14,000	17,500	21,000	24,500
3 feet 7 inches	3,583	7,166	10,750	14,333	17,916	21,500	25,083
3 feet 8 inches	3,667	7,333	11,000	14,667	18,333	22,000	25,667
3 feet 9 inches	3,750	7,500	11,250	15,000	18,750	22,500	26,250
3 feet 10 inches	3,833	7,666	11,500	15,333	19,166	23,000	26,833
3 feet 11 inches	3,917	7,833	11,750	15,667	19,583	23,500	27,417
4 feet	4,000	8,000	12,000	16,000	20,000	24,000	28,000

Viewing distance	1/8,000	1/9,000	1/10,000	1/11,000	1/12,000	1/13,000	1/14,000
1 inch	667	750	833	917	1,000	1,084	1,167
2 inches	1,333	1,500	1,667	1,833	2,000	2,166	2,333
3 inches	2,000	2,250	2,500	2,750	3,000	3,250	3,500
4 inches	2,667	3,000	3,333	3,667	4,000	4,334	4,667
5 inches	3,333	3,750	4,167	4,583	5,000	5,416	5,833
6 inches	4,000	4,500	5,000	5,500	6,000	6,500	7,000
7 inches	4,667	5,250	5,833	6,417	7,000	7,584	8,167
8 inches	5,333	6,000	6,667	7,333	8,000	8,668	9,333
9 inches	6,000	6,750	7,500	8,250	9,000	9,750	10,500
10 inches	6,667	7,500	8,333	9,167	10,000	10,834	11,667
11 inches	7,333	8,250	9,167	10,083	11,000	11,916	12,833
1 foot	8,000	9,000	10,000	11,000	12,000	13,000	14,000
1 foot 1 inch	8,667	9,750	10,833	11,917	13,000	14,084	15,167
1 foot 2 inches	9,333	10,500	11,667	12,833	14,000	15,166	16,333

Viewing distance (height of eye above model)	SCALE OF MODEL						
	1/8,000	1/9,000	1/10,000	1/11,000	1/12,000	1/13,000	1/14,000
1 foot 3 inches	10, 000	11, 250	12, 500	13, 750	15, 000	16, 250	17, 500
1 foot 4 inches	10, 667	12, 000	13, 333	14, 667	16, 000	17, 334	18, 667
1 foot 5 inches	11, 333	12, 750	14, 167	15, 583	17, 000	18, 416	19, 833
1 foot 6 inches	12, 000	13, 500	15, 000	16, 500	18, 000	19, 500	21, 000
1 foot 7 inches	12, 667	14, 250	15, 833	17, 417	19, 000	20, 584	22, 167
1 foot 8 inches	13. 333	15, 000	16, 667	18, 333	20, 000	21, 666	23, 333
1 foot 9 inches	14, 000	15, 750	17, 500	19, 250	21, 000	22, 750	24, 500
1 foot 10 inches	14, 667	16, 500	18, 333	20, 167	22, 000	23, 834	25, 667
1 foot 11 inches	15, 333	17, 250	19, 167	21, 083	23, 000	24, 916	26, 833
2 feet	16, 000	18, 000	20, 000	22, 000	24, 000	26, 000	28, 000
2 feet 1 inch	16, 667	18, 750	20, 833	22, 917	25, 000	27, 084	29, 167
2 feet 2 inches	17, 333	19, 500	21, 667	23, 833	26, 000	28, 186	30, 333
2 feet 3 inches	18, 000	20, 250	22, 500	24, 750	27, 000	29, 250	31, 500
2 feet 4 inches	18, 666	21, 000	23, 333	25, 666	28, 000	30, 332	32, 666
2 feet 5 inches	19, 333	21, 750	24, 167	26, 583	29, 000	31, 416	33, 833
2 feet 6 inches	20, 000	22, 500	25, 000	27, 500	30, 000	32, 500	35, 000
2 feet 7 inches	20, 666	23, 250	25, 833	28, 416	31, 000	33, 582	36, 166
2 feet 8 inches	21, 333	24, 000	26, 667	29, 333	32, 000	34, 666	37, 333
2 feet 9 inches	22, 000	24, 750	27, 500	30, 250	33, 000	35, 750	38, 500
2 feet 10 inches	22, 666	25, 500	28, 333	31, 166	34, 000	36, 832	39, 666
2 feet 11 inches	23, 333	26, 250	29, 167	32, 083	35, 000	37, 916	40, 833
3 feet	24, 000	27, 000	30, 000	33, 000	36, 000	39, 000	42, 000
3 feet 1 inch	24, 666	27, 750	30, 833	33, 916	37, 000	40, 082	43, 166
3 feet 2 inches	25, 333	28, 500	31, 667	34, 833	38, 000	41, 166	44, 333
3 feet 3 inches	26, 000	29, 250	32, 500	35, 750	39, 000	42, 250	45, 500
3 feet 4 inches	26, 666	30, 000	33, 333	36, 666	40, 000	43, 332	46, 666
3 feet 5 inches	27, 333	30, 750	34, 167	37, 000	41, 000	44, 416	47, 833
3 feet 6 inches	28, 000	31, 500	35, 000	38, 500	42, 000	45, 500	49, 000
3 feet 7 inches	28, 666	32, 250	35, 833	39, 416	43, 000	46, 582	....
3 feet 8 inches	29, 333	33, 000	36, 667	40, 583	44, 000	47, 666	....
3 feet 9 inches	30, 000	33, 750	37, 500	41, 500	45, 000	48, 750	....
3 feet 10 inches	30, 666	34, 500	38, 333	42, 166	46, 000	49, 832	....
3 feet 11 inches	31, 333	35, 250	39, 167	43, 083	47, 000	....	....
4 feet	32, 000	36, 000	40, 000	44, 000	48, 000	....	....

