

NSDI of the Korea and NGII

Hyunhee Joo

October 28th, 2019



CONTENTS



NSDI of the Korea



Roles and Activities of NGII



CHAPTER

1

NSDI of the Korea

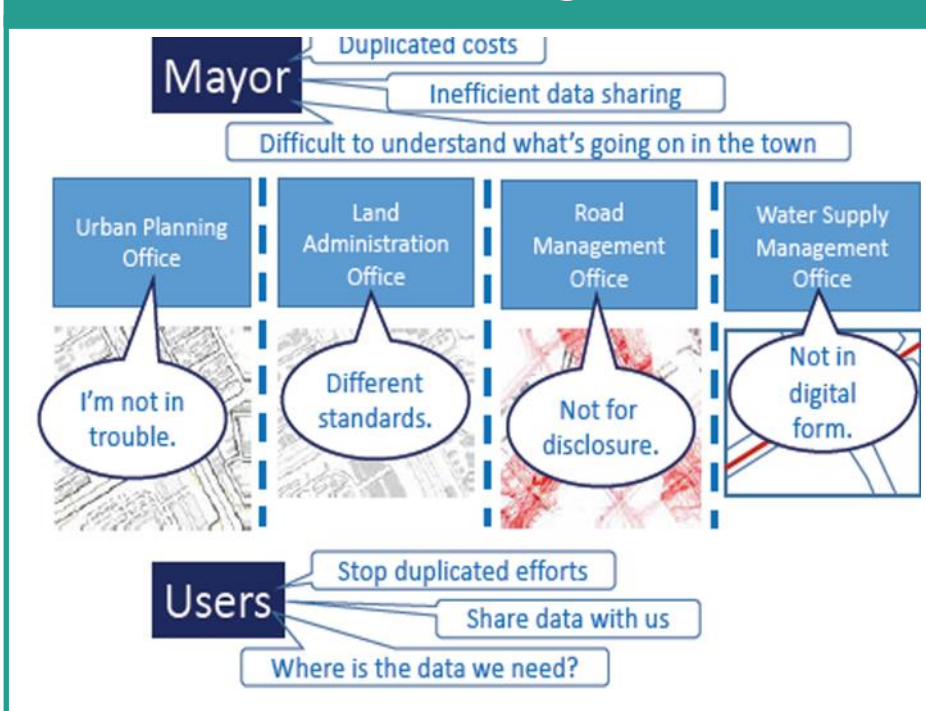


1. Outline

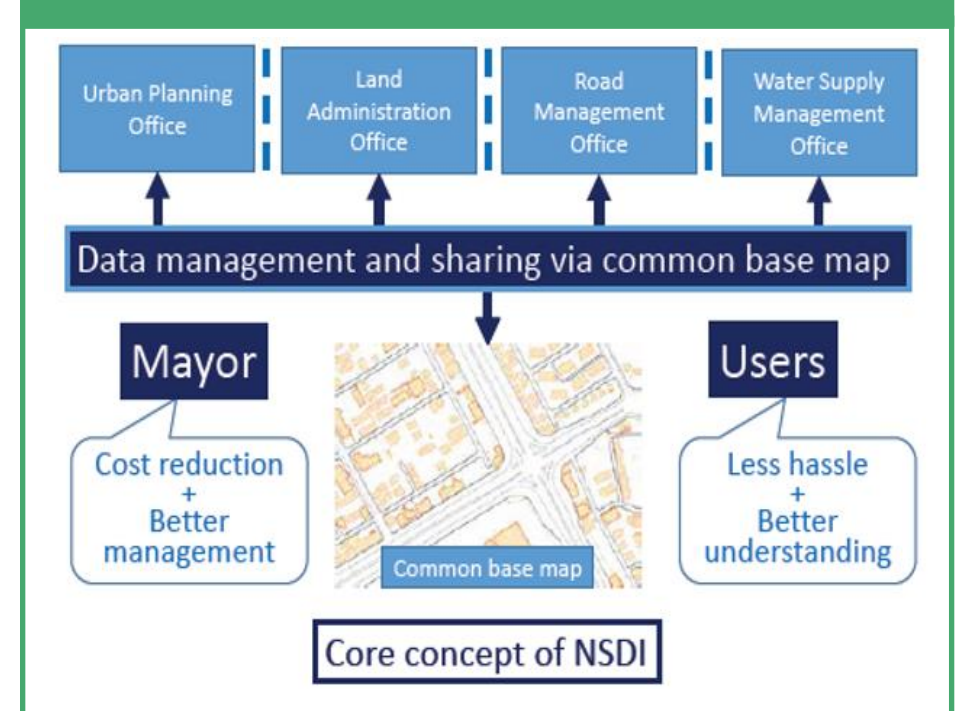
What is a National Spatial Data Infrastructure?

- To encourage the collection, processing, archiving, integrating, and sharing of geospatial data and information using common standards, interoperable systems and techniques.

Silo structure within governments



What is NSDI?



1. Outline

NSDI in Korea

- The Republic of Korea has built National Spatial Data Infrastructure (NSDI) to better serve the citizens and enhance efficiency of public administration.
- Our nation is also actively engaged in international cooperation.

Background of NSDI in Korea

① Creating the initial demand for GIS

- Digitalizing topographic, parcel, thematic map etc.
- Developing GIS application systems

② Building foundation for NGIS

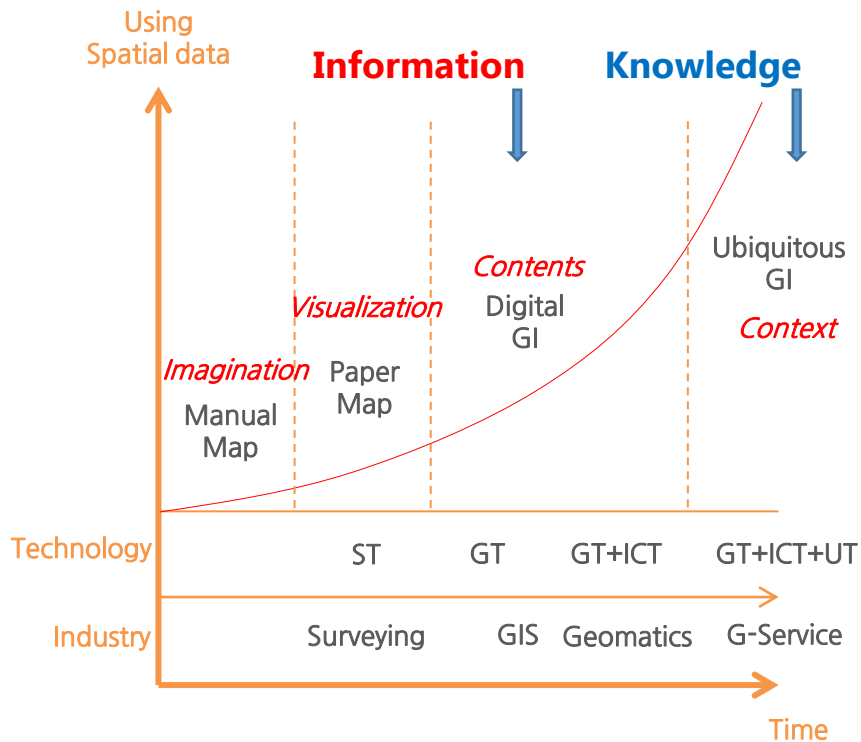
- Establishment of standardization for data sharing
- Maintenance of related law systems for effective promotion
- Development of GIS base technology
- Education for training GIS experts



2. History

History of NSDI in Korea

➤ Geospatial Information is a big strength in Korea's economic growth.



