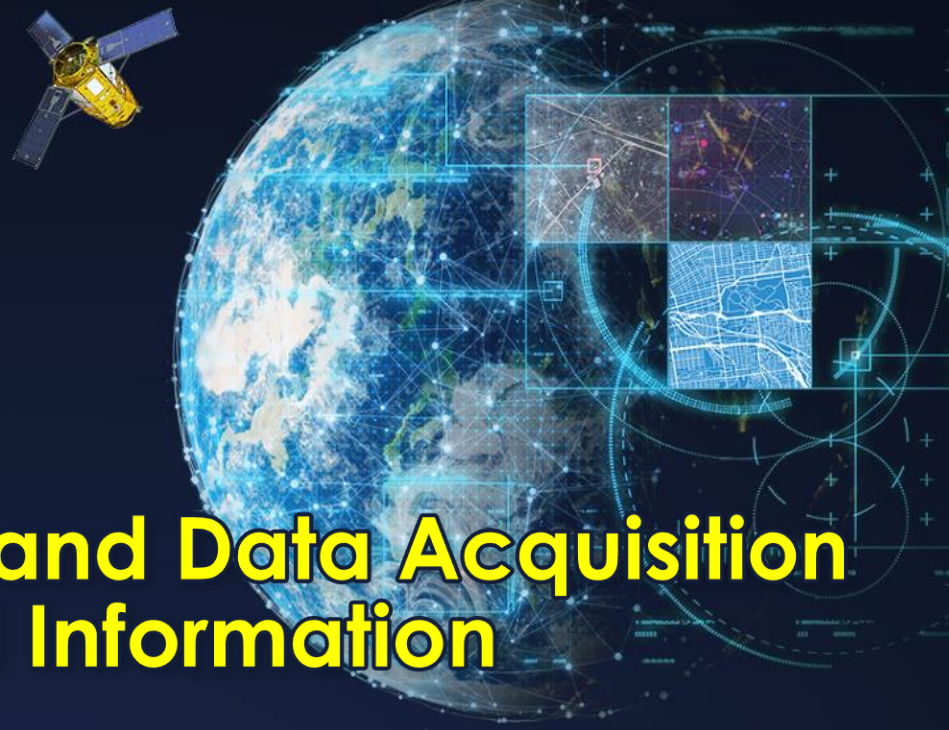
Innovative Partnerships
Exceptional Results

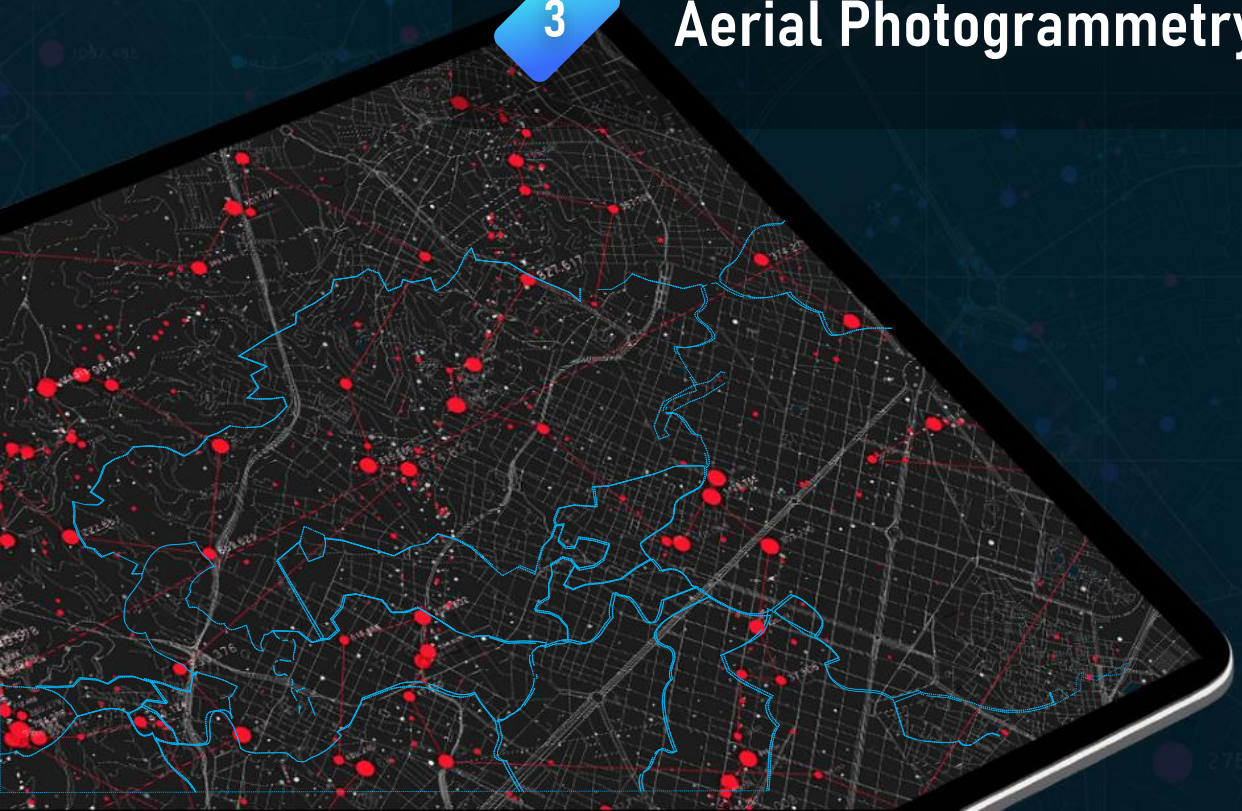
SHINHAN
Aerial Survey Co, LTD

A-1002, 33, Gwacheon-daero 7-gil, Gwacheon-si Gyeonggi-do, Republic of Korea
http://www.shas.co.kr / +82-10-2899-8712 / +82-10-9743-0418
dcan@shas.co.kr / shchoi@shas.co.kr

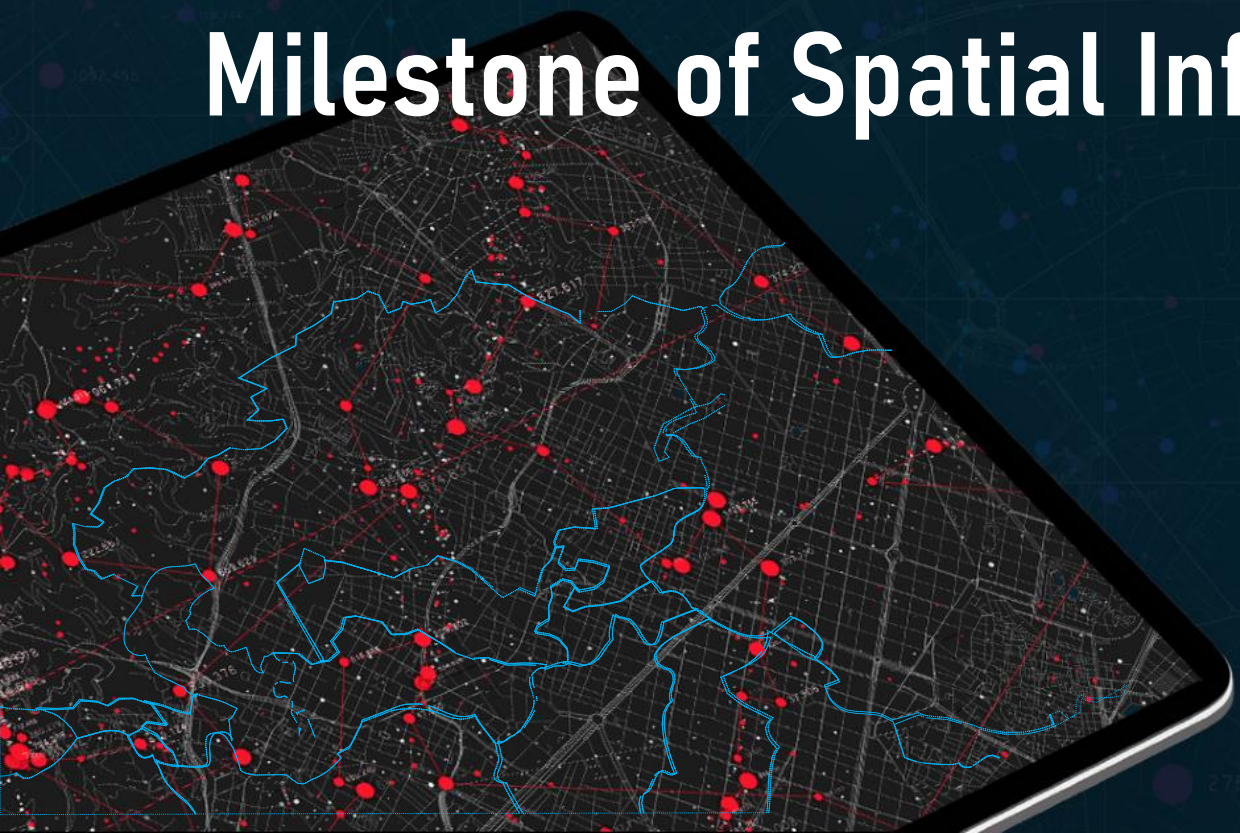


Aerial Photogrammetry and Data Acquisition for Geo-spatial Information

CONTENTS



Milestone of Spatial Info. in S.Korea



I MILESTONE OF GEOSPATIAL INFORMATION IN SOUTH KOREA

HISTORY

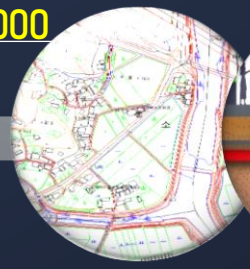
~1995

Paper Map
(1/50k, 1/2.5k, 1/5,000)

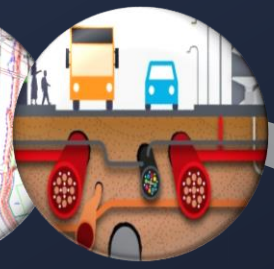
1997

Installation of
GPS Station

2000



Digital Map
(1/5,000)



Underground
Facility Map(1/5,000)

2013

Indoor 3D Map

2011

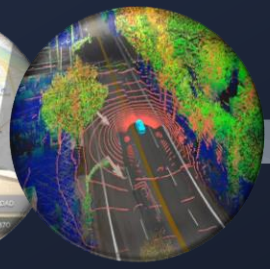
3D Topographic Map

2010

Introduction of the
World Geodetic System(WGS84)

2015

Internet Map
Service



High definition Map
for Self-driving car

2016

Free Service of
Digital Map & Aerial Photo

2020

Service of Location
Information Correction Signal

2022~

3D base Digital Twin
Modeling

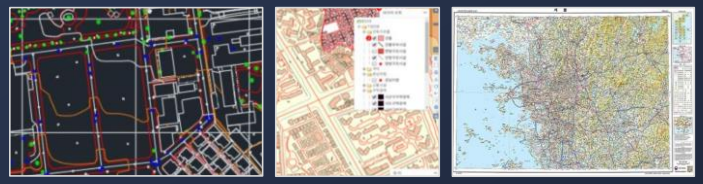
II CURRENT STATUS OF MAPS IN SOUTH KOREA

NATIONAL GEOSPATIAL INFORMATION

National Base Map

2D : 1/5,000 1/10,000/ 1/50,000 scale map

- Various scaled digital topographic map series



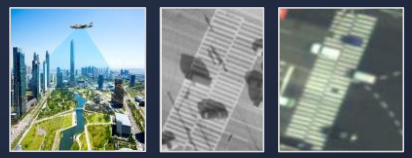
3D : LOD 2(Building, Facilities) / DEM

- 3D Visualization Models and Terrain Information

Imagery Map

Aerial photography

- Urban area: 12cm, Entire country 25cm
- Time-series aerial photographs



Orthophoto Map

- Annual updating and modernization
- Nationwide integration production

Satellite Image

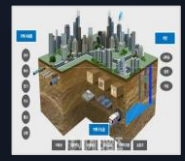
- 50cm Panchromatic band

Indoor Map

- Public facilities such as railway station and city hall

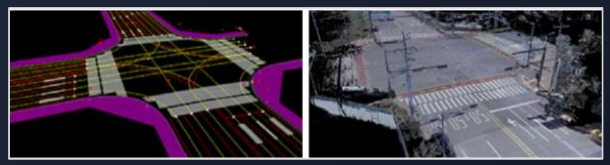
Underground Facility Map

- Underground pipeline such as water supply, sewage, electricity, communication, gas, etc.