	1/15,000	1/16,000	1/17,000	1/18,000	1/19,000	1/20,000	1/21,000
1 inch	1, 250	1, 333	1, 416	1, 500	1, 584	1, 667	1, 750
2 inches	2, 500	2, 667	2, 834	3, 000	3, 166	3, 333	3, 500
3 inches	3, 750	4, 000	4, 250	4, 500	4, 750	5, 000	5, 250
4 inches	5, 000	5, 333	5, 666	6, 000	6, 334	6, 667	7, 000
5 inches	6, 250	6, 667	7, 084	7, 500	7, 916	8, 333	8, 750
6 inches	7, 500	8, 000	8, 500	9, 000	9, 500	10, 000	10, 500
7 inches	8, 750	9, 333	9, 916	10, 500	11, 084	11, 667	12, 250
8 inches	10, 000	10, 667	11, 334	12, 000	12, 666	13, 333	14, 000
9 inches	11, 250	12, 000	12, 750	13, 500	14, 250	15, 000	15, 750
10 inches	12, 500	13, 333	14, 166	15, 000	15, 834	16, 667	17, 500
11 inches	13, 750	14, 667	15, 584	16, 500	17, 416	18, 333	19, 250
1 foot	15, 000	16, 000	17, 000	18, 000	19, 000	20, 000	21, 000
1 foot 1 inch	16, 250	17, 333	18, 416	19, 500	20, 584	21, 667	22, 750
1 foot 2 inches	17. 500	18, 667	19, 834	21, 000	22, 166	23, 333	24, 500
1 foot 3 inches	18, 750	20, 000	21, 250	22, 500	23, 750	25, 000	26, 250
1 foot 4 inches	20, 000	21, 333	22, 666	24, 000	25, 334	26, 667	28, 000
1 foot 5 inches	21. 250	22, 667	24, 084	25, 500	26, 916	28, 333	29, 750
1 foot 6 inches	22, 500	24, 000	25, 500	27, 000	28, 500	30, 000	31, 500
1 foot 7 inches	23, 750	25, 333	26, 916	28, 500	30, 084	31, 667	33, 250
1 foot 8 inches	25, 000	26, 667	28, 334	30, 000	31, 666	33, 333	35, 000
1 foot 9 inches	26, 250	28, 000	29, 750	31, 500	33, 250	35, 000	36, 750
1 foot 10 inches	27, 500	29, 355	31, 188	33, 000	34, 834	86, 667	38, 500
1 foot 11 inches	28, 750	30, 667	32, 584	34, 500	36, 416	38, 333	40, 250
2 feet	30, 000	32, 000	34, 000	36, 000	38, 000	40, 000	42, 000
2 feet 1 inch	31, 250	33, 333	35, 416	37, 500	39, 584	41, 667	43, 750
2 feet 2 inches	32, 500	34, 667	36, 834	39, 000	41, 166	43, 333	45, 500
2 feet 3 inches	33, 750	36, 000	38, 250	40, 500	42, 750	45, 000	47, 250
2 feet 4 inches	35, 000	37, 333	39, 666	41, 999	44, 332	48, 333	48, 999
2 feet 5 inches	36, 250	38, 667	41, 084	43, 500	45, 916	50, 000	....
2 feet 6 inches	37, 500	40, 000	42, 500	45, 000	47, 500	....	....
2 feet 7 inches	38, 750	41, 333	43, 916	46, 499	49, 082	....	....
2 feet 8 inches	40, 000	42, 667	45, 334	48, 000	....	....	....
2 feet 9 inches	41, 250	44, 000	46, 750	49, 500	....	....	....
2 feet 10 inches	42, 500	45, 333	48, 166	....	....	....	....
2 feet 11 inches	43, 750	46, 667	49, 584	....	....	....	....
3 feet	45, 000	48, 000	....	....	....	....	....
3 feet 1 inch	46, 250	49, 333	....	....	....	....	....
3 feet 2 inches	47, 500	....	....	....	....	....	....
3 feet 3 inches	48, 750	....	....	....	....	....	....
3 feet 4 inches	50, 000	....	....	....	....	....	....