Year	Contents
1910s	• Chosun National Land Survey
1960s	• 1:25,000 National Topographic Map
1970s	• Large-scale Topographic Map, Territory Development
1980s	• Survey extended to Geospatial Information Concept
1990s	• GIS rising as the Core of National Geospatial Information
2000s	• Success of National GIS Program
After 2010	• Smart City and Smart Government Era with combination of Smartphones, and Geospatial Information

3. Policy

NSDI Project in Korea

➤ Korea has established a reliable geospatial information infrastructure by systematically driving national geospatial information policies.

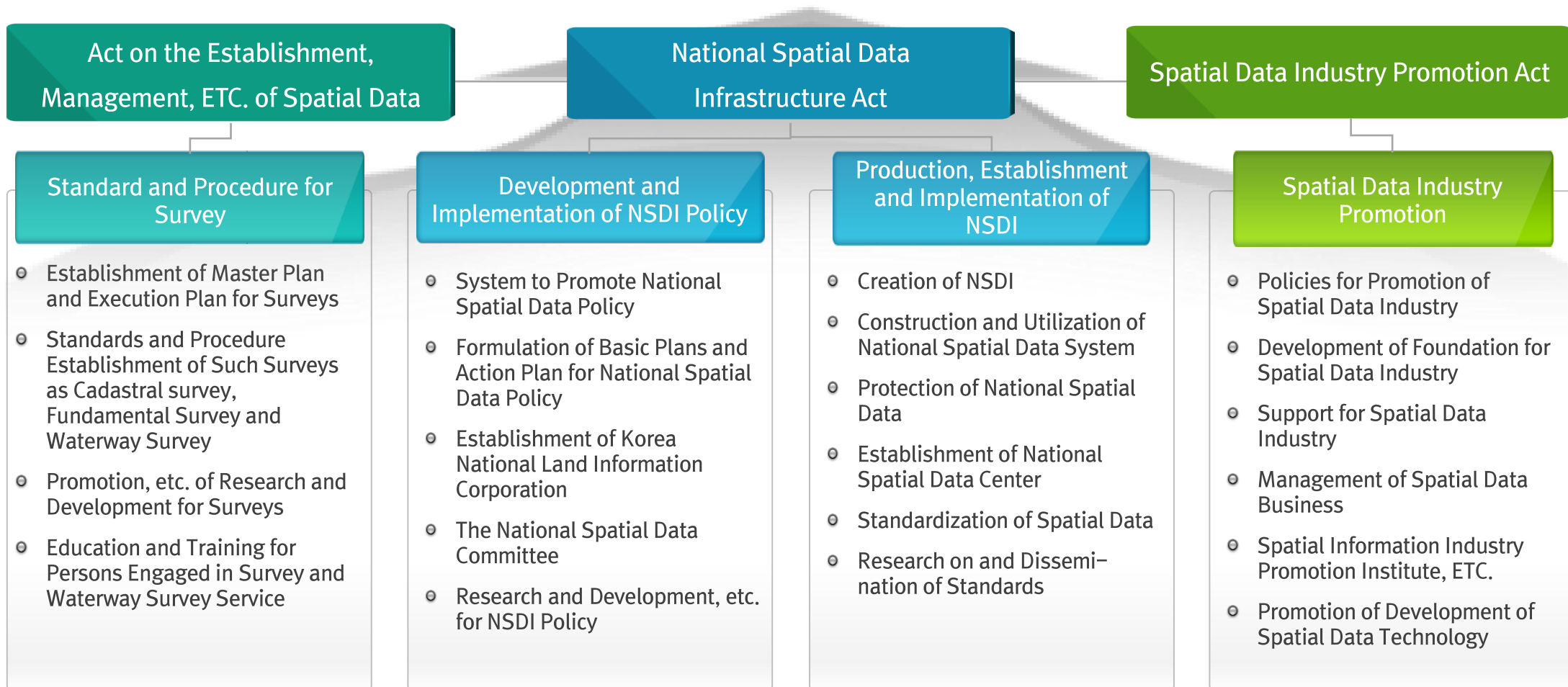
— National SDI Project by the Government

1st National SDI Project (1995~2000)	2nd National SDI Project (2001~2005)	3rd National SDI Project (2006~2010)	4th National SDI Project (2011~2012)	5th National SDI Project (2013~2017)	6th National SDI Project (2018~2022)
<ul style="list-style-type: none"> • Computerization of Topographic Map and Cadastral Map • Established Thematic Maps such as Land Use Map and Underground Facilities Map • Mapping Technology, DB Tool, GIS S/W Technology Development 	<ul style="list-style-type: none"> • Established Framework Data such as Roads, Sewers and Buildings • Propelled GIS Utilization System for Land Usage, Underground, Environment, Cultural Assets, Ocean, Agriculture and Forestry • Three-Dimension GIS, High-Precision Satellite Image Processing Technology Development etc. 	<ul style="list-style-type: none"> • Established National Base Map, Base Map of the Sea, and Aerial Image • Propelled Establishment of Utilization System • Three-Dimension National Geospatial Information, UPIS, KOPSS and Building Consolidation • Improved National Geographic Information Network 	<ul style="list-style-type: none"> • Maintain and Manage the Geospatial Information and Establish its Utilization System • Establish Digital Cadastre • Establish Three-Dimension National Geospatial Information • Domestic GIS Solution Development, Commercialization and Dissemination 	<ul style="list-style-type: none"> • Establish a System for Fundamental Geospatial Information • Expanding the Construction of High-Precision 3D and Indoor Geospatial Information • Open all Geospatial Information in Stages Except for Special Cases such as National Security • Improve System to Share Geospatial Information Produced by Private Sector 	<ul style="list-style-type: none"> • Production of Geospatial Information that Creates Value • Innovation Sharing through the Activation of Geospatial Information Platform • Fostering the Geospatial Information Industry to Create Jobs • Creating a Win-Win Policy Environment through Participation