3D Road Map

- MMS Surveying for Self-driving Car(25cm)



Internet Map

- On line Map/API services

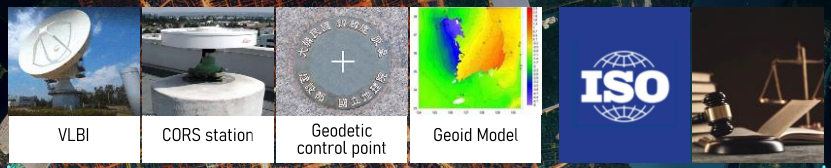
Ⅲ NATIONAL BASE MAP

NATIONAL SPATIAL DATA INFRASTRUCTURE

NSDI Enhancement/Improvement

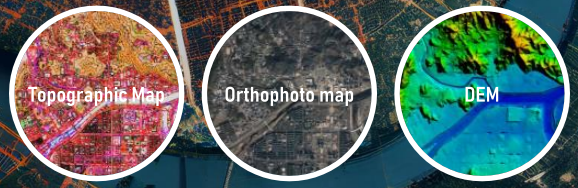
A framework of policies, standards, data, and technologies that facilitates the efficient discovery, sharing, access, and use of geospatial data and resources across an entire nation

Geodetic Network | **Law Policy**

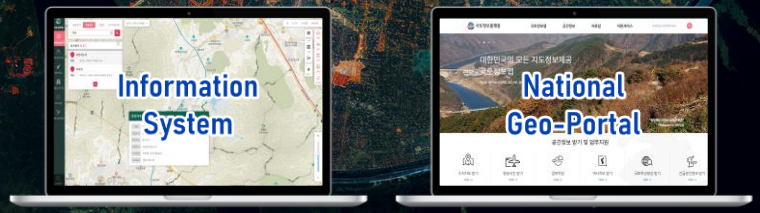


VLBI | CORS station | Geodetic control point | Geoid Model

Spatial Data Infrastructure



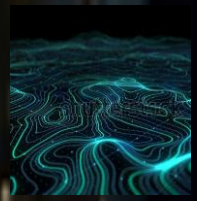
Management Sharing Distribution



- Provide it to Users such as Government, Organization, Institution, University
- Distribute it to the Data Center and Hubs

Map Service

You can check the spatial information produced by the national, public, and private sectors.



1	Map inquiry
2	Digital Topographic Map
3	Open data set
4	Flight Safety

Open Market

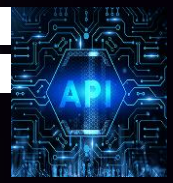
You can check the spatial information produced by the national, public, and private sectors.

1	Continuous Cadastral Map-Nationwide
2	Continuous Digital Cadastral DB
3	Integrated Information for Building
4	Digital Topographic Map v1.0
5	Seamless Integrated spatial thematic map
6	Continuous Cadastral Map-Seoul

Open API

It shares technology and services to facilitate the development of applications

1	Road Address Guide API
2	National Key Open Data API



Spatial Info. Inquiry

National Spatial Info. List surveyed annually by the Ministry of Land, as well as the spatial info provided on the Portal.

1	National Spatial Information List
2	Open Catalog of the National Spatial Information Portal

Real Estate Service

It allows users to access information related to real estate agent and development business

1	Real Estate Agent
2	Real Estate Development

Professional Knowledge

It provides the knowledge-sharing service between users and spatial experts.

1	LOD Professional Knowledge
2	Spatial Term
3	Spatial Column
4	Expert-Q/A

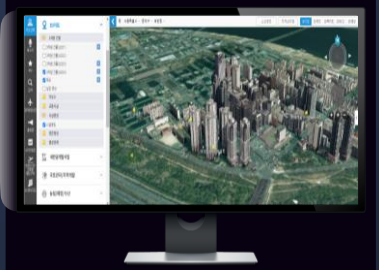
Ⅲ NATIONAL BASE MAP
SHARING AND SERVICE

Geo Portal

- Government
- Investment

GEO-Data Store
web

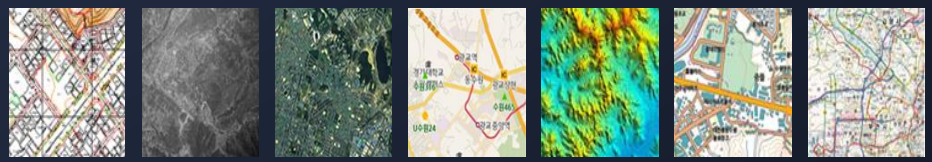
3D Modeling



- Developing company
- Consulting company

Annual Visitors ▸ 2M

Integration of Production · Management, Distribution, Utilization



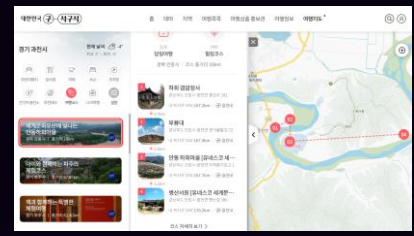
Digital Map | Aerial Photograph | Ortho-imagery | National Control Point | Open DEM | On-Map | Old Base Map

Public Administration Information

Various internet map

Life & safety map

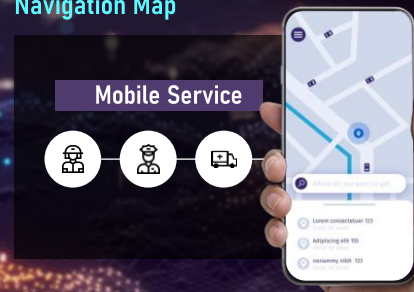
Culture/Tourist map



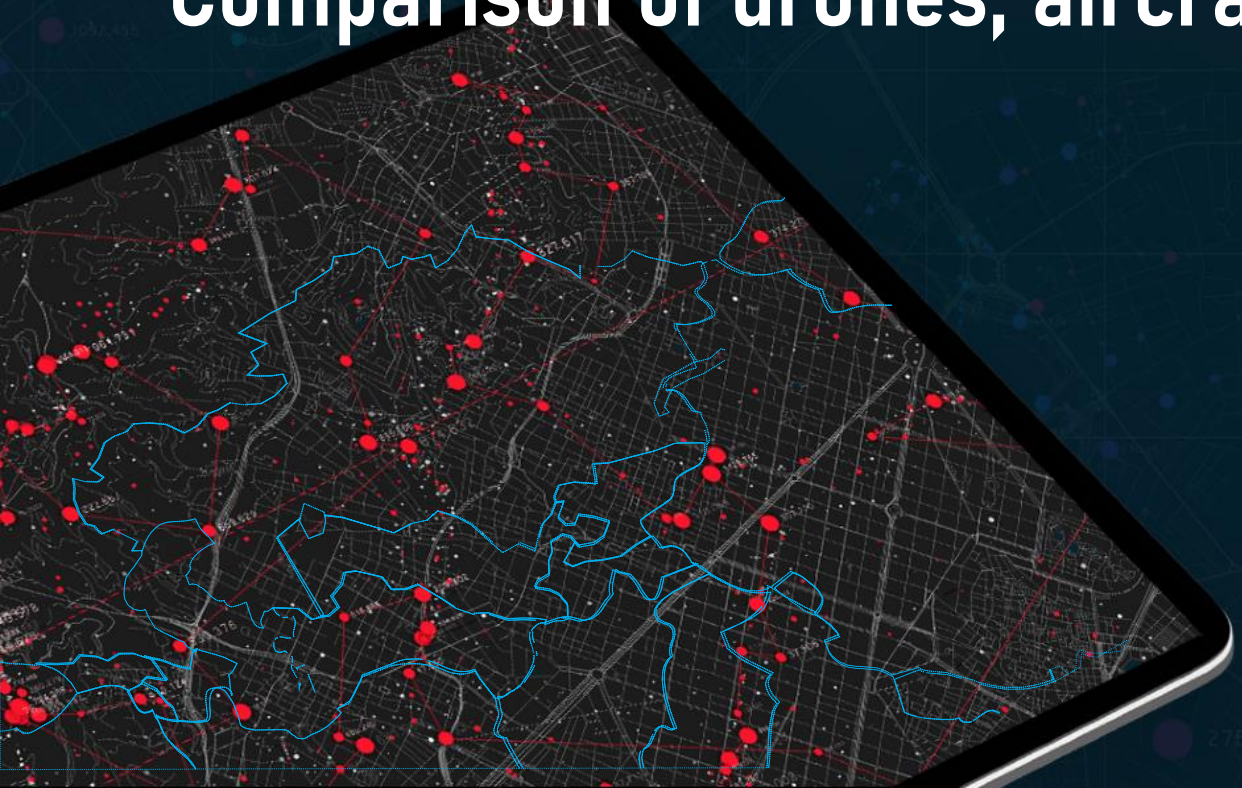
POI(Places of Interest)

- Easy to expand structure
- Easy to transfer capacity
- Using environment based on text

Navigation Map



Comparison of drones, aircraft, and satellites



VARIOUS GEO-SPATIAL INFORMATION ACQUISITION EQUIPMENT

Latest Aerial Photogrammetry Equipment

Cessna Grand Caravan 208B

Cessna Caravan 206 (Two)

ULTRACAM EAGLE MARK Ⅲ
(Vertical camera) (Two)

CityMapper-Ⅱ S
(Five-way camera + Lidar)

UAV/Drones and Integrated Mobile Mapping

Matrice UAV

Scout B-330 UAV

Mobile Mapping System
(MMS-G)

Multi Purpose Aerial Sensor/Equipment

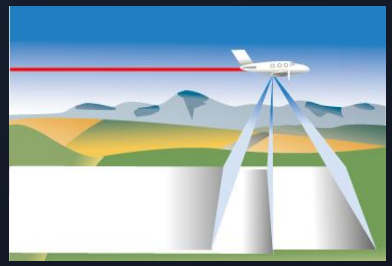
Nano-Hyperspec
(Hyper spectral camera+sensor)

Leica ALS60
(Multi sensor aerial LiDAR)