RESTRICTED

RESTRICTED

	1/22,000	1/23,000	1/24,000	1/25,000	1/26,000	1/27,000	1/28,000
1 inch	1, 833	1, 917	2, 000	2, 084	2, 167	2, 250	2, 334
2 inches	3, 667	3, 833	3, 999	4, 166	4, 333	4, 499	4, 666
3 inches	5, 500	5, 750	6, 000	6, 250	6, 500	6, 790	7, 000
4 inches	7, 333	7, 667	8, 001	8, 334	8, 667	9, 001	9, 334
5 inches	9, 167	9, 583	9, 999	10, 416	10, 833	11, 249	11, 666
6 inches	11, 000	11, 500	12, 000	12, 500	13, 000	13, 500	14, 000
7 inches	12, 833	13, 417	14, 001	14, 584	15, 167	15, 751	16, 334
8 inches	14, 667	15, 333	15, 999	16, 666	17, 333	17, 999	18, 666
9 inches	16, 500	17, 250	18, 000	18, 750	19, 500	20, 250	21, 000
10 inches	18, 333	19, 167	20, 001	20, 834	21, 667	22, 501	23, 334
11 inches	20, 167	21, 083	21, 999	22, 916	23, 833	24, 749	25, 666
1 foot	22, 000	23, 000	24, 000	25, 000	26, 000	27, 000	28, 000
1 foot 1 inch	23, 833	24, 917	26, 001	27, 084	28, 167	29, 251	30, 334
1 foot 2 inches	25, 667	26, 833	27, 999	29, 166	30, 333	31, 499	32, 666
1 foot 3 inches	27, 500	28, 750	30, 000	31, 250	32, 500	33, 750	35, 000
1 foot 4 inches	29, 333	30, 667	32, 001	33, 334	34, 667	36, 001	37, 334
1 foot 5 inches	31, 167	32, 583	33, 999	35, 416	36, 833	38, 249	39, 666
1 foot 6 inches	33. 000	34, 500	36, 000	37, 500	39, 000	40, 500	42, 000
1 foot 7 inches	34. 833	36, 417	38, 001	39, 584	41, 167	42, 751	44, 334

Viewing distance (height of eye above model)	SCALE OF MODEL						
	1/22,000	1/23,000	1/24,000	1/25,000	1/26,000	1/27,000	1/28,000
1 foot 8 inches.....	36,667	38,333	39,999	41,666	43,333	44,999	46,666
1 foot 9 inches.....	38,500	40,250	42,000	43,750	45,500	47,250	49,000
1 foot 10 inches....	40,333	42,167	44,001	45,834	47,667	49,501	....
1 foot 11 inches....	42,167	44,083	45,999	47,916	49,833	....	....
2 feet..........	44,000	46,000	48,000	50,000	....	....	....
2 feet 1 inch......	45,388	47,917	50,001	....	....	....	....
2 feet 2 inches.....	47,667	49,833	....	....	....	....	....
2 feet 3 inches.....	49,500	....	....	....	....	....	....

	1/29,000	1/30,000	1/31,000	1/32,000	1/33,000	1/34,000	1/35,000
1 inch..........	2,417	2,500	2,583	2,667	2,750	2,833	2,916
2 inches.........	4,833	5,000	5,167	5,334	5,501	5,667	5,834
3 inches.........	7,250	7,500	7,750	8,000	8,250	8,500	8,750
4 inches.........	9,667	10,000	10,333	10,666	10,999	11,333	11,666
5 inches.........	12,083	12,500	12,917	13,334	13,751	14,167	14,584
6 inches.........	14,500	15,000	15,500	16,000	16,500	17,000	17,500
7 inches.........	16,917	17,500	18,083	18,666	19,249	19,833	20,416
8 inches.........	19,333	20,000	20,667	21,334	22,001	22,667	23,334
9 inches.........	21,750	22,500	23,250	24,000	24,750	25,500	26,250
10 inches........	24,167	25,000	25,833	26,666	27,499	28,333	29,166
11 inches........	26,583	27,500	28,417	29,334	30,251	31,167	32,084
1 foot..........	29,000	30,000	31,000	32,000	33,000	34,000	35,000
1 foot 1 inch......	31,417	32,500	33,583	34,666	35,749	36,833	37,916
1 foot 2 inches.....	33,833	35,000	36,167	37,334	38,501	39,667	40,834
1 foot 3 inches.....	36,250	37,500	38,750	40,000	41,250	42,000	43,750
1 foot 4 inches.....	38,667	40,000	41,333	42,666	43,999	45,333	46,666
1 foot 5 inches.....	41,083	42,500	44,917	45,334	46,751	48,167	49,584
1 foot 6 inches.....	43,500	45,000	46,500	48,000	49,500	....	....
1 foot 7 inches.....	45,917	47,500	49,033	....	....	....	....
1 foot 8 inches.....	48,333	50,000	....	....	....	....	....
1 foot 9 inches.....	....	....	....	....	....	....	....

RESTRICTED

	1/36,000	1/37,000	1/38,000	1/39,000	1/40,000	1/41,000	1/42,000
1 inch..........	3,000	3,083	3,167	3,250	3,334	3,417	3,500
2 inches.........	6,000	6,667	6,333	6,499	6,666	6,833	7,000
3 inches.........	9,000	9,250	9,500	9,750	10,000	10,250	10,500
4 inches.........	12,000	12,333	12,667	13,001	13,334	13,667	14,000
5 inches.........	15,000	15,417	15,833	16,249	16,666	17,083	17,500
6 inches.........	18,000	18,500	19,000	19,500	20,000	20,500	21,000
7 inches.........	21,000	21,583	22,167	22,751	23,334	23,917	24,500
8 inches.........	24,000	24,667	25,333	25,999	26,666	27,333	28,000
9 inches.........	27,000	27,750	28,500	29,250	30,000	30,750	31,500
10 inches........	30,000	30,833	32,667	32,501	33,334	34,167	35,000
11 inches........	33,000	33,917	34,833	35,749	36,666	37,583	38,500
1 foot..........	36,000	37,000	38,000	39,000	40,000	41,000	42,000
1 foot 1 inch......	39,000	40,083	41,167	42,251	43,334	44,417	45,533
1 foot 2 inches.....	42,000	43,167	44,333	45,499	46,666	47,833	....
1 foot 3 inches.....	45,000	46,250	47,500	48,750	50,000	....	....
1 foot 4 inches.....	48,000	49,333	....	....	....	....	....