3. Policy

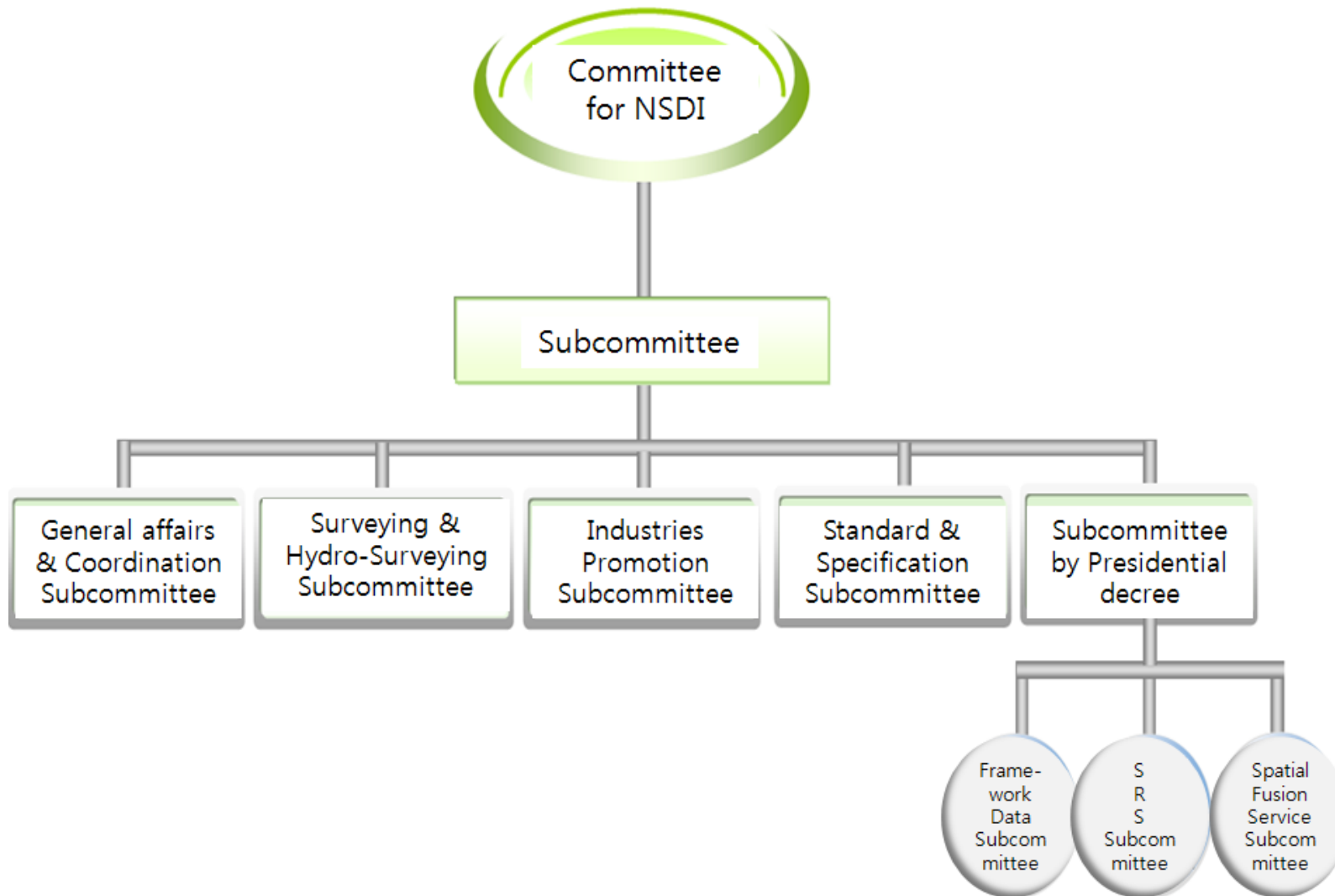
Major Legislations for Korean NSDI

► Production, Establishment, Management, Operation and Implementation of Spatial Data Infrastructure



4. Organization of Korean NSDI

■ Korean NSDI Organizations – Committee

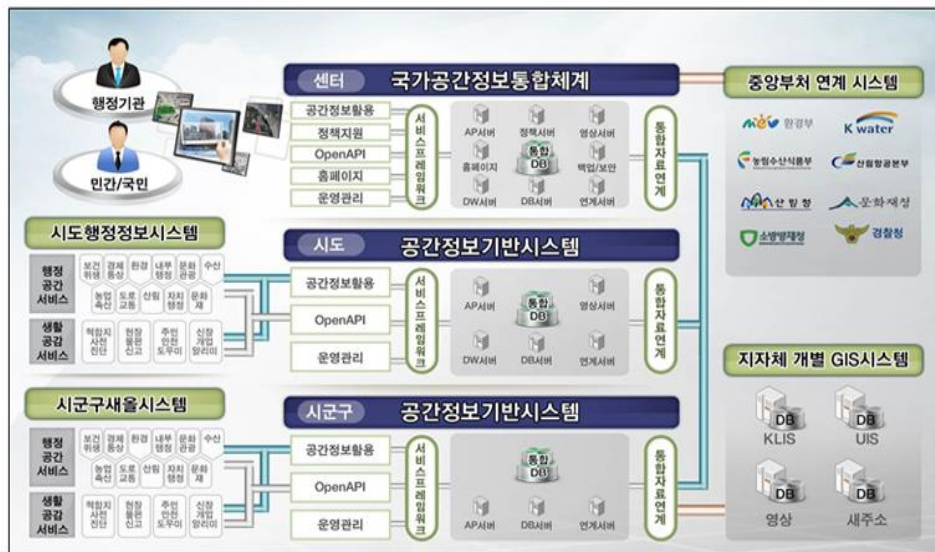


5. Best Practices in Korea

National Integrated (Spatial) Information System (NIIS)

- › Efforts for integration of spatial data.
- › Necessary to build the seamless data covering the entire country.
- › Using Open API and geo-web standards (WMS, WFS etc.).
- › Geospatial Open Stop Portal.
- › Data updating and technological supports.