I VARIOUS GEO-SPATIAL INFORMATION ACQUISITION EQUIPMENT

DIGITAL CAMERA FOR AERIAL PHOTOGRAMMETRY

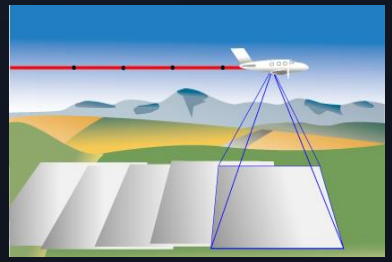
Linear Digital Camera



ADS 100

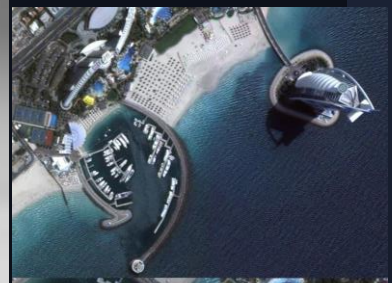
- 3 line Pushbroom Scanning
- Continuous scanning

Frame Digital Camera



ULTRACAM EAGLE MARK-3

- Frame sense
- RGB, IR(At the same time photographing is possible)



DMC-3

GSD(cm)	Flying height(m)	Swath Width (m)
3	708	772
5	1,179	1,286
10	2,359	2,573
15	3,538	3,859
20	4,718	5,146
25	5,897	6.432

II VARIOUS GEO-SPATIAL INFORMATION ACQUISITION EQUIPMENT

UTILIZATION OF KOREAN SATELLITE

Satellite Name	Resolution (m)	Swath Width (km)	Altitude/Revisit (km)	Country
KOMPSAT-2	1.0	17	685	
KOMPSAT-3	0.7	15	685	Republic of Korea
KOMPSAT-3A	0.55	15	528	
Pleiades Neo	0.3	20	630	
Pleiades	0.5	20	695	France
Vision-1	0.9	20	600	
Worldview-2	0.46	16.4	770	
Worldview-3	0.31	13.1	617	United States
GeoEye-1	0.41	15.2	681	

KOMPSAT-5
Design lifetime : 5 years Oct 2013 ~
1.0 m SAR Payload
LTAN : 6:00 (18:00)

KOMPSAT-2
Design lifetime : 3 years July 2006
~
1.0 m EO Payload
LTAN : 10:50

KOMPSAT-3
Design lifetime : 4 years May 2012
~
0.7 m EO Payload
LTAN : 13:30

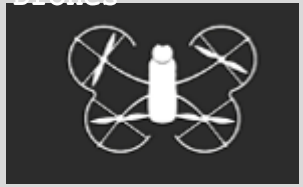
KOMPSAT-3A
Design lifetime : 4 years
March 2015 ~
0.55 m EO & 5.5 m IR Payload
LTAN : 13:30

II VARIOUS GEO-SPATIAL INFORMATION ACQUISITION EQUIPMENT

UTILIZATION OF FRENCH / USA SATELLITE

III VARIOUS GEO-SPATIAL INFORMATION ACQUISITION EQUIPMENT

TYPE OF DRONES BY OPERATION

	Fixed-Wing Drones	Multirotor Drones
Classification		
Project	Mapping	Small area mapping & inspection
Applications	Land surveying(rural), Agriculture, GIS, Mining, Environmental mgt, Construction, Humanitarian	Inspection, cinematography/videography, real estate, surveying(urban), construction, emergency response, law enforcement
Cruising Speed	High	Low
Coverage	Large	Small
Object Resolution	cm/inch per pixel	mm per pixel
Take-off/ Land area	Large	Very small
Flight time& Wind resistance	High	Low

Camera	Sensor Size (mm)	Focal Length (mm)	GCD @ 120m cm/pixel
Phantom 4 Pro	20.1	12.8 x 9.6	3.2
Canon 5Ds	50.6	36 x 24	With 35mm lens 0.9471
DJI Zenmuse X4S	20.1	12.8 x 9.6	3.3
Sony RX100 VI	20.13	24-70	3.3=2.15

Phantom 4 Pro

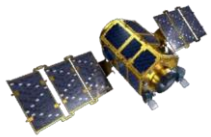
Canon 5Ds

DJI Zenmuse X4S

Sony RX100 VI

VARIOUS GEO-SPATIAL INFORMATION ACQUISITION EQUIPMENT

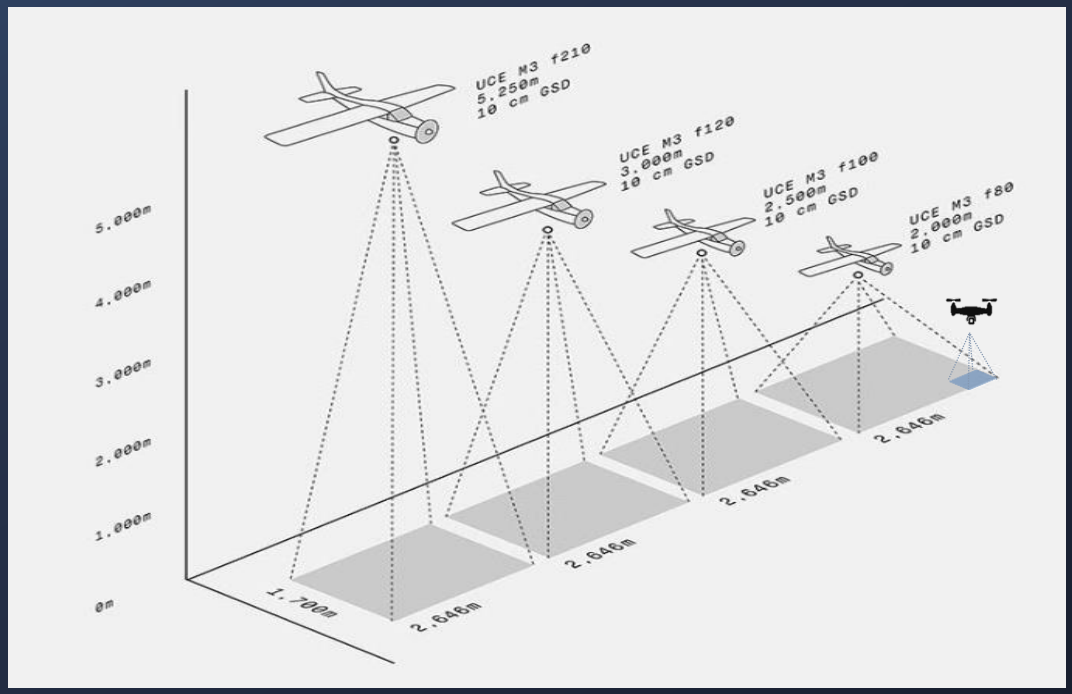
COMPARISON BETWEEN SURVEYING METHOD

System Name	Utilization	Advantages	Disadvantages
TS/GNSS 	▪ Mapping for small area ▪ Complementary Surveying of Aerial Photogrammetry	▪ Cost savings of small area surveying ▪ High Accuracy	▪ Wider Area -> Expensive Cost/Long time ▪ Increase of Inaccessible Area
Drone 	▪ Mapping for small area (Under 5km²) ▪ Making of Imagery Map	▪ "Saving time and cost for areas under 5km². ▪ Faster surveying than TS/GNSS	▪ Unable to capture wide areas due to battery life limitations (requires many drones). ▪ Increased installation of GCPs for wide area surveys leads to higher costs.
Aircraft 	▪ Making of National Base Map(Big, Middle, Small Scale) ▪ Making of Imagery Map	▪ Observation to the wide area ▪ Uniformity of Accuracy ▪ Inaccessible areas -> Possible	▪ Expensive Cost ▪ Delay of Aerial Photographing(Weather)
Satellite 	▪ Mapping for no fly area ▪ Mapping(Middle, Small Scale) ▪ Making of Imagery Map	▪ Observation to the all area ▪ Low Cost ▪ One scene -> Covering a wide area	▪ Accuracy and Uniformity less than Aerial Photogrammetry ▪ Relatively Low Resolution

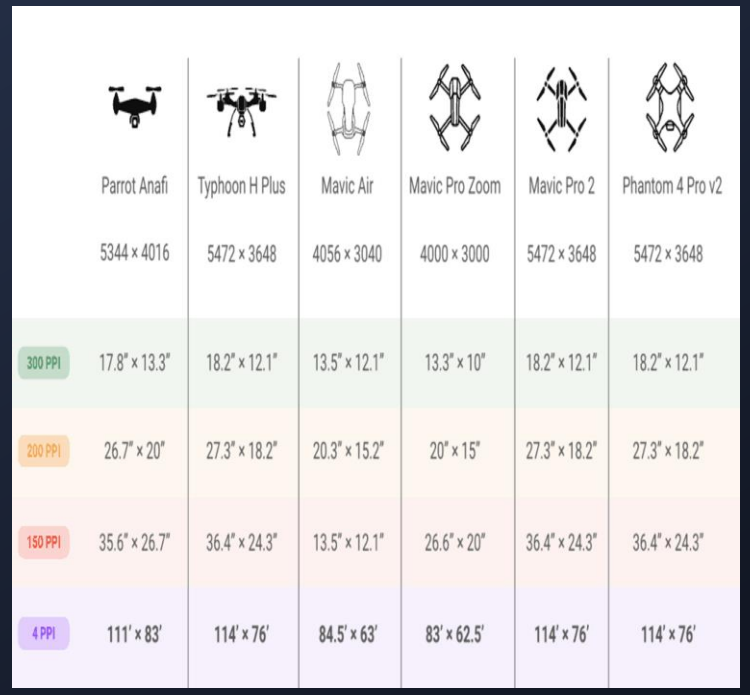
VARIOUS GEO-SPATIAL INFORMATION ACQUISITION EQUIPMENT

MANNED AIRCRAFT VS DRONE FOR AERIAL PHOTOGRAPHY

Aerial Photogrammetry with UltraCAM Mark 3



Aerial Photogrammetry with Drones



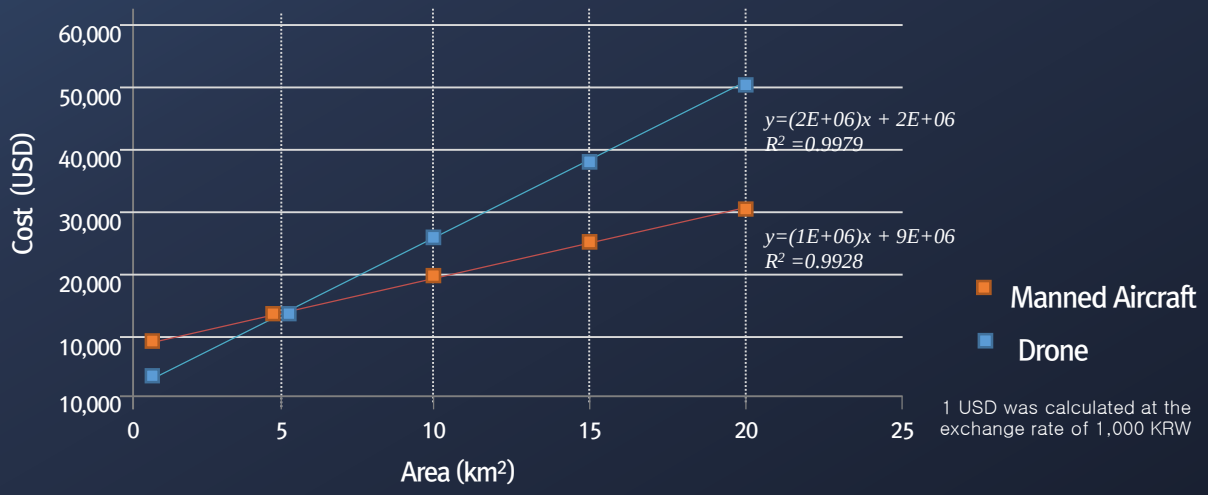
	Parrot Anafi	Typhoon H Plus	Mavic Air	Mavic Pro Zoom	Mavic Pro 2	Phantom 4 Pro v2
	5344 × 4016	5472 × 3648	4056 × 3040	4000 × 3000	5472 × 3648	5472 × 3648
300 PPI	17.8" × 13.3"	18.2" × 12.1"	13.5" × 12.1"	13.3" × 10"	18.2" × 12.1"	18.2" × 12.1"
200 PPI	26.7" × 20"	27.3" × 18.2"	20.3" × 15.2"	20" × 15"	27.3" × 18.2"	27.3" × 18.2"
150 PPI	35.6" × 26.7"	36.4" × 24.3"	13.5" × 12.1"	26.6" × 20"	36.4" × 24.3"	36.4" × 24.3"
4 PPI	111' × 83'	114' × 76'	84.5' × 63'	83' × 62.5'	114' × 76'	114' × 76'