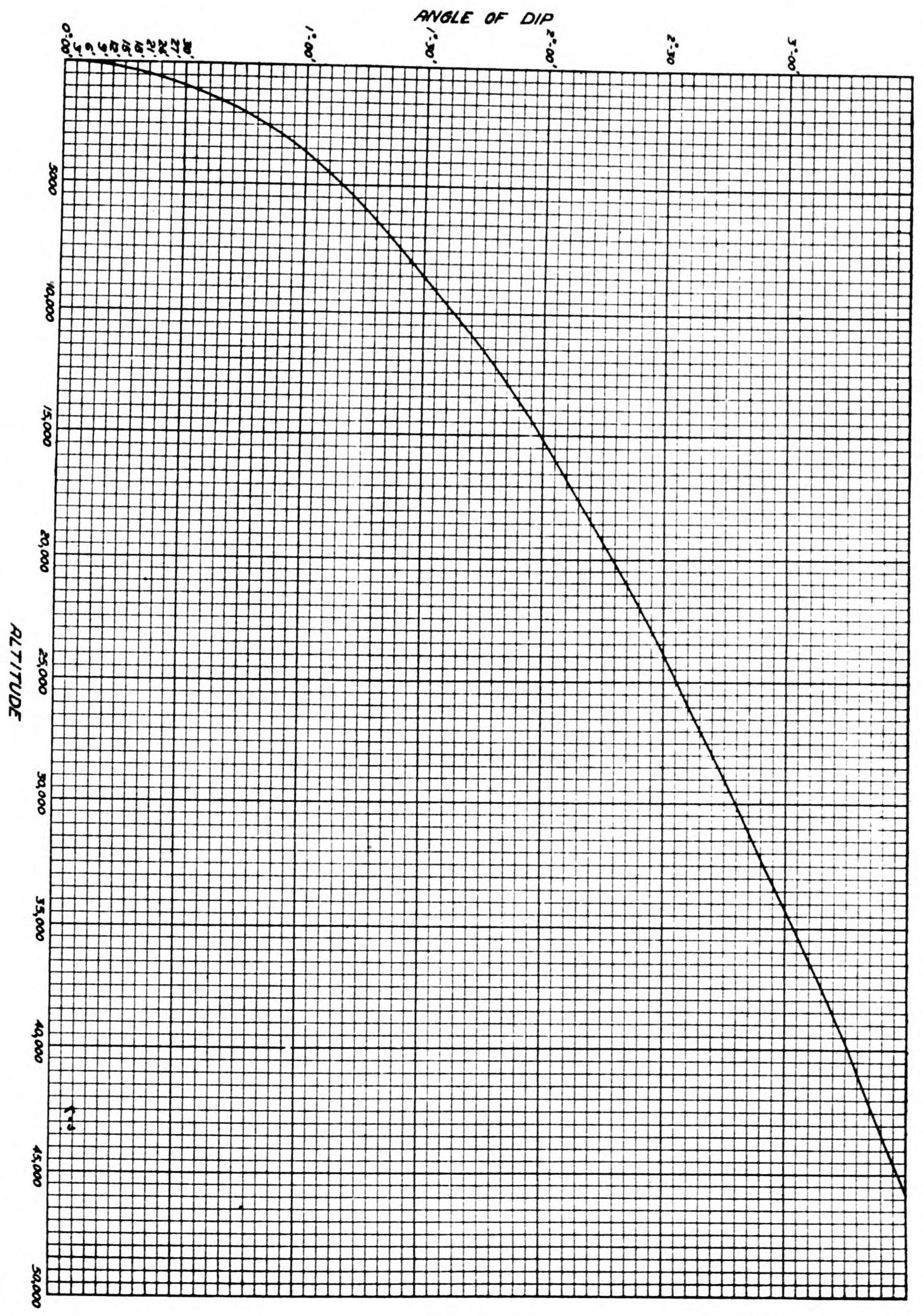
RESTRICTED

Height of eye above model	1/43,000	1/44,000	1/45,000	1/46,000	1/47,000	1/48,000	1/49,000	1/50,000
1 inch..........	3,583	3,667	3,750	3,833	3,917	4,001	4,084	4,167
2 inches.........	7,167	7,333	7,500	7,666	7,832	7,999	8,165	8,332
3 inches.........	10,750	11,000	11,250	11,500	11,750	12,000	12,250	12,500
4 inches.........	14,333	14,667	15,000	15,334	15,668	16,001	16,335	16,668
5 inches.........	17,917	18,333	18,750	19,166	19,582	19,999	20,415	20,832
6 inches.........	21,500	22,000	22,500	23,000	23,500	24,000	24,500	25,000
7 inches.........	25,083	25,667	26,250	26,834	27,418	28,001	28,585	29,168
8 inches.........	28,667	29,333	30,000	30,666	31,332	31,999	32,665	33,332
9 inches.........	32,250	33,000	33,750	34,500	35,250	36,000	36,750	37,500
10 inches........	35,833	36,667	37,500	38,334	39,168	40,001	40,825	41,668
11 inches........	39,417	40,333	41,250	42,166	43,082	43,999	44,915	45,832
1 foot..........	43,000	44,000	45,000	46,000	47,000	48,000	49,000	50,000
1 foot 1 inch......	46,583	47,667	48,750	49,834	....	....	....	....