Integrated System of National Spatial Information



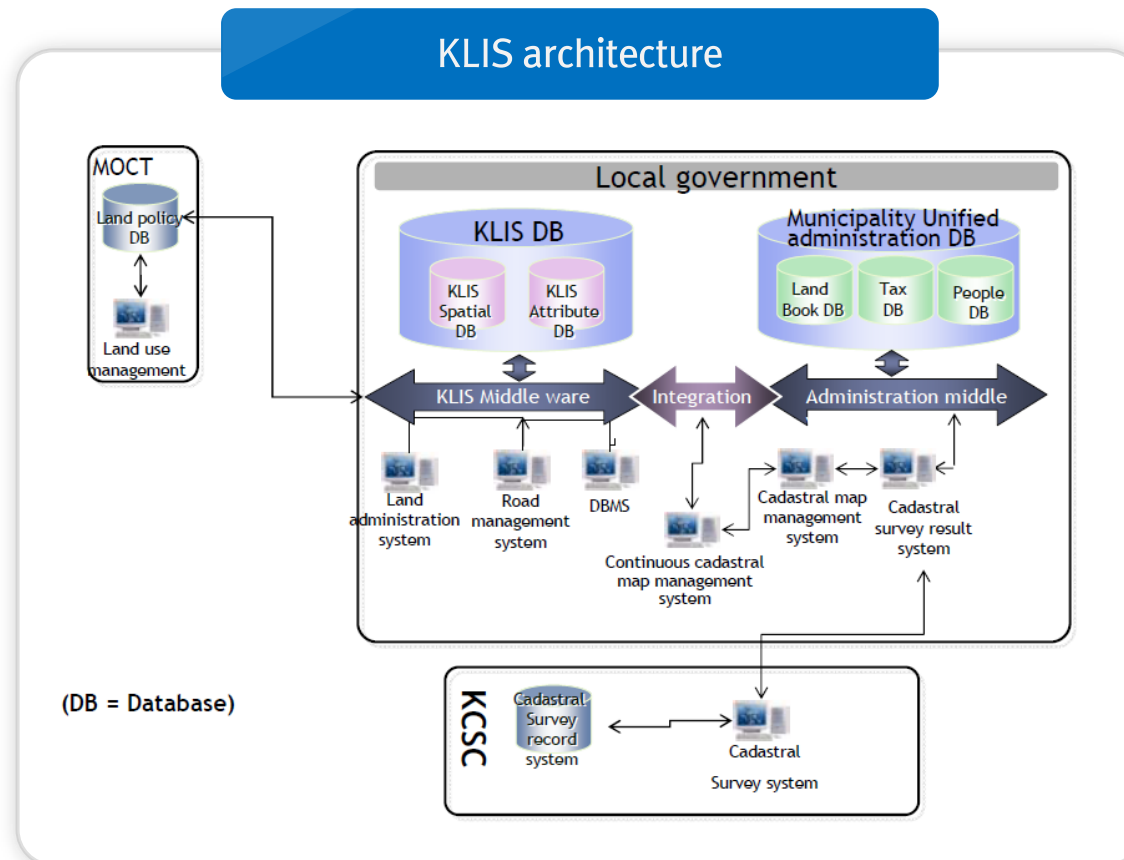
Database Structure of NIIS



5. Best Practices in Korea

■ Korea Land Information System (KLIS)

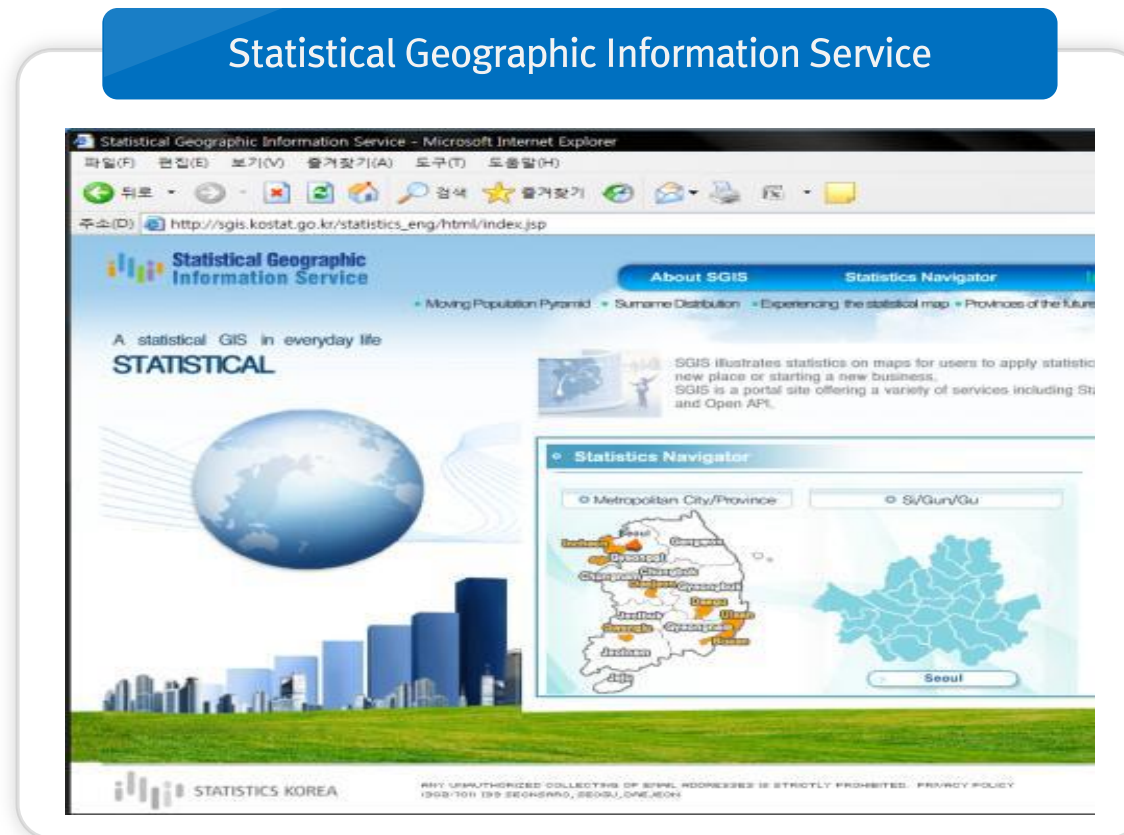
- Harmonization model of top-down with bottom-up, by matching funds and with partnerships.
- Proper division of who does what.
- Integration of land information and cadastral information will take the synergy effects.



5. Best Practices in Korea

Statistical Geographic Information Service

- › Creation and usage of various useful statistical geographic data and services.
- › Basic unit district for proper minimum size of statistical area and a framework for integration of administrative data.
- › SGIS Open API for mash-up spatial data with other administrative data.
- › Toward more customized and sophisticated statistical application.