-	UltraCAM	Parrot	Typhoon	Mavic	Mavic Pro	Marvic Pro2	Phantom4
Panchromatic GSD	5cm~	7cm~	7cm~	8cm~	7cm~	7cm~	7cm~
Land area (GSD : 10cm)	4.50km^2	0.21km^2	0.20km^2	0.12km^2	0.12km^2	0.20km^2	0.20km^2
Estimated Model(400km2)	234 (models)	4,881	5,248	8,496	8,730	5,248	5,248
Qty of GCP per 6 model	69 (GCPS)	942	1,054	1,624	1,642	1,054	1,054

VARIOUS GEO-SPATIAL INFORMATION ACQUISITION EQUIPMENT

MANNED AIRCRAFT VS DRONE FOR AERIAL PHOTOGRAPHY

Comparison of Direct Labor Cost between Manned Aircraft and Drone



1 USD was calculated at the exchange rate of 1,000 KRW

For Control Point Surveying,

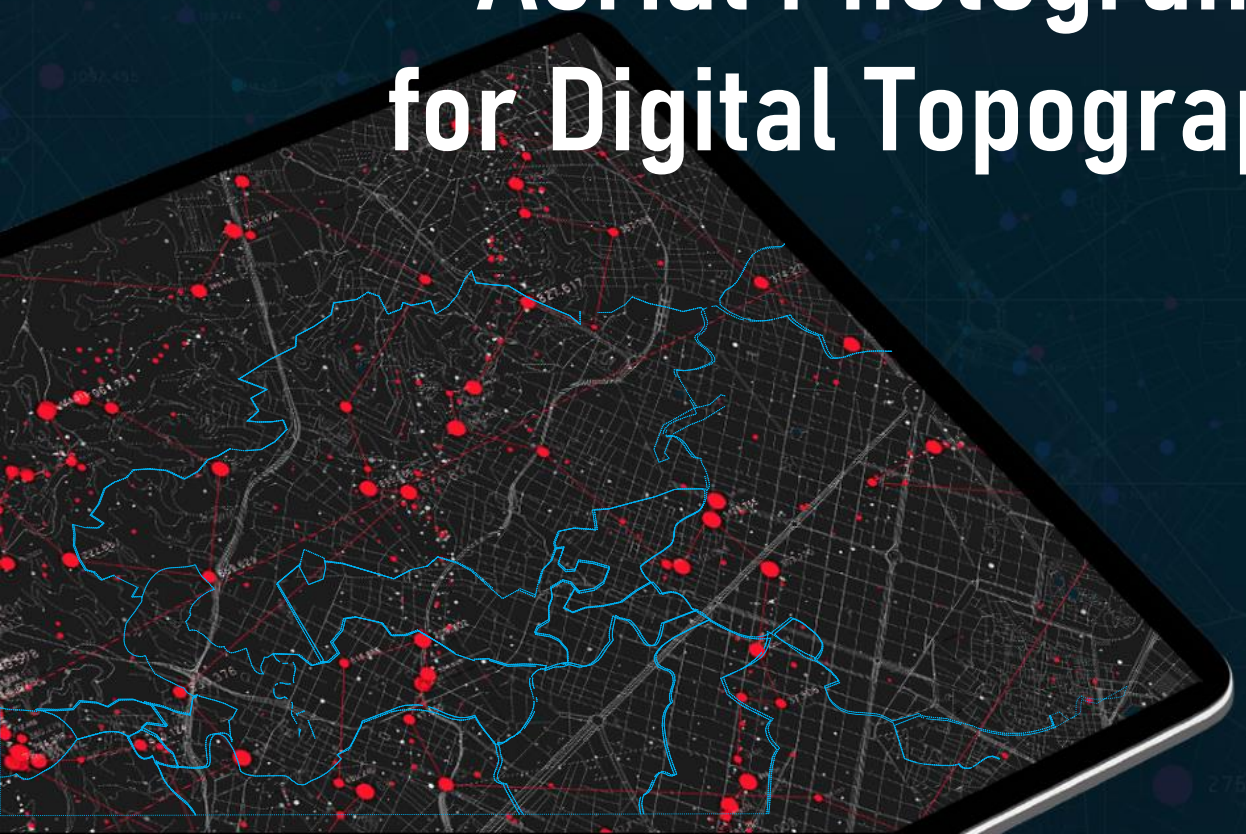
- ~ 5 km², Drone is economical
- 5 km² ~, Manned Aircraft is economical
- If only drones are only used, then cost increases 'EXPONENTIALLY'

5 km² ~10km² : Drone is **26%** expensive
10km² ~15km² : Drone is **32%** expensive
15km² ~20km² : Drone is **40%** expensive

For Producing topographic map,

- ~ 2 km², Drone is economical
- 2 km² ~, Manned Aircraft is economical
- Generally, Drone is suitable for small areas of 1km² to 2 km²
- Generally, Manned Aircraft is suitable for large areas of 10 km² to 100 km²

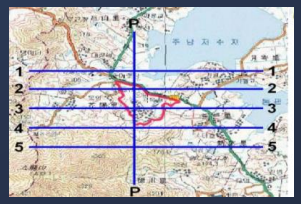
Aerial Photogrammetry for Digital Topographic Map

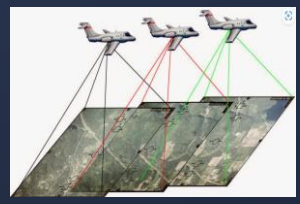


I WORK-FLOW FOR NATIONAL BASE MAP

Project Scope

Planning & Design > Photography / Imagery > GCP surveying > Arial Triangulation > 3D Stereo Plotting > Geographic Survey > Cartographic Works > Topo Map / Geo DB > National Base Map





Planning — Step 01

Aerial Photographing — Step 02

Ground control points (GCP) — Step 03

Aerial Triangulation — Step 04

Step 05

Stereo Plotting

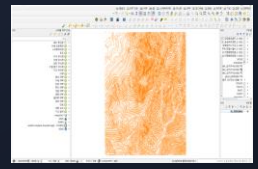
Step 06 — Data conversion

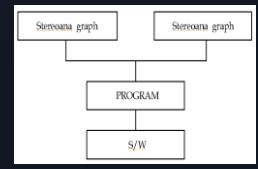
Step 07 — Field Identification

Step 08 — Editing Map

Step 09 — Check of Mapping quality

Step 10 — Completion Mapping





Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

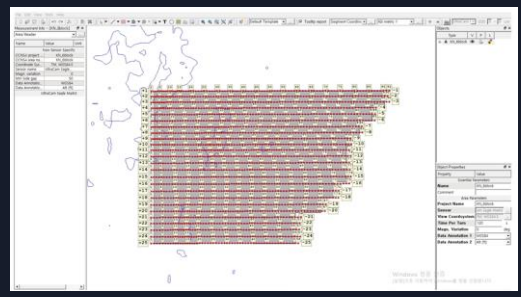
SETUP PLANNING

Workflow Chart

- Planning
- Aerial Photographing
- Ground Control Points(GCP)
- Aerial Triangulation
- Stereo Plotting
- Data Conversion
- Field Identification
- Editing Map
- Check of Mapping quality
- Completion Mapping

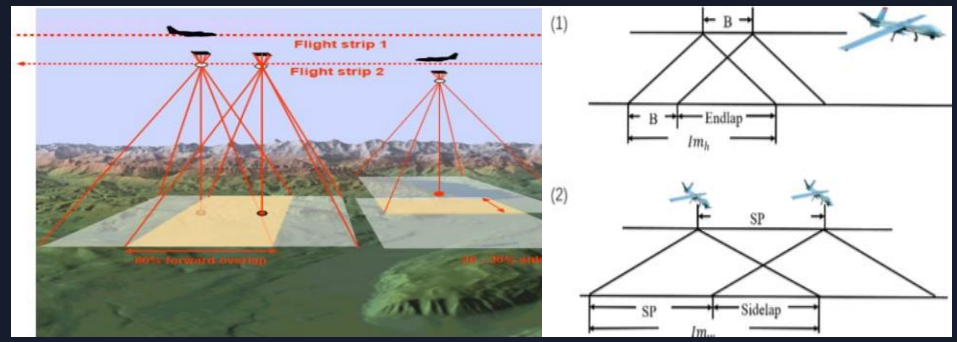
Setup Planning

Location
Amount of work
Duration
Purpose
Scale
Accuracy
Instruments
Atmospheric Conditions



Airplane
Scale of aerial photograph
Flying height and velocity
Aerial camera calibration
Photographing period
Photographing course
Overlap of aerial photograph
Number of course and photographs

Permission for Aerial Photographing



Resolution	Flight Course Distance	# of courses	# of images	Note
Within 12cm	6,464.98km	207	14,240	Ultracam Eagle Mark3-F100

Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

AERIAL PHOTOGRAPHY

Workflow Chart

- Planning
- **Aerial Photographing**
- Ground Control Points(GCP)
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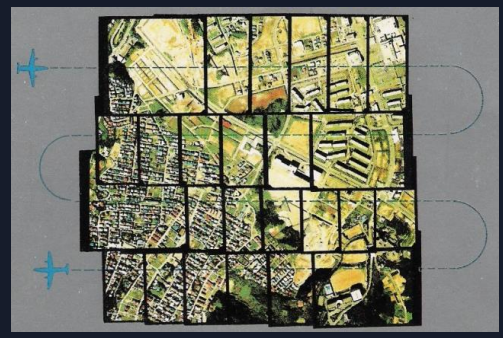
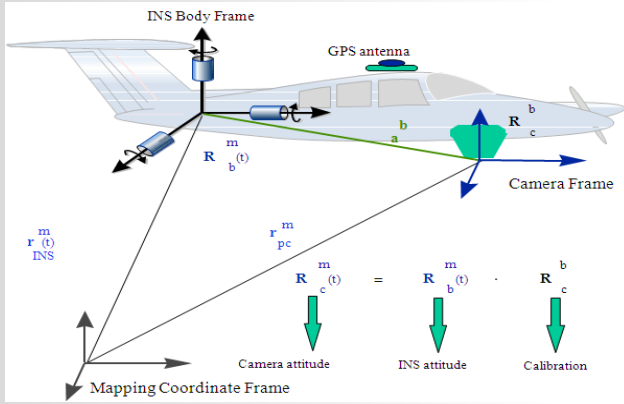
- Check of Mapping quality
- Completion Mapping

Aerial Photographing

"According to the Aerial Surveying Regulations," longitudinal overlap should be set at 60% in the direction of flight, while lateral overlap should be set at 30%