Tan	Degrees	Sine	Tan	Degrees	Sine	Tan	Degrees	Sine
	° ′			° ′			° ′	
0.0000	0 00	0.0000	0.1051	6 00	0.1045	0.2126	12 00	0.2079
.0044	15	.0044	.1095	15	.1089	.2171	15	.2122
.0087	30	.0087	.1139	30	.1132	.2217	30	.2164
.0131	45	.0131	.1184	45	.1175	.2263	45	.2207
.0175	1 00	.0175	.1228	7 00	.1219	.2309	13 00	.2250
.0218	15	.0218	.1272	15	.1262	.2355	15	.2292
.0262	30	.0262	.1317	30	.1305	.2401	30	.2335
.0306	45	.0305	.1361	45	.1349	.2447	45	.2377
.0349	2 00	.0349	.1405	8 00	.1392	.2493	14 00	.2419
.0393	15	.0393	.1450	15	.1435	.2540	15	.2462
.0437	30	.0436	.1495	30	.1478	.2586	30	.2504
.0480	45	.0480	.1539	45	.1521	.2633	45	.2546
.0524	3 00	.0523	.1584	9 00	.1564	.2680	15 00	.2588
.0568	15	.0567	.1629	15	.1607	.2726	15	.2630
.0612	30	.0611	.1673	30	.1651	.2773	30	.2672
.0655	45	.0654	.1718	45	.1694	.2820	45	.2714
.0699	4 00	.0698	.1763	10 00	.1737	.2868	16 00	.2756
.0743	15	.0741	.1808	15	.1779	.2915	15	.2798
.0787	30	.0785	.1853	30	.1822	.2962	30	.2840
.0831	45	.0828	.1899	45	.1865	.3010	45	.2882
.0875	5 00	.0872	.1944	11 00	.1908	.3057	17 00	.2924
.0919	15	.0915	.1989	15	.1951	.3105	15	.2965
.0963	30	.0959	.2035	30	.1994	.3153	30	.3007
.1007	45	.1002	.2080	45	.2036	.3201	45	.3049

Tan	Degrees	Sine	Tan	Degrees	Sine	Tan	Degrees	Sine
	° ′			° ′			° ′	
0.3249	18 00	0.3090	0.6009	31 00	0.5150	0.9657	44 00	0.6947
.3298	15	.3132	.6068	15	.5188	.9742	15	.6978
.3346	30	.3173	.6128	30	.5225	.9827	30	.7009
.3395	45	.3214	.6188	45	.5262	.9913	45	.7040
.3443	19 00	.3256	.6249	32 00	.5299	1.000	45 00	.7071
.3492	15	.3297	.6310	15	.5336	1.009	15	.7102
.3541	30	.3338	.6371	30	.5373	1.018	30	.7133
.3590	45	.3379	.6432	45	.5410	1.027	45	.7163
.3640	20 00	.3420	.6494	33 00	.5446	1.036	46 00	.7193
.3689	15	.3461	.6556	15	.5483	1.045	15	.7224
.3739	30	.3502	.6619	30	.5519	1.054	30	.7254
.3789	45	.3543	.6682	45	.5556	1.063	45	.7284
.3839	21 00	.3584	.6745	34 00	.5592	1.072	47 00	.7314
.3889	15	.3624	.6809	15	.5628	1.082	15	.7343
.3939	30	.3665	.6873	30	.5664	1.091	30	.7373
.3990	45	.3706	.6937	45	.5700	1.101	45	.7402
.4040	22 00	.3746	.7002	35 00	.5736	1.111	48 00	.7431
.4091	15	.3787	.7067	15	.5772	1.120	15	.7461
.4142	30	.3827	.7133	30	.5807	1.130	30	.7490
.4193	45	.3867	.7199	45	.5843	1.140	45	.7518
.4245	23 00	.3907	.7265	36 00	.5878	1.150	49 00	.7547
.4296	15	.3947	.7332	15	.5913	1.161	15	.7576
.4348	30	.3988	.7400	30	.5948	1.171	30	.7604
.4400	45	.4028	.7467	45	.5983	1.181	45	.7632
.4452	24 00	.4067	.7536	37 00	.6018	1.192	50 00	.7660
.4505	15	.4107	.7604	15	.6053	1.202	15	.7688
.4557	30	.4147	.7673	30	.6088	1.213	30	.7716
.4610	45	.4187	.7743	45	.6122	1.224	45	.7744
.4663	25 00	.4226	.7813	38 00	.6157	1.235	51 00	.7772
.4716	15	.4266	.7883	15	.6191	1.246	15	.7799
.4770	30	.4305	.7954	30	.6225	1.257	30	.7826
.4823	45	.4345	.8026	45	.6259	1.268	45	.7853
.4877	26 00	.4384	.8098	39 00	.6293	1.280	52 00	.7880
.4932	15	.4423	.8170	15	.6327	1.292	15	.7907
.4986	30	.4462	.8243	30	.6361	1.303	30	.7934
.5040	45	.4501	.8317	45	.6394	1.315	45	.7960
.5095	27 00	.4540	.8391	40 00	.6428	1.327	53 00	.7986
.5150	15	.4579	.8466	15	.6461	1.339	15	.8013
.5206	30	.4618	.8541	30	.6495	1.351	30	.8039
.5261	45	.4656	.8617	45	.6528	1.364	45	.8064
.5317	28 00	.4695	.8693	41 00	.6561	1.376	54 00	.8090
.5373	15	.4733	.8770	15	.6594	1.389	15	.8116
.5430	30	.4772	.8847	30	.6626	1.402	30	.8141
.5486	45	.4810	.8925	45	.6659	1.415	45	.8166
.5543	29 00	.4848	.9004	42 00	.6691	1.428	55 00	.8192
.5600	15	.4886	.9083	15	.6724	1.442	15	.8217
.5658	30	.4924	.9163	30	.6756	1.455	30	.8241
.5716	45	.4962	.9244	45	.6788	1.469	45	.8266
.5774	30 00	.5000	.9325	43 00	.6820	1.483	56 00	.8290
.5832	15	.5038	.9407	15	.6852	1.497	15	.8315
.5891	30	.5075	.9490	30	.6884	1.511	30	.8339
.5949	45	.5113	.9573	45	.6915	1.525	45	.8363