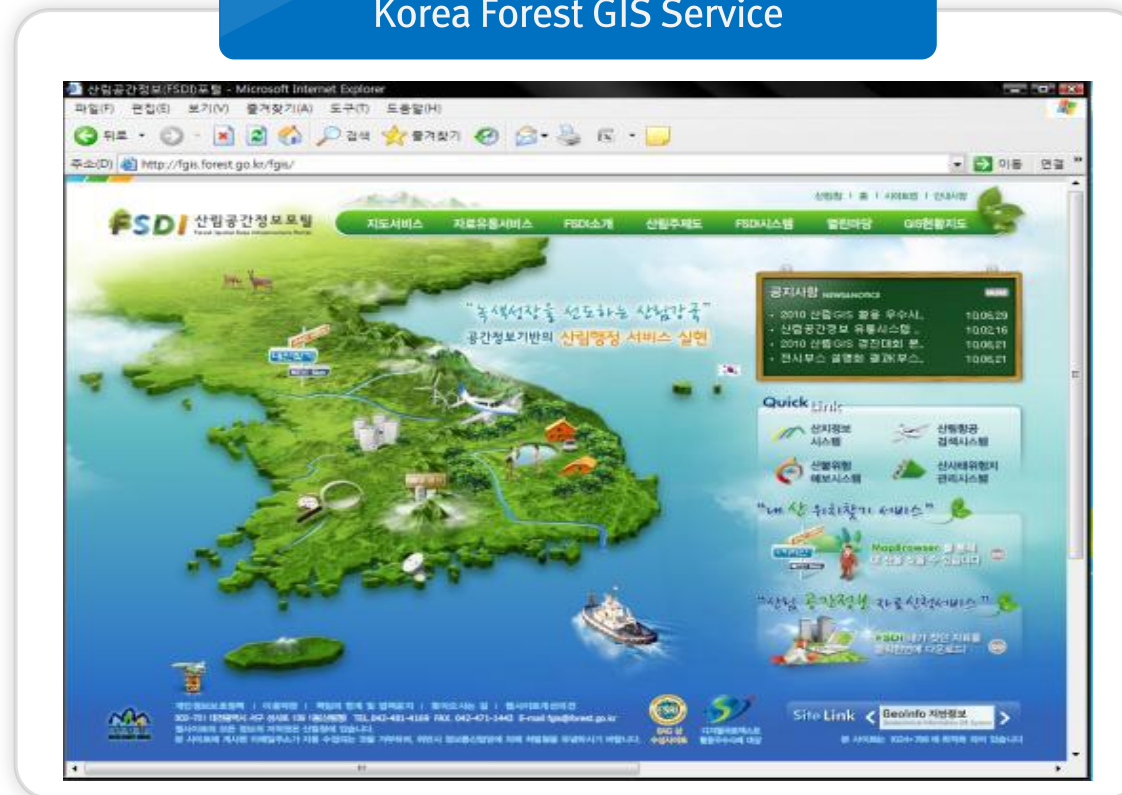


5. Best Practices in Korea

Korea Forest GIS Service

- › Evolution of the concept of SDI from GIS in Forest domain is remarkable.
- › Can be a lesson learned.
- › Ease access to spatial forest data.
- › Use standards and Web 2.0-based new technology.

Korea Forest GIS Service

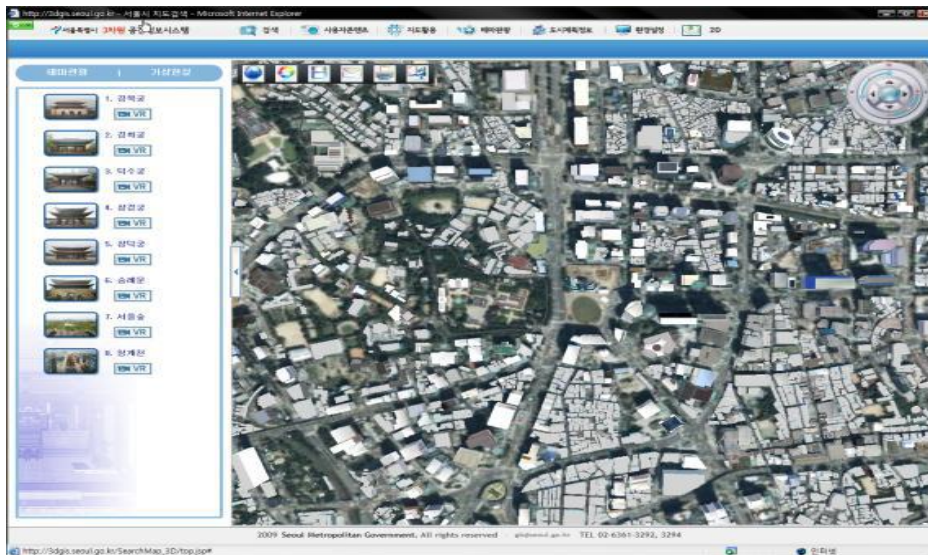


5. Best Practices in Korea

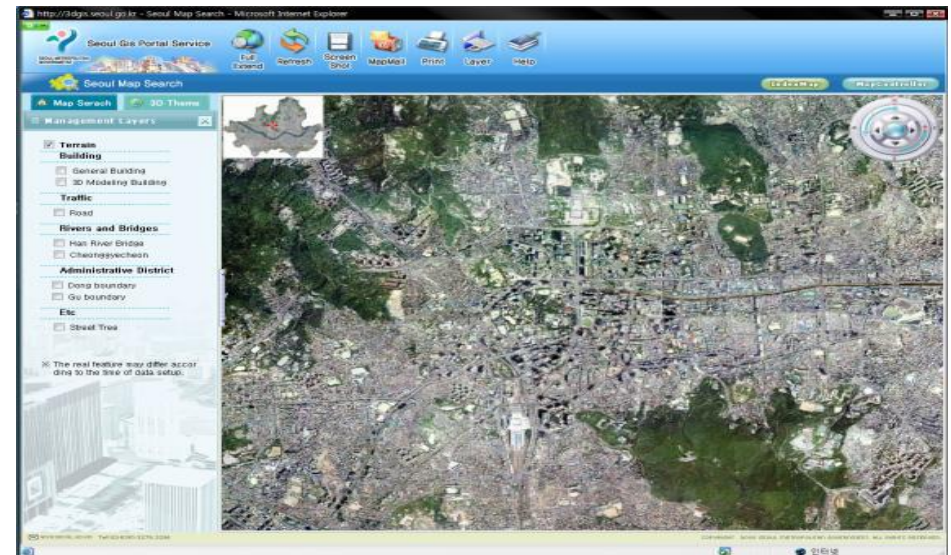
Seoul Metropolitan City

- › As an excellent LSDI implementation (3D tourist service).
- › Good quality and diversity of thematic spatial data.
- › Higher accuracy and efficient updating of many thematic spatial data.
- › Redundant data processing and for saving cost.

Seoul GIS portal



Seoul 3D GIS portal service





CHAPTER

II

Roles and Activities of NGII

CHAPTER

II -1

Status of NGII

CHAPTER


II -2

Roles and Activities





| Status of NGII

- 01 | Introduction of NGII
 - 02 | Organizational Chart
 - 03 | History
 - 04 | Major Achievements
 - 05 | Vision and Strategy
- 

The Valuable GI for the People
“GI Hub to create the value”



National Geographic
Information Institute
Ministry of Land, Infrastructure
and Transport

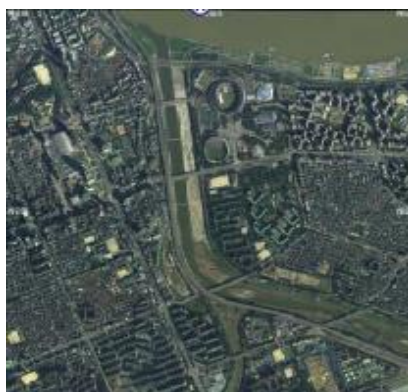


- **Organization** : 7 Dep, 127 Staffs
- **Facilities** : HQ, Map Museum, VLBI Center
- **Budget** : about 90m US Dollar

[Main Tasks]