Principle of GPS/INS



Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

AERIAL PHOTOGRAPHY

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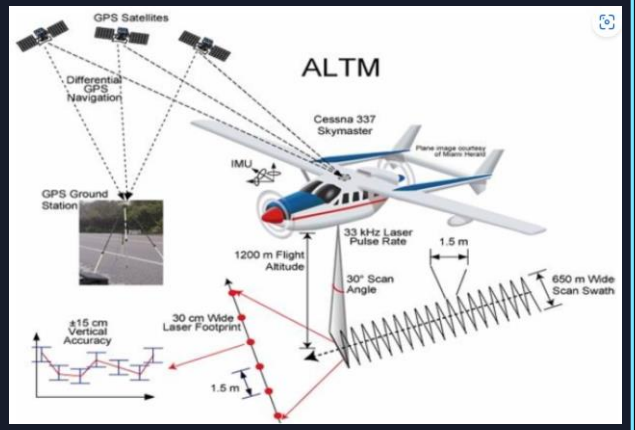
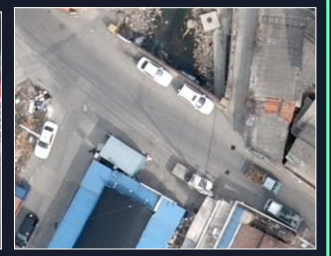
Scale of plotting vs. Scale of photograph and GSD

Scale of Plotting	Scale of Photograph	GSD (less than)
1/500 ~ 1/600	1/3,000 ~1/4,000	8 cm
1/1,000 ~ 1/1,200	**1/5,000 ~ 1/8,000**	**12 cm**
1/2,500 ~ 1/3.000	1/10,000 ~ 1/15,000	25 cm
1/5,000	1/18,000 ~ 1/20,000	42 cm
1/10,000	1/25,000 ~ 1/30,000	65 cm
1/25,000	1/37,500	80 cm

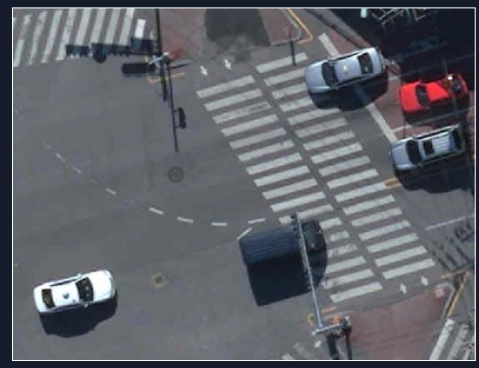


Ground Sampling Distance

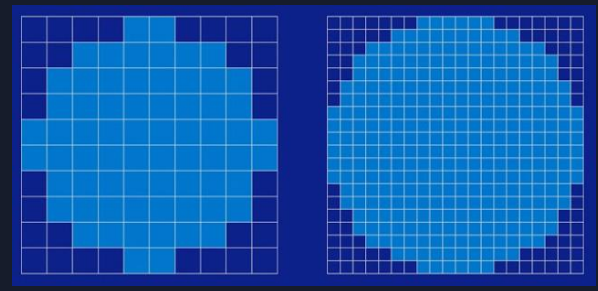
1/2,500 (GSD 25cm)



1/1,000 (GSD 10cm)



1/500 (GSD 5cm)



Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

GROUND CONTROL POINTS(GCP)

Workflow Chart

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Maintenance of Coordinate System

Accuracy : mm
1 point

Accuracy : cm
16,412 points

Accuracy : cm
92 points

Accuracy : cm
4,282 points

Accuracy : cm
7,300 points

Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

GROUND CONTROL POINTS(GCP)

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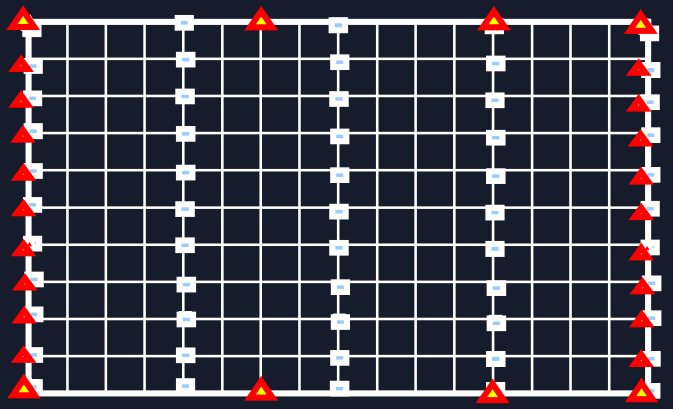
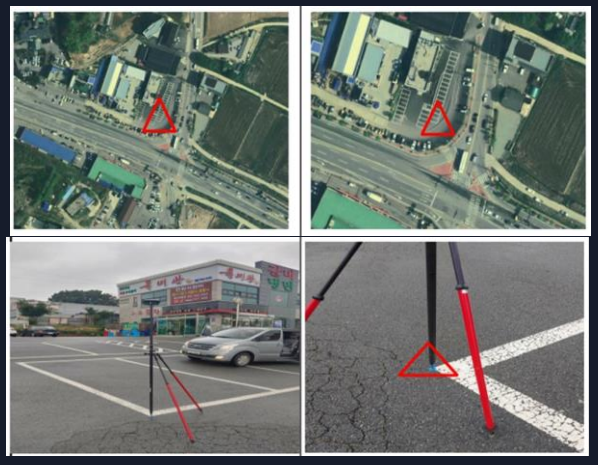
GCP Surveying

Current Survey of Control Points for Ground Reference

Observation Instruments, Method of surveying, Kind of GCP, Accuracy of GCP, Number of GCP, Location of GCP





Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

AERIAL TRIANGULATION

Workflow Chart

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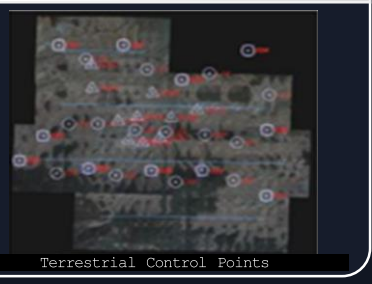
Aerial Triangulation

Flow chart of Photo Control Point Surveying

- Point generation
- Image pyramid generation
- Terrestrial control point Input
- Measurement & adjustment for photo control surveying
- Quality Check

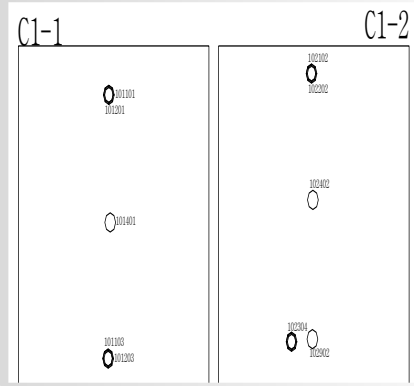
Aerial Photogrammetry Index



Terrestrial Control Points

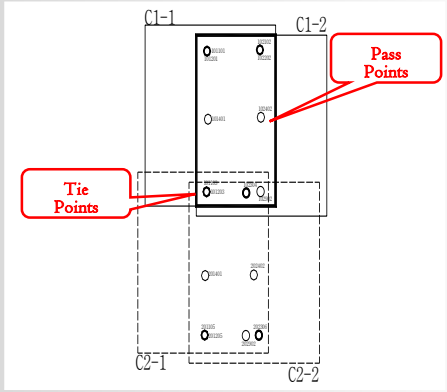
The procedure for aerial triangulation point selection

1. Position of aerial triangulation point



- It is positioned 3cm above and 3 cm below the centerline.

2. Position of aerial triangulation point



- Requires min. 6pts.
- Pre-survey is necessary in case of observation uncertainty or relocation of points
- The accuracy of points determines the accuracy within the block.

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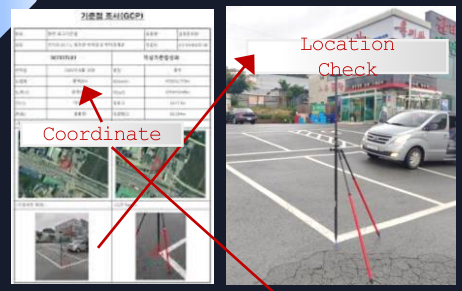
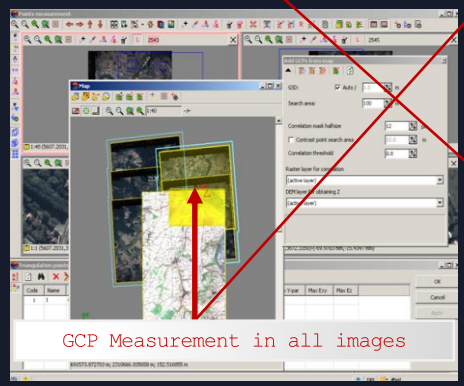
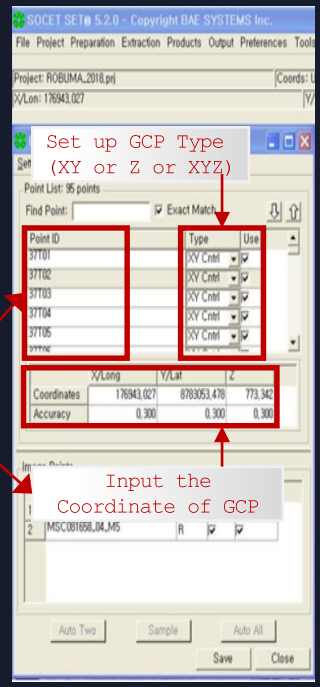
PROJECT(AT BLOCK) Setting / Data Processing and Loading/Input

Project Setting	Data Processing	Data Loading/Input
1. Coordinate System 2. Ground Sample Distance 3. Geoid Model	1. Image Pyramid 2. Digital Elevation Model Crop	1. Processed Image loading 2. GNSS/INS(Interior Orientation) 3. Camara parameter 4. GCP list and coordinate

GCP measurement







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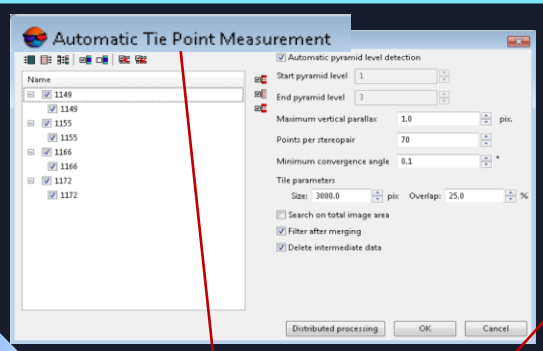
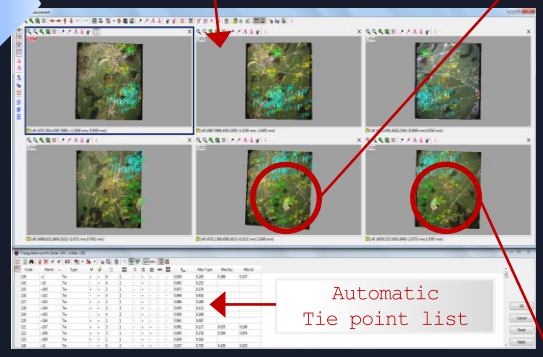
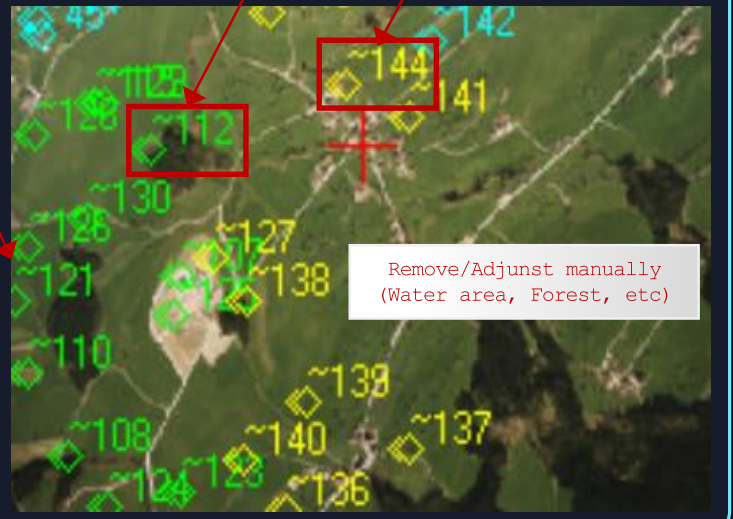
TIE Point measurement (Automatic/Manual)