Tan	Degrees	Sine	Tan	Degrees	Sine	Tan	Degrees	Sine
	° ′			° ′			° ′	
1.540	57 00	.8387	2.507	15	.9288	5.396	30	.9833
1.555	15	.8410	2.539	30	.9304	5.530	45	.9840
1.570	30	.8434	2.572	45	.9320	5.671	80 00	.9848
1.585	45	.8457	2.605	69 00	.9336	5.820	15	.9856
1.600	58 00	.8481	2.640	15	.9351	5.976	30	.9863
1.616	15	.8504	2.675	30	.9367	6.140	45	.9870
1.632	30	.8526	2.711	45	.9382	6.314	81 00	.9877
1.648	45	.8549	2.748	70 00	.9397	6.497	15	.9884
1.664	59 00	.8572	2.785	15	.9412	6.691	30	.9890
1.681	15	.8594	2.824	30	.9426	6.897	45	.9897
1.698	30	.8616	2.864	45	.9441	7.115	82 00	.9903
1.715	45	.8638	2.904	71 00	.9455	7.348	15	.9909
1.732	60 00	.8660	2.946	15	.9469	7.596	30	.9914
1.750	15	.8682	2.989	30	.9483	7.861	45	.9920
1.768	30	.8704	3.033	45	.9497	8.144	83 00	.9926
1.786	45	.8725	3.078	72 00	.9511	8.449	15	.9931
1.804	61 00	.8746	3.124	15	-9524	8.777	30	.9936
1.823	15	.8767	3.172	30	.9537	9.131	45	.9941
1.842	30	.8788	3.221	45	.9550	9.514	84 00	.9945
1.861	45	.8809	3.271	73 00	.9563	9.931	15	.9950
1.881	62 00	.8830	3.323	15	.9576	10.39	30	.9954
1.901	15	.8850	3.378	30	.9588	10.88	45	.9958
1.921	30	.8870	3.431	45	.9601	11.43	85 00	.9962
1.942	45	.8890	3.487	74 00	.9613	12.04	15	.9966
1.963	63 00	.8910	3.546	15	.9625	12.71	30	.9969
1.984	15	.8930	3.606	30	.9636	13.46	45	.9973
2.006	30	.8949	3.668	45	.9648	14.30	86 00	.9976
2.028	45	.8969	3.732	75 00	.9659	15.26	15	.9979
2.050	64 00	.8988	3.798	15	.9671	16.35	30	.9981
2.073	15	.9007	3.867	30	.9682	17.61	45	.9984
2.097	30	.9026	3.938	45	.9692	19.08	87 00	.9986
2.120	45	.9045	4.011	76 00	.9703	20.82	15	.9989
2.145	65 00	.9063	4.087	15	.9713	22.90	30	.9991
2.169	15	.9081	4.165	30	.9724	25.45	45	.9992
2.194	30	.9100	4.247	45	.9734	28.64	88 00	.9994
2.220	45	.9118	4.332	77 00	.9744	32.73	15	.9995
2.246	66 00	.9136	4.419	15	.9753	38.19	30	.9997
2.273	15	.9153	4.511	30	.9763	45.83	45	.9998
2.300	30	.9171	4.606	45	.9772	57.29	89 00	.9999
2.328	45	.9188	4.705	78 00	.9782	76.39	15	.9999
2.356	67 00	.9205	4.808	15	.9791	114.6	30	.9999
2.385	15	.9222	4.915	30	.9799	229.2	45	.9999
2.414	30	.9239	5.027	45	.9808	Inf.	90 00	1.000
2.444	45	9255	5.145	79 00	.9816			
2.475	68 00	.9272	5.267	15	.9825			



SCALE EQUIVALENTS

Scale	Nautical miles		Statute miles	
	Inches	Centimeters	Inches	Centimeters
1:1200	60. 803	154. 44	52. 800	134. 11
1:2400	30. 401	77. 22	26. 400	67. 06
1:4800	15. 201	38. 61	13. 200	33. 53
1:5000	14. 593	37. 06	12. 672	32. 19
1:10000	7. 296	18. 53	6. 336	16. 09
1:15000	4. 864	12. 36	4. 224	10. 73
1:20000	3. 648	9. 27	3. 168	8. 05
1:30000	2. 432	6. 18	2. 112	5. 36
1:40000	1. 824	4. 63	1. 584	4. 02
1:50000	1. 459	3. 71	1. 267	3. 22
1:60000	1. 216	3. 09	1. 056	2. 68
1:63360	....	....	1. 000	....
1:80000	. 912	2. 32	. 792	2. 01
1:100000	. 730	1. 85	. 634	1. 61
1:200000	. 365	. 93	. 317	. 80
1:400000	. 182	. 46	. 158	. 40
1:1000000	. 073	. 18	. 063	. 16
1:1200000	. 061	. 15	. 053	. 13

A nautical mile is a minute of an average great circle of the earth, and its length is 6,080 feet or 1,853.2 meters; a statute mile is 5,280 feet or 1,609.3 meters; 1 meter equals 39.37 inches; 1 centimeter equals 0.3937 inches; 1 inch equals 2.54 centimeters.