Establishment of National
Geodetic Datum



Construction of National
Imagery Geospatial Information



Construction of National
Fundamental GI DB

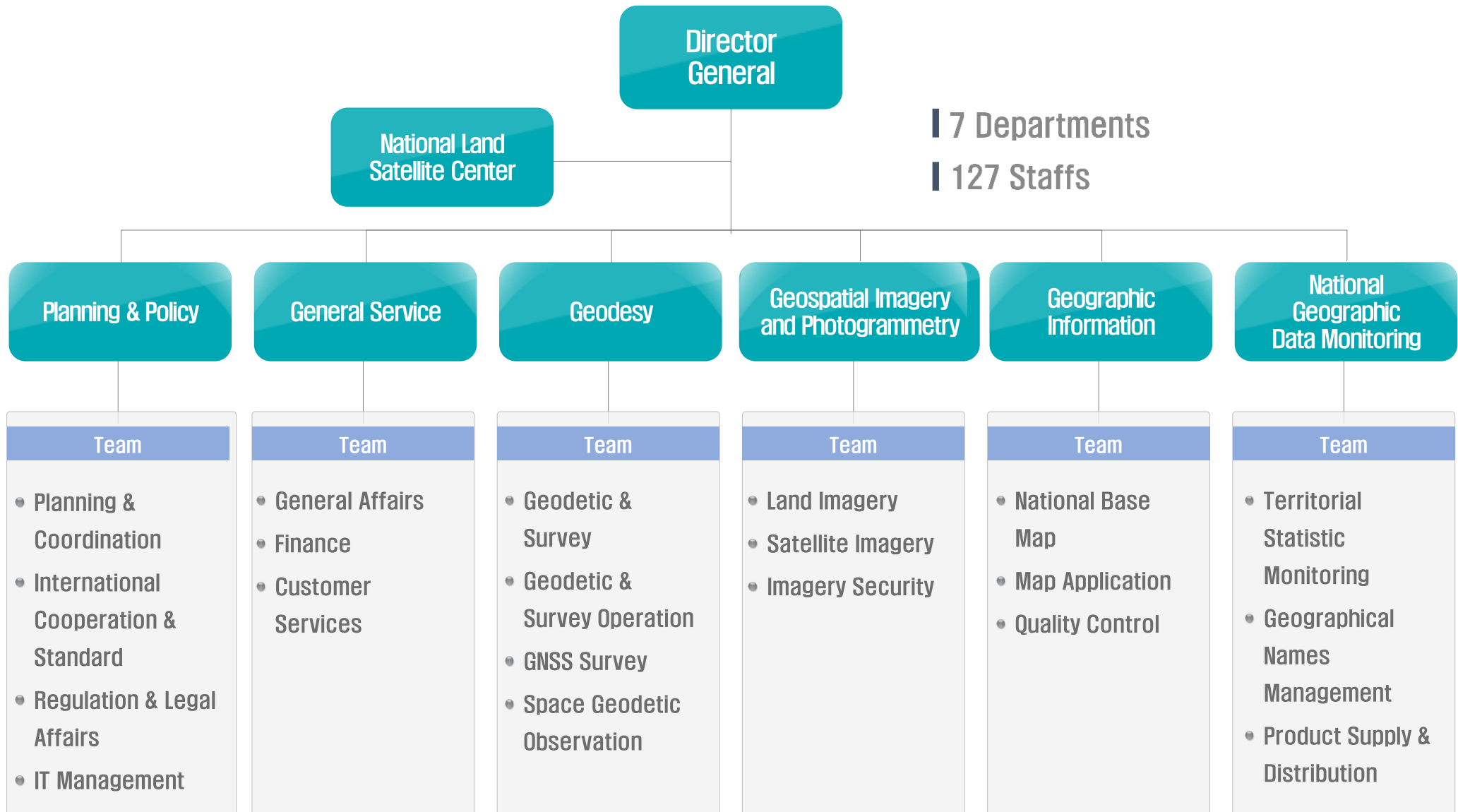


Management of Geographical
Names



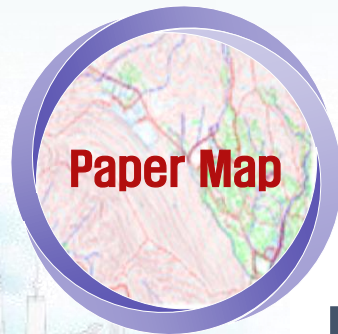
Map Museum Service

2. Organizational Chart



| 1958.04

The National Geographic Research Institute was founded under the Ministry of Defense



| 2003.07

Change of Institute Name (National Geographic Information Institute(NGII))



| 2012.03

Establishment of Geodetic VLBI Observation Center



| 2014.10.31

40th Anniversary



| 2013.03

NGII, Ministry of Land, Infrastructure and Transport

| 2004.11.

Opened Map Museum

| 1974.11.

Establishment of the National Geographic Institute in the Ministry of Construction



2019

- **Spatial Information Provided Free of Charge**
- **Production of Precise Road Map**
- Building Africa Resource Spatial Data (ODA)

2016

- **Mapping of the Continuous(Seamless) Digital Topographic Map of KOREA**
- Hosting of the First High Level Forum on United Nations Global Geographic Information Management
- **Opening of the Space Geodetic VLBI Center (Enrollment in IVS)**

2010

- Hosting the 13th PCGIAP
- Mapping of the Polar region GI(1/1k, 1/5k, 1/25k)
- Opening of Map Museum
- **Changeover of Korean Geodetic Datum to Global Geodetic datum for GNSS Survey**

2000

- **Mapping of 1/5K, 1/25K, 1/50K Digital Topographic map**
- Election of PCGIAP Board
- Supplying the digital map to the public

1990

- Enrollment in ICA and ISPRS
- The Foundation of the National Horizontal Datum

1980

- **Mapping of 1/5K, 1/25K, 1/50K Topographic map**
- Affiliation of UNGEGN


1970

- Enrollment in IAG and I.U.G.G
- **Establishment of Act on Land Survey**
- The Foundation of the National Vertical Datum
- Conclusion of MOU between Korea and Netherlands about Aerial Photography

1960

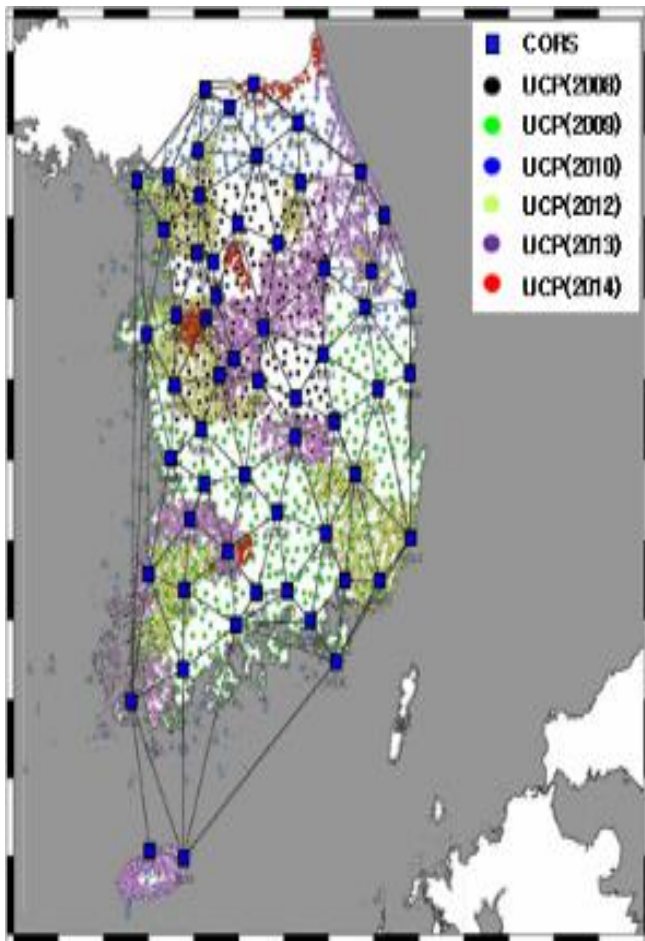


|| Roles and Activities

- 01 | Managing the National Geodetic Datum
 - 02 | Producing Imagery Data for National Land
 - 03 | Mapping and Producing the Geographic Information
 - 04 | Managing the Geographical Names
 - 05 | International Cooperation
 - 06 | Map Museum
- 

Types and Status of Control Points

➤ Establishing, managing and providing of national control points.