Strips: 2—1 Inter-Strip

Stereopair	Number of points	Vertical parallax, pix. RMS	Mean abs.	Max	Discrepancy of kappa angle, rad
R10_S05—R09_S87	24	0.319	0.263	0.643	-0.02176829
R10_S06—R09_S86	35	0.319	0.239	0.935	-0.03199809
R10_S07—R09_S85	16	0.260	0.219	0.532	-0.05611179

Strip: 2 In-Strip

Stereopair	Number of points	Vertical parallax, pix. RMS	Mean abs.	Max	Discrepancy of kappa angle, rad
R10_S05—R10_S06	66	0.276	0.206	0.912	0.00682889
R10_S06—R10_S07	56	0.335	0.256	0.963	0.03222982

Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

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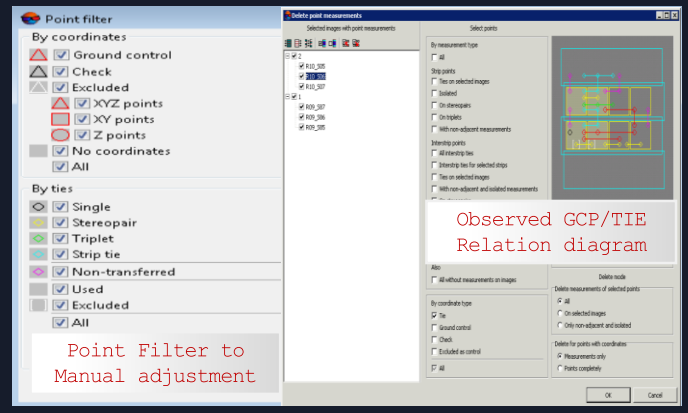
Calculation / Adjustment

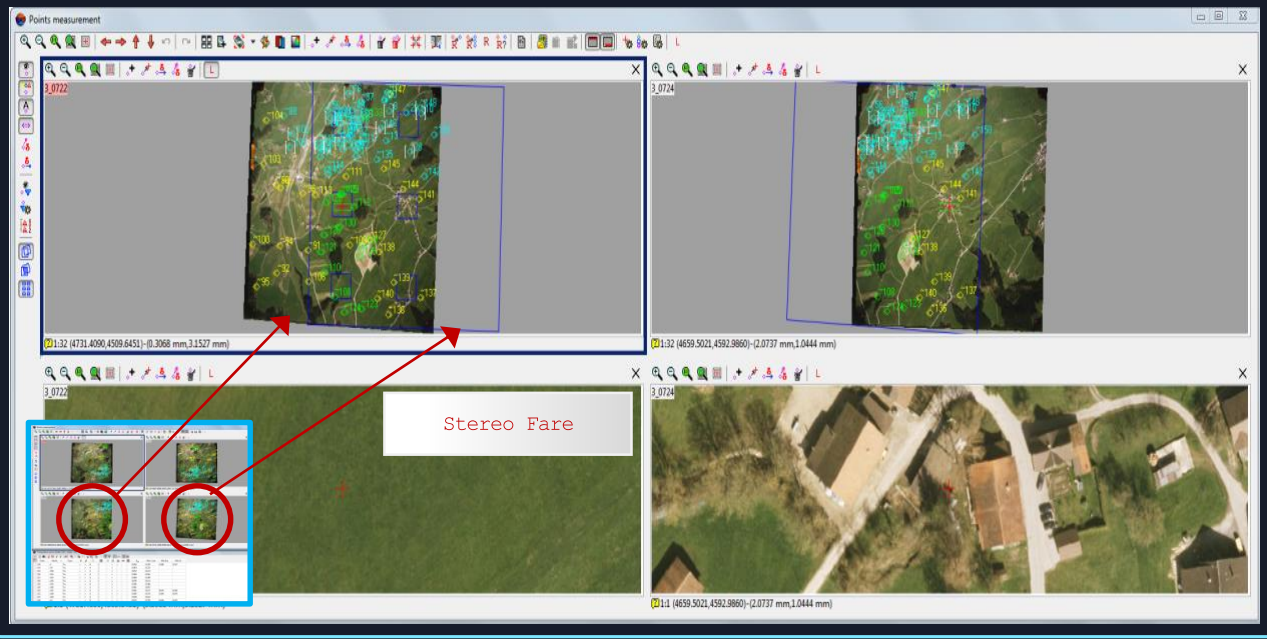
GROUND POINT PARAMETERS

Image ID, Ground Pt	Number Images	Parameter Name	Original Value	Original Sigma	Residual Value	Adjusted Value	Adjusted Sigma
GCP_L098	2x(	Z Cntrl)	550968.786	10000.000	0.292	550969.078	no sigma
	y		8326473.476	10000.000	-0.060	8326473.416	no sigma
	z		309.911	0.100	0.048	309.959	no sigma
GCP_T099	2x (	XY Cntrl)	512078.273	0.100	0.008	512078.282	no sigma
	y		8324215.944	0.100	-0.022	8324215.922	no sigma
	z		321.910	10000.000	-0.386	321.524	no sigma
GCP_L099	2x (	Z Cntrl)	512077.528	10000.000	1.393	512078.921	no sigma
	y		8324208.019	10000.000	0.163	8324208.182	no sigma
	z		322.041	0.100	-0.052	321.989	no sigma

RMS x ==> 0.073
RMS y ==> 0.117
RMS z ==> 0.032
Total RMS ==> 0.099

Calculation → Report Check(RMS) → Adjunstment → Calculation





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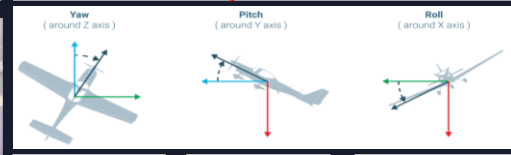
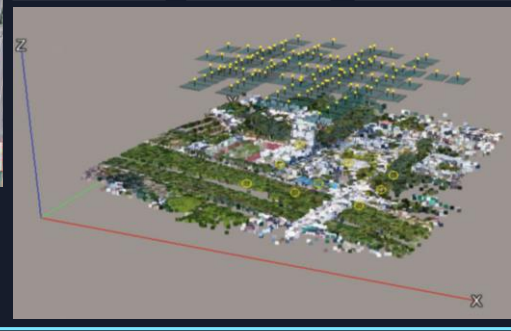
Export EO(Exterior Orientation)

1	CON	X	Y	Z	Omega	Phi	Kappa
2	0001_0059	134674.113	322755.801	2309.543	0.01082	-0.19404	-0.62289
3	0001_0060	135123.356	322754.904	2313.161	0.02325	-0.18700	-0.71258
4	0001_0061	135582.577	322753.494	2317.107	-0.00416	-0.18252	-0.60546
5	0001_0062	136038.598	322752.757	2321.031	0.01138	-0.18516	-0.66015
6	0001_0063	136502.477	322753.118	2317.426	0.01817	-0.20805	-0.66164
7	0001_0064	136963.061	322755.554	2310.673	0.04291	-0.21147	-0.70102
8	0001_0065	137419.445	322757.305	2306.365	-0.01454	-0.22079	-0.71262
9	0001_0066	137879.647	322756.204	2304.316	0.00318	-0.17458	-0.65440
10	0001_0067	138337.128	322753.830	2302.589	0.01517	-0.19527	-0.62181

Course_Snap No. | Position(North-East-Orthogonal Height) | Orientation during the image acquisition



Z = Kappa | Y = Phi | X = Omega



Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

STEREO PLOTTING

Workflow Chart

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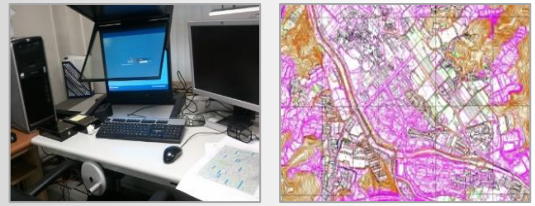
Stereo Plotting

Plotting

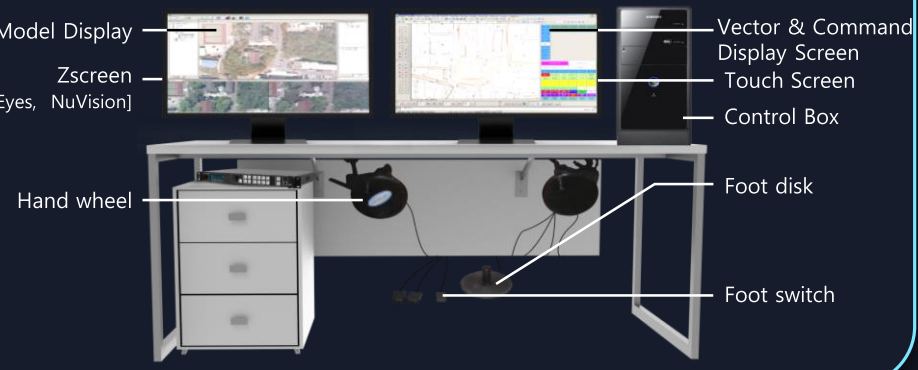
Measure the topography natural feature using aerial photographs from the machine refers to the description and coordinates survey and image interpretation

Digital plotter



Scale of Stereo plotting	Standard deviation			Max. Tolerance		
	Plane Coor.	Contour	Elevation Pts.	Plane Coor.	Contour	Elevation Pts
1/500	0.1 0m	0.20m	0.1 0m	0.20m	0.40m	0.20m
1/1,000	0.20m	0.30m	0.15m	0.40m	0.60m	0.30m
1/5,000	1.00m	1.00m	0.50m	2.00m	2.00m	1.00m
1/10,000	2.00m	2.00m	1.00m	4.00m	3.00m	1.50m
1/25,000	5.00m	3.00m	1.50m	10.00m	5.00m	2.50m