Source: Coast and Geodetic Survey Catalogue No. 641.

SCALES FOR VARIOUS ALTITUDES AND FOCAL LENGTHS

Height above ground (feet)	Focal length of lens				
	6 inches	8¼ inches	12 inches	13½ inches	24 inches
	Scale	*Scale*	*Scale*	*Scale*	*Scale*
1,000	1:2000	1:1454	1:1000	1:889	1:500
2,000	1:4000	1:2910	1:2000	1:1778	1:1000
3,000	1:6000	1:4360	1:3000	1:2667	1:1500
4,000	1:8000	1:5820	1:4000	1:3556	1:2000
5,000	1:10000	1:7270	1:5000	1:4440	1:2500
6,000	1:12000	1:8730	1:6000	1:5330	1:3000
7,000	1:14000	1:10280	1:7000	1:6220	1:3500
8,000	1:16000	1:11630	1:8000	1:7110	1:4000
9,000	1:18000	1:13100	1:9000	1:8000	1:4500
10,000	1:20000	1:14540	1:10000	1:8890	1:5000
11,000	1:22000	1:16000	1:11000	1:9780	1:5500
12,000	1:24000	1:17450	1:12000	1:10670	1:6000
13,000	1:26000	1:18900	1:13000	1:11560	1:6500
14,000	1:28000	1:20360	1:14000	1:12450	1:7000
15,000	1:30000	1:21810	1:15000	1:13330	1:7500
16,000	1:32000	1:23270	1:16000	1:14220	1:8000
17,000	1:34000	1:24750	1:17000	1:15110	1:8500
18,000	1:36000	1:26200	1:18000	1:16000	1:9000
19,000	1:38000	1:27640	1:19000	1:16890	1:9500
20,000	1:40000	1:29080	1:20000	1:17780	1:10000
21,000	1:42000	1:30550	1:21000	1:18670	1:10500
22,000	1:44000	1:32000	1:22000	1:19560	1:11000
23,000	1:46000	1:33460	1:23000	1:20450	1:11500
24,000	1:48000	1:34900	1:24000	1:21340	1:12000
25,000	1:50000	1:36380	1:25000	1:22220	1:12500
26,000	1:52000	1:37820	1:26000	1:23110	1:13000
27,000	1:54000	1:39270	1:27000	1:24000	1:13500
28,000	1:56000	1:40750	1:28000	1:24890	1:14000
29,000	1:58000	1:42200	1:29000	1:25780	1:14500
30,000	1:60000	1:43650	1:30000	1:26670	1:15000
31,000	1:62000	1:45200	1:31000	1:27560	1:15500
32,000	1:64000	1:46600	1:32000	1:28450	1:16000
33,000	1:66000	1:48100	1:33000	1:29340	1:16500
34,000	1:68000	1:49500	1:34000	1:30230	1:17000
35,000	1:70000	1:51000	1:35000	1:31120	1:17500
36,000	1:72000	1:52400	1:36000	1:32010	1:18000
37,000	1:74000	1:53900	1:37000	1:32900	1:18500
38,000	1:76000	1:55400	1:38000	1:33790	1:19000
39,000	1:78000	1:56800	1:39000	1:34680	1:19500
40,000	1:80000	1:58300	1:40000	1:35570	1:20000

METRIC LINEAR MEASURE

	Meters	U. S. inches	Feet	Yards	Miles
Millimeter [1]	0. 001	0. 03937	0. 00328	....	....
Centimeter [2]	. 01	. 3937	. 03281	0. 010936	....
Decimeter	. 1	3. 937	. 32808	0. 1096	....
Meter	1.	39. 37008	3. 28084	1. 096	....
Decameter	10.	....	32. 80840	10. 936	....
Hectometer	100.	....	328. 08399	109. 36	0. 062137
Kilometer	1, 000.	....	3, 280. 83990	1, 093. 6	. 621371
Myriameter	10, 000.	....	32, 808. 39895	10, 936	6. 213712

[1] Nearly 1/25 part of an inch.
[2] Full ⅜ inch.

Millimeters × 0.03937 equals inches.
Millimeters ÷ 25.4 equals inches.
Centimeters × 0.3937 equals inches.
Centimeters ÷ 2.54 equals inches.
Meters × 39.37 equals inches.
Meters × 3.281 equals feet.
Meters × 1.094 equals yards.
Kilometers × 0.621 equals U. S. statute miles.
Kilometers ÷ 1,6093 equals U. S. statute miles.
Kilometers × 3280.84 equals feet.