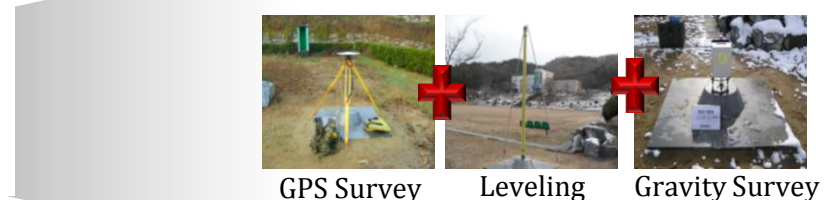
Unified Control Point
(5,132 pts)



Satellite Control Point
(60 pts)



Gravity control Point
(13,384 pts)



GPS Survey Leveling Gravity Survey



Triangulation Point
(16,411 pts)



Benchmark
(7,296 pts)



Magnetic point
(672 pts)

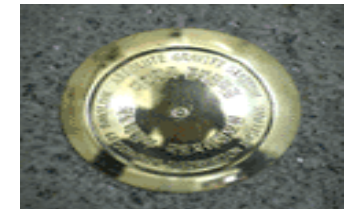
Origin



Horizontal Origin



Vertical Origin



Gravity Origin

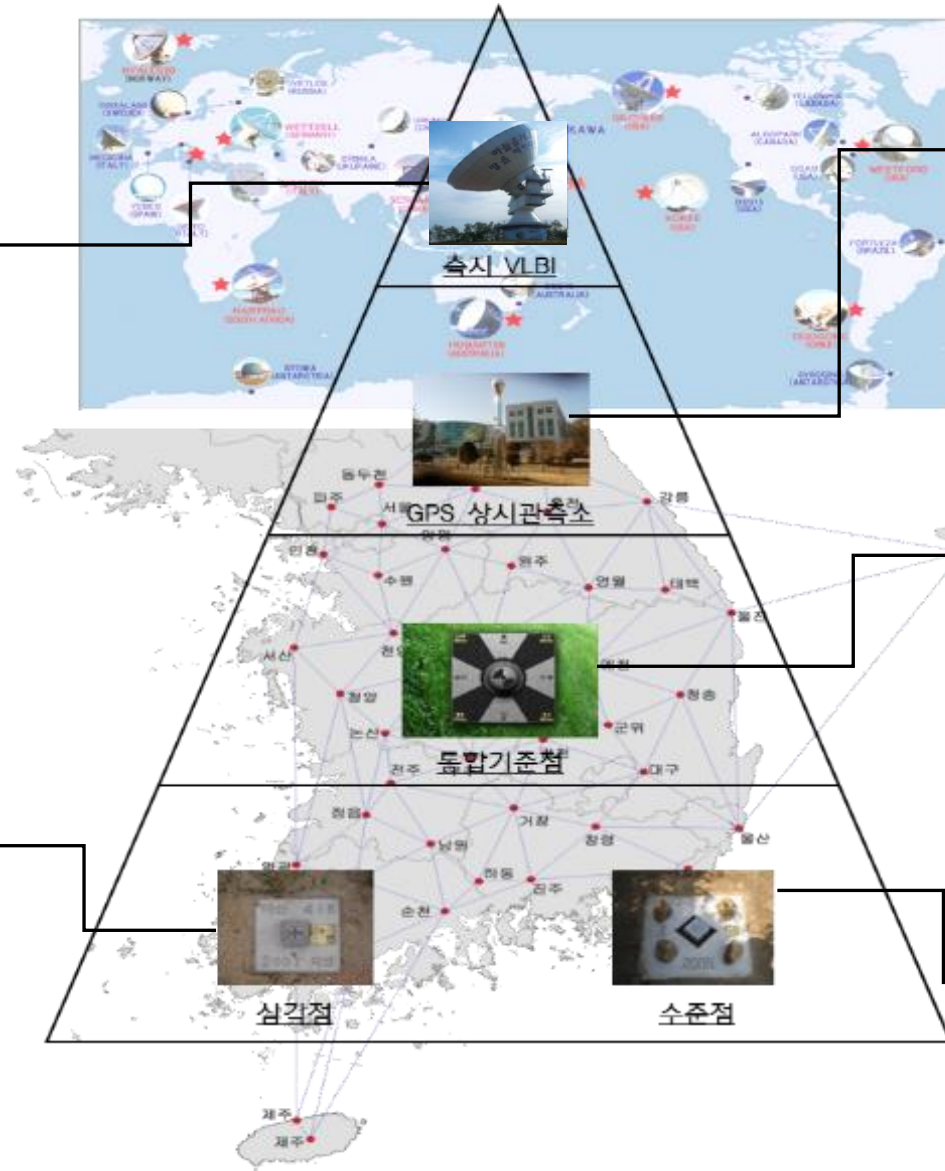
Maintenance of Coordinate System



VLBI
Accuracy : mm
1 point



Triangulation Point
Accuracy : cm
16,411 points



Satellite Control Point
Accuracy : cm
60 points