DEM/DTM자료 육안 확인 수정



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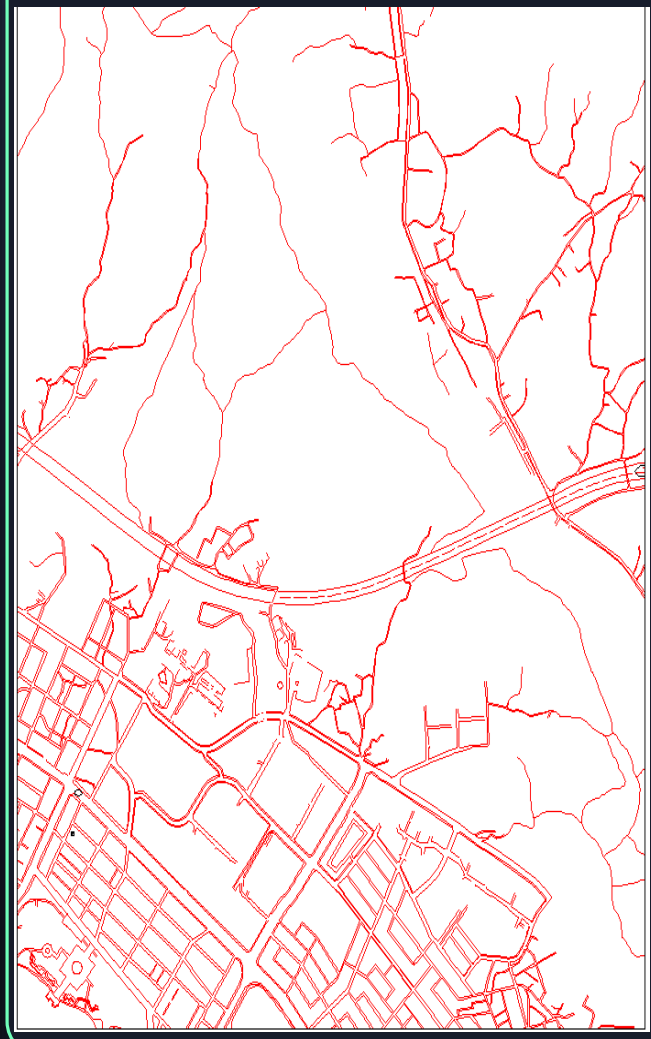
Order of Plotting

1. Road, Railroad
2. River, Waterway
3. Building
4. Tributary
5. Topography & Natural feature
6. contour
7. Height

Stereo Plotting



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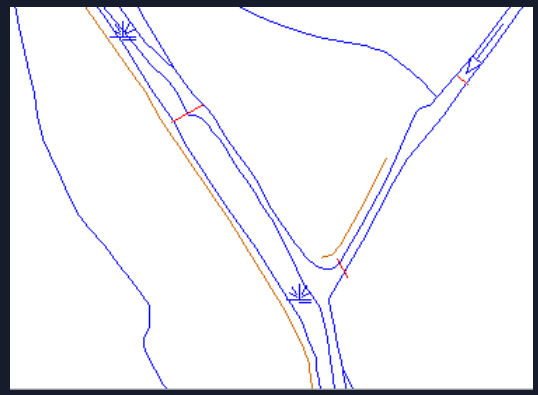
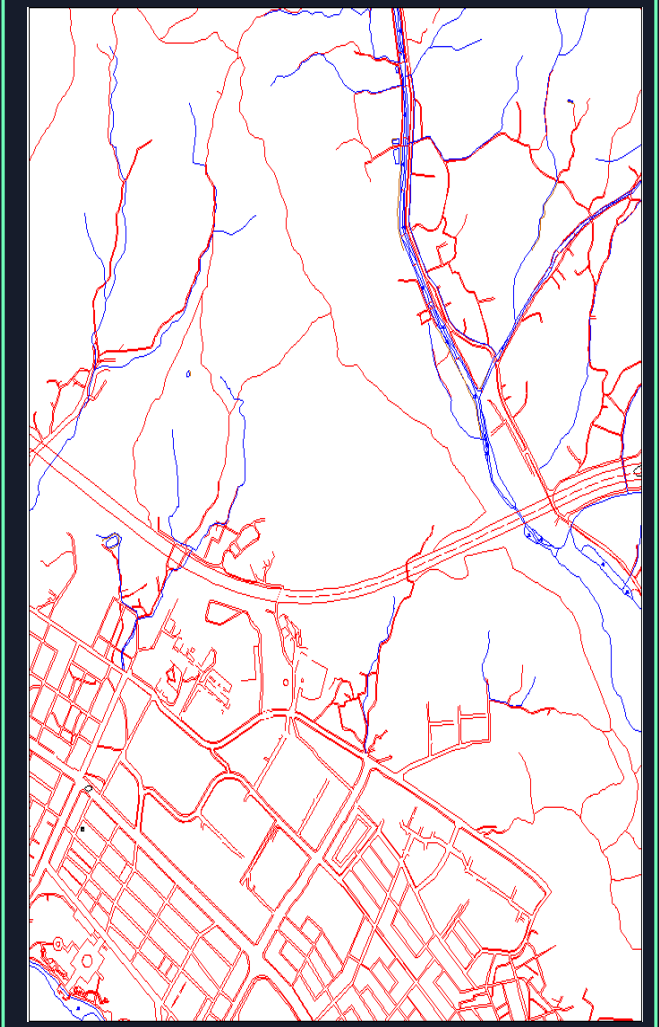


Stereo Plotting



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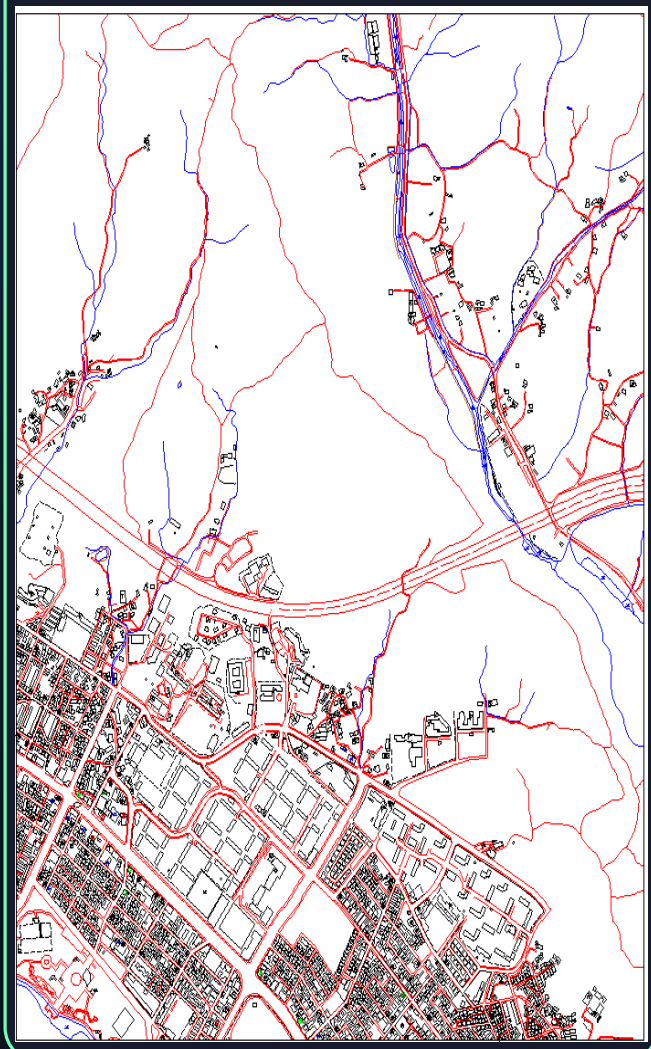
Stereo Plotting



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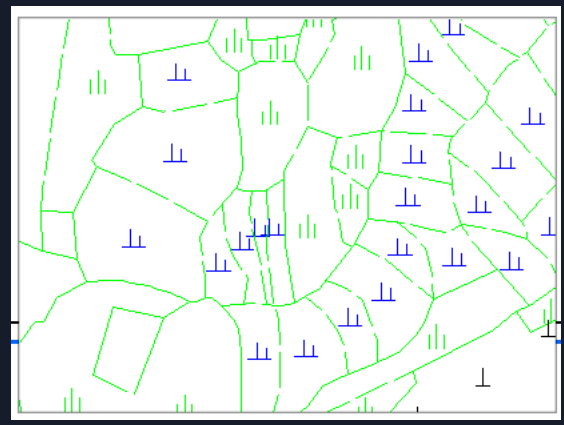
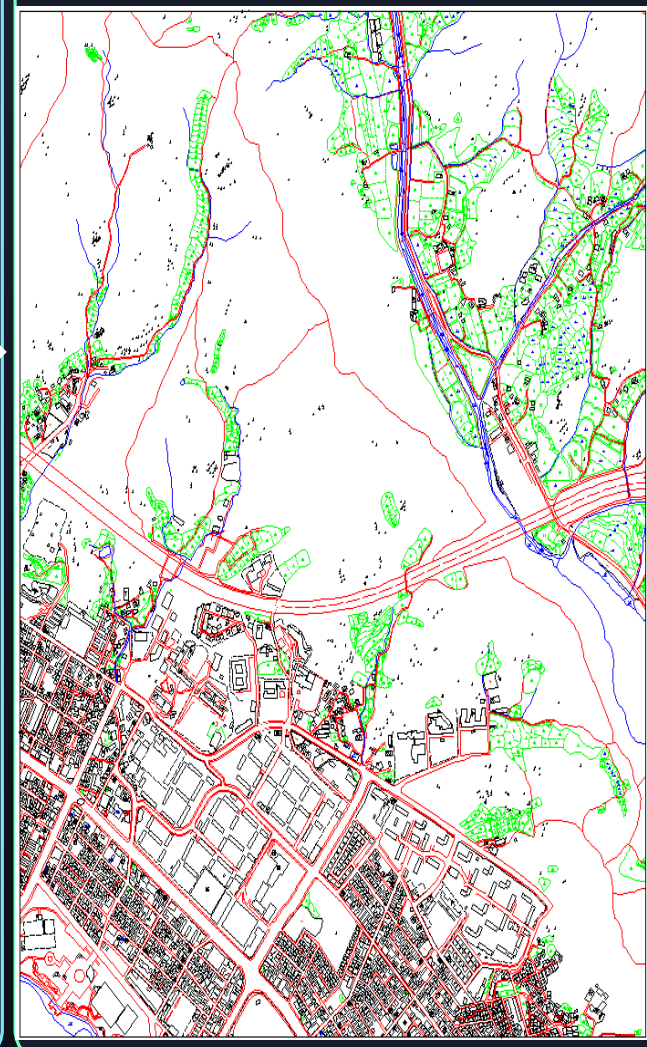