TABLE FOR VISION RANGE

Aviation technicians have worked out a vision range formula to help determine how far pilots and air navigators see from their airplanes. According to this formula, the range of vision is equal to the square root of the altitude multiplied by 1.225 miles. The formula yields the following table:

	Miles
From 1,000 feet you can see	39
From 2,000 feet you can see	55
From 3,000 feet you can see	67
From 4,000 feet you can see	77
From 5,000 feet you can see	87
From 10,000 feet you can see	123
From 15,000 feet you can see	150
From 20,000 feet you can see	173
From 25,000 feet you can see	194

DECIMAL OF AN INCH AND OF A FOOT

Fractions of Inch or Foot		Inch Equivalents to Foot Fractions	Fractions of Inch or Foot		Inch Equivalents to Foot Fractions	Fractions of Inch or Foot		Inch Equivalents to Foot Fractions	Fractions of Inch or Foot		Inch Equivalents to Foot Fractions
	.0052	1/16		.2552	3 1/16		.5052	6 1/16		.7552	9 1/16
	.0104	1/8		.2604	3 1/8		.5104	6 1/8		.7604	9 1/8
1/64	.015625	3/16	17/64	.265625	3 3/16	33/64	.515625	6 3/16	49/64	.765625	9 3/16
	.0208	1/4		.2708	3 1/4		.5208	6 1/4		.7708	9 1/4
	.0260	5/16		.2760	3 5/16		.5260	6 5/16		.7760	9 5/16
1/32	.03125	3/8	9/32	.28125	3 3/8	17/32	.53125	6 3/8	25/32	.78125	9 3/8
	.0365	7/16		.2865	3 7/16		.5365	6 7/16		.7865	9 7/16
	.0417	1/2		.2917	3 1/2		.5417	6 1/2		.7917	9 1/2
3/64	.046875	9/16	19/64	.296875	3 9/16	35/64	.546875	6 9/16	51/64	.796875	9 9/16
	.0521	5/8		.3021	3 5/8		.5521	6 5/8		.8021	9 5/8
	.0573	11/16		.3073	3 11/16		.5573	6 11/16		.8073	9 11/16
1/16	.0625	3/4	5/16	.3125	3 3/4	9/16	.5625	6 3/4	13/16	.8125	9 3/4
	.0677	13/16		.3177	3 13/16		.5677	6 13/16		.8177	9 13/16
	.0729	7/8		.3229	3 7/8		.5729	6 7/8		.8229	9 7/8
5/64	.078125	15/16	21/64	.328125	3 15/16	37/64	578125	6 15/16	53/64	.828125	9 15/16
	.0833	1		.3333	4		.5833	7		.8333	10
	.0885	1 1/16		.3385	4 1/16		.5885	7 1/16		.8385	10 1/16
3/32	.09375	1 1/8	11/32	.34375	4 1/8	19/32	.59375	7 1/8	27/32	.84375	10 1/8
	.0990	1 3/16		.3490	4 3/16		.5990	7 3/16		.8490	10 3/16
	.1042	1 1/4		.3542	4 1/4		.6042	7 1/4		.8542	10 1/4
7/64	.109375	1 5/16	23/64	.359375	4 5/16	39/64	.609375	7 5/16	55/64	.859375	10 5/16
	.1146	1 3/8		.3646	4 3/8		.6146	7 3/8		.8646	10 3/8
	.1198	1 7/16		.3698	4 7/16		.6198	7 7/16		.8698	10 7/16
1/8	.1250	1 1/2	3/8	.3750	4 1/2	5/8	.6250	7 1/2	7/8	.8750	10 1/2
	.1302	1 9/16		.3802	4 9/16		.6302	7 9/16		.8802	10 9/16
	.1354	1 5/8		.3854	4 5/8		.6354	7 5/8		.8854	10 5/8
9/64	.140625	1 11/16	25/64	.390625	4 11/16		.640625	7 11/16	57/64	.890625	10 11/16
	.1458	1 3/4		.3968	4 3/4	41/64	.6458	7 3/4		.8958	10 3/4
	.1510	1 13/16		.4010	4 13/16		.6510	7 13/16		.9010	10 13/16
5/32	.15625	1 7/8	13/32	.40625	4 7/8	21/32	.65625	7 7/8	29/32	.90625	10 7/8
	.1615	1 15/16		.4115	4 15/16		.6615	7 15/16		.9115	10 15/16
	.1667	2		.4167	5		.6667	8		.9167	11
11/64	.171875	2 1/16	27/64	.421875	5 1/16	43/64	.671875	8 1/16	59/64	.921875	11 1/16
	.1771	2 1/8		.4271	5 1/8		.6771	8 1/8		.9271	11 1/8
	.1823	2 3/16		.4323	5 3/16		.6823	8 3/16		.9323	11 3/16
3/16	.1875	2 1/4	7/16	.4375	5 1/4	11/16	.6875	8 1/4	15/16	.9375	11 1/4
	.1927	2 5/16		.4427	5 5/16		.6927	8 5/16		.9427	11 5/16
	.1979	2 3/8		.4479	5 3/8		.6979	8 3/8		.9479	11 3/8
13/64	.203125	2 7/16	29/64	.453125	5 7/16	45/64	.703125	8 7/16	61/64	.953125	11 7/16
	.2083	2 1/2		.4583	5 1/2		.7083	8 1/2		.9583	11 1/2
	.2135	2 9/16		.4635	5 9/16		.7135	8 9/16		.9635	11 9/16
7/32	.21875	2 5/8	15/32	.46875	5 5/8	23/32	.71875	8 5/8	31/32	.96875	11 5/8
	.2240	2 11/16		.4740	5 11/16		.7240	8 11/16		.9740	11 11/16
	.2292	2 3/4		.4792	5 3/4		.7292	8 3/4		.9792	11 3/4
15/64	.234375	2 13/16	31/64	.484375	5 13/16	47/64	.734375	8 13/16	63/64	.984375	11 13/16
	.2396	2 7/8		.4896	5 7/8		.7396	8 7/8		.9896	11 7/8
	.2448	2 15/16		.4948	5 15/16		.7448	8 15/16		.9948	11 15/16
1/4	.2500	3	1/2	.5000	6	3/4	.7500	9	1	1.0000	12

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