Stereo Plotting



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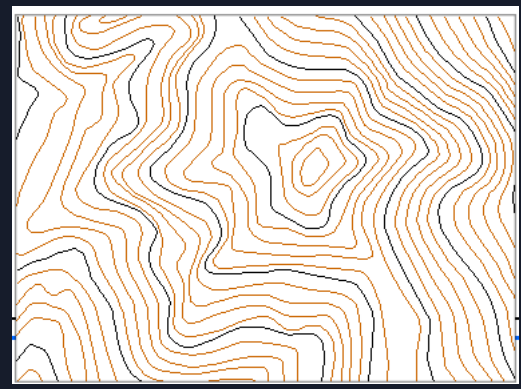
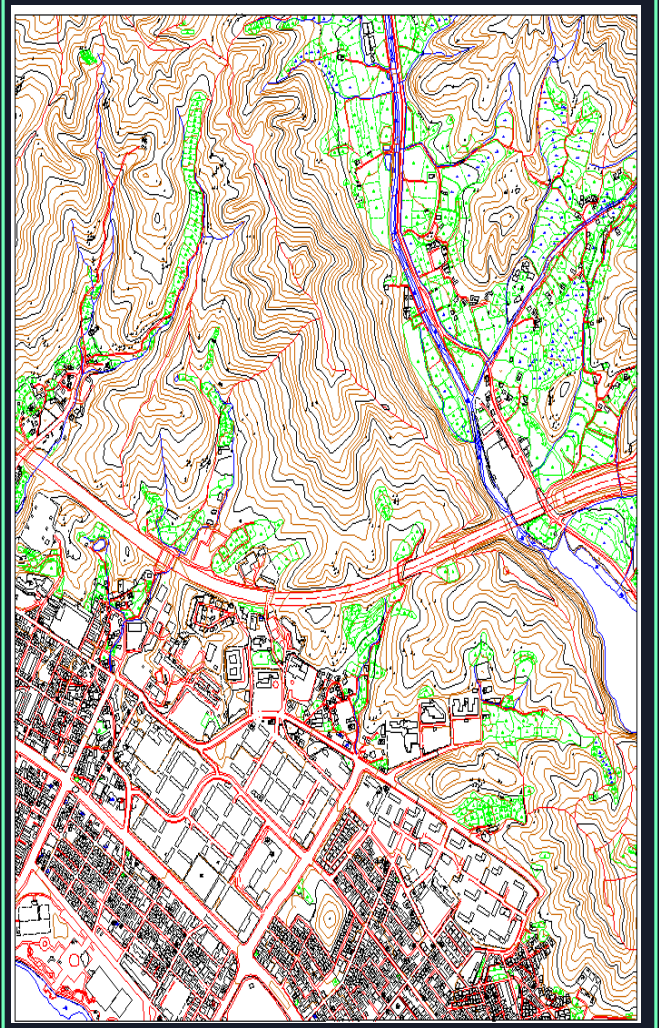


Stereo Plotting



Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

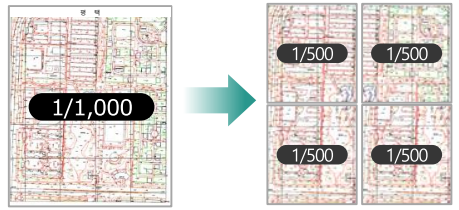
FIELD IDENTIFICATION

Workflow Chart

- Planning
- Aerial Photographing
- Ground Control Points(GCP)
- Aerial Triangulation
- Stereo Plotting
- Data Conversion
- **Field Identification**
- Editing Map
- Check of Mapping quality
- Completion Mapping

Field Identification

1. Geospatial Survey Map Printing (1/500)



2. Field Identification

Example

Field Identification

Field identification cannot be described and depicted solely through plotting instruments; it requires surveying and identification in the field.

Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

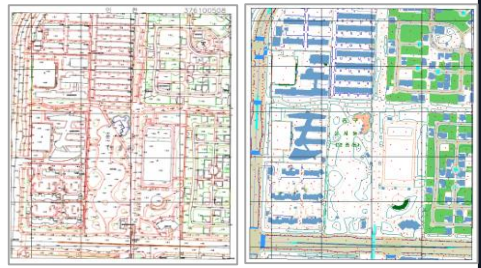
EDITING MAP

Workflow Chart

- Planning
- Aerial Photographing
- Ground Control Points(GCP)
- Aerial Triangulation
- Stereo Plotting
- Data Conversion
- Field Identification
- **Editing Map**
- Check of Mapping quality
- Completion Mapping

Editing Map

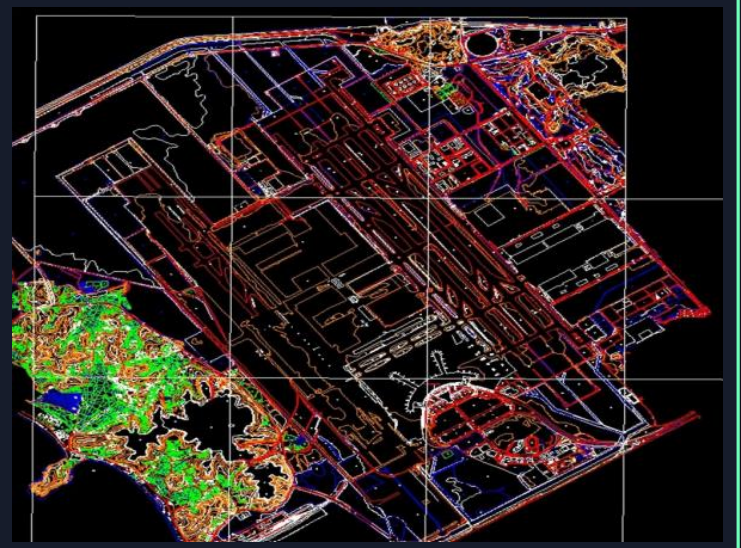
1. Georeferencing/ Structurization



2. Continuous Data Compilation

Example

Editing Map



The construction of a digital map involves using software such as AutoCAD to apply standard codes and schemas for inputting data, including plotting results and field identification.

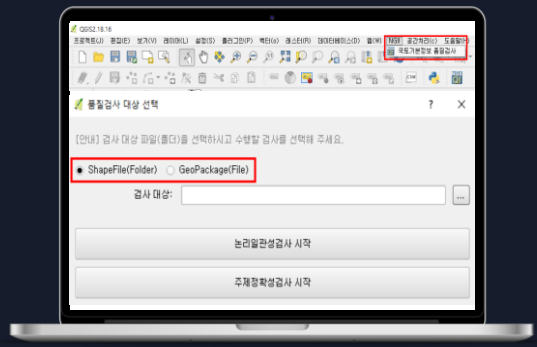
Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

CHECK OF MAPPING QUALITY

Workflow Chart

- Planning
- Aerial Photographing
- Ground Control Points(GCP)
- Aerial Triangulation
- Stereo Plotting
- Data Conversion
- Field Identification
- Editing Map
- **Check of Mapping quality**
- Completion Mapping

Editing Map

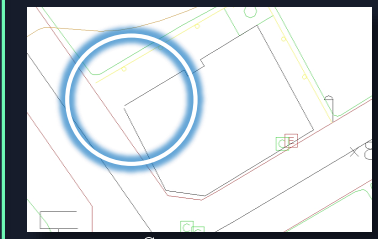


Software for QC

MapInspect Manager

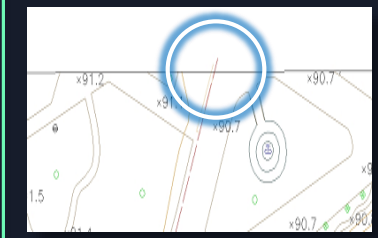
QC Plugin based on Q-GIS

Type of Error

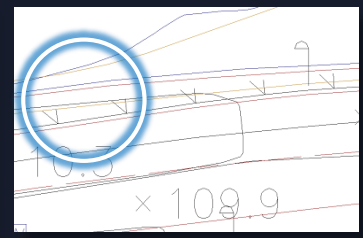


Coverage error

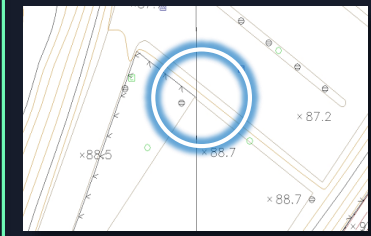
Symbol Error



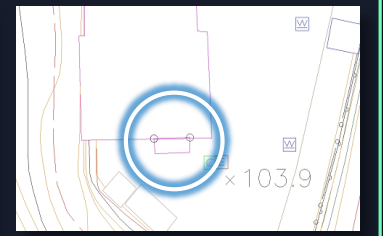
Baseline Exceedance



Contour crossing and Connectivity



Adjacent area omission



Object Duplication

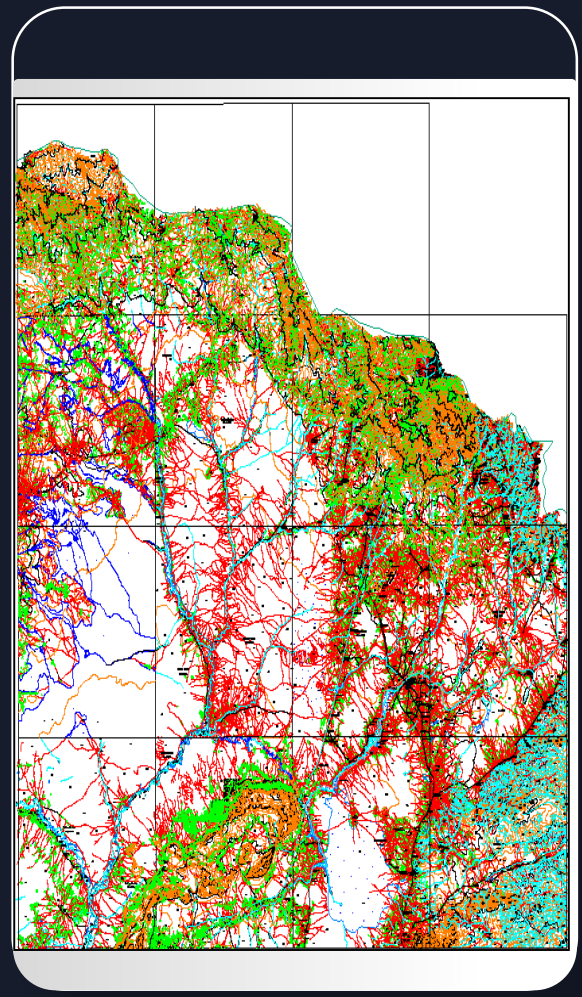
Ⅱ CONSTRUCTION OF A 1/1K TOPOGRAPHIC MAP

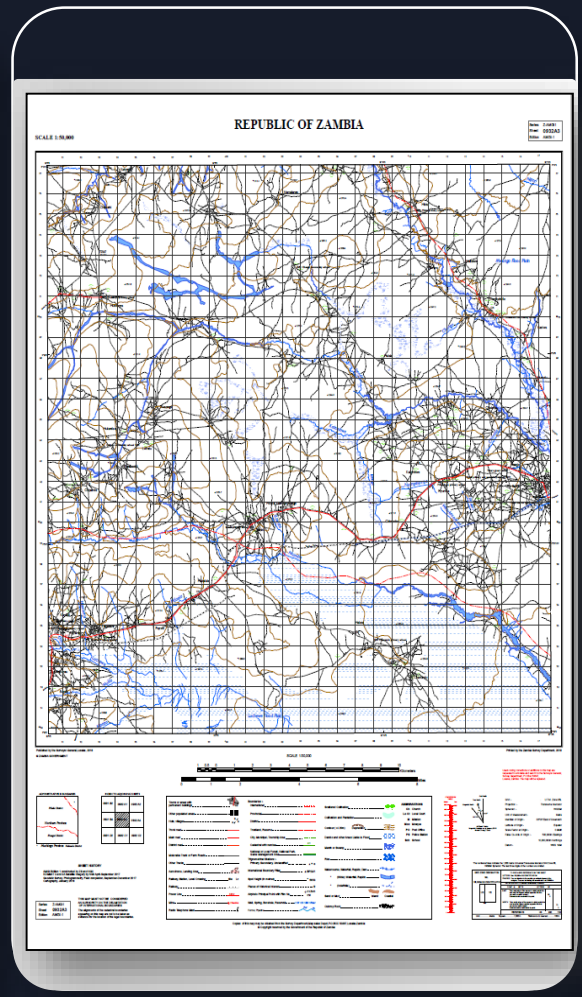
COMPLETION MAPPING

Workflow Chart

- Planning
- Aerial Photographing
- Ground Control Points(GCP)
- Aerial Triangulation
- Stereo Plotting
- Data Conversion
- Field Identification
- Editing Map
- Check of Mapping quality
- **Completion Mapping**

Topographic map





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