Unified Control Point
Accuracy : cm
5,132 points

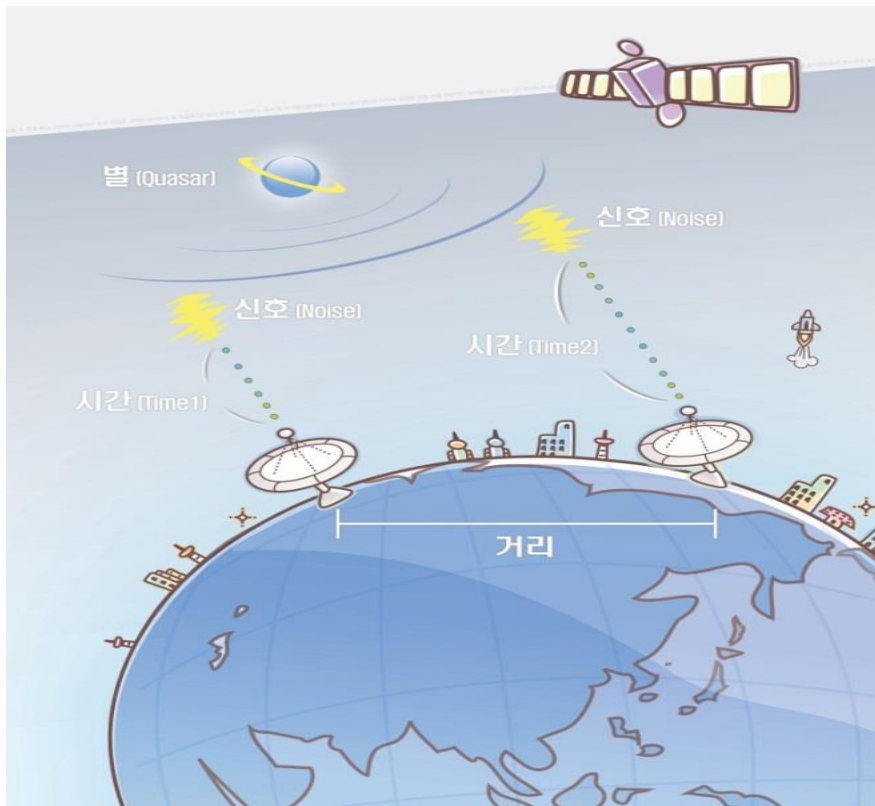


Benchmark
Accuracy : cm
7,296 points

VLBI (Very Long Baseline Interferometry)

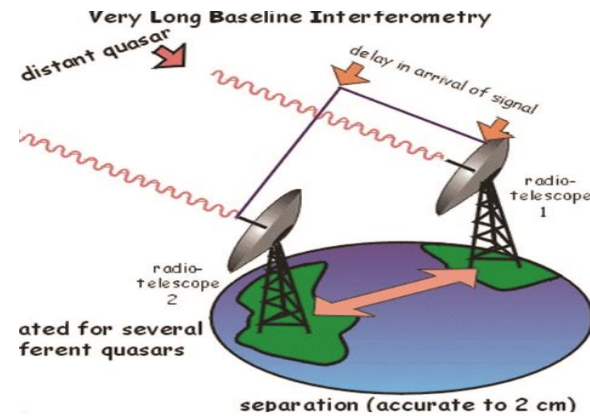
Observation Principle Geodetic VLBI

- Distance and position calculation by using the antenna arrival time difference of the space signal (Quasar).

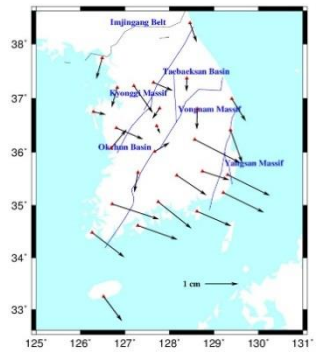
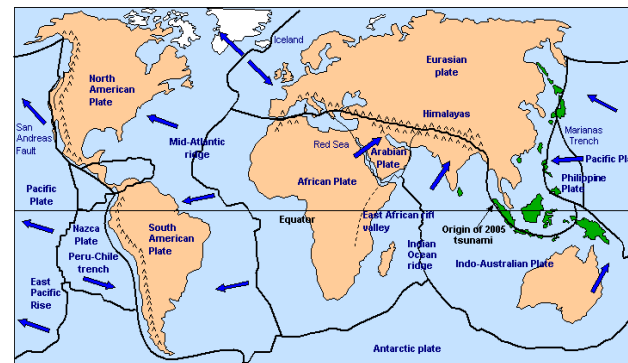


Primary Function

- Measuring the Intercontinental Distance.

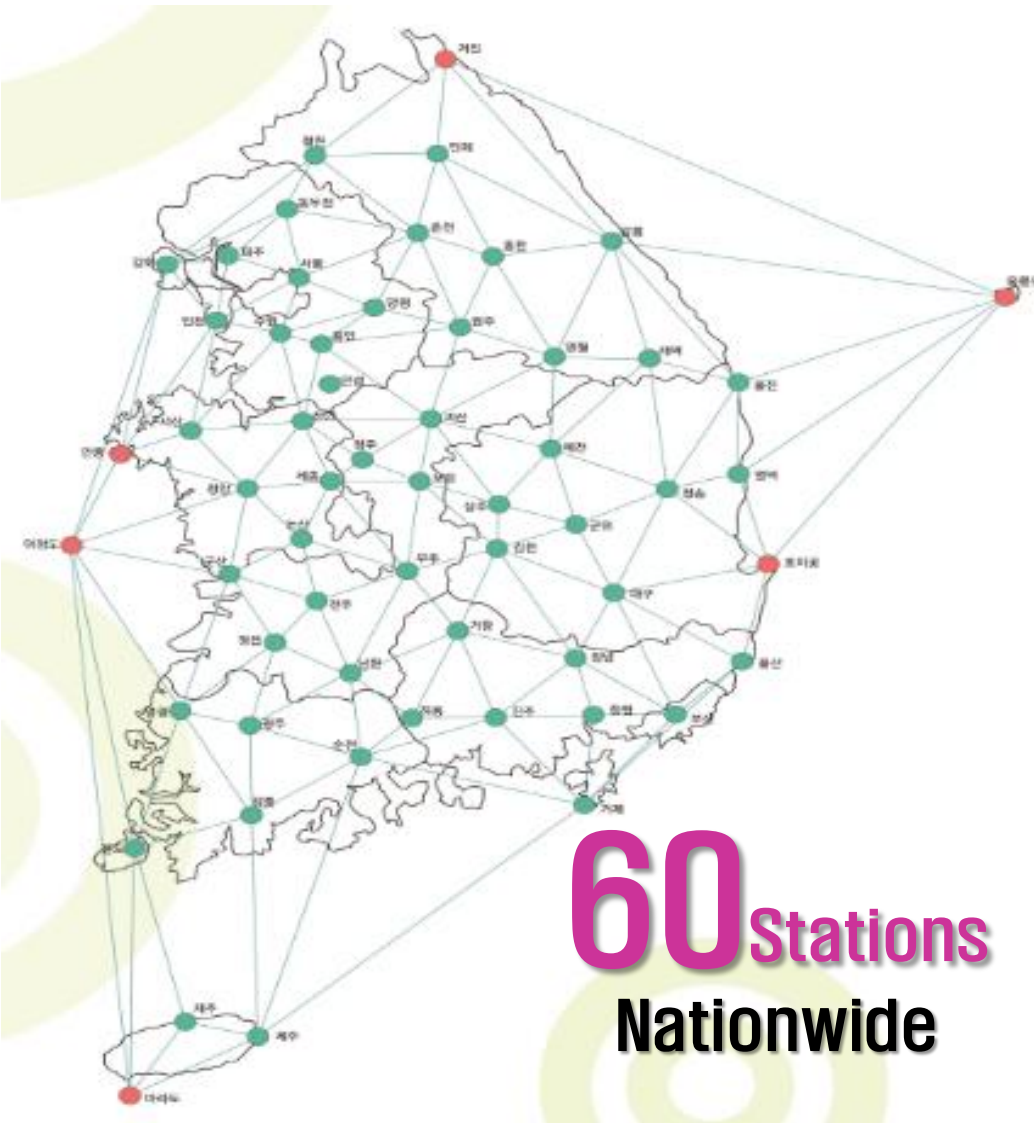


- Calculation of Crustal Movement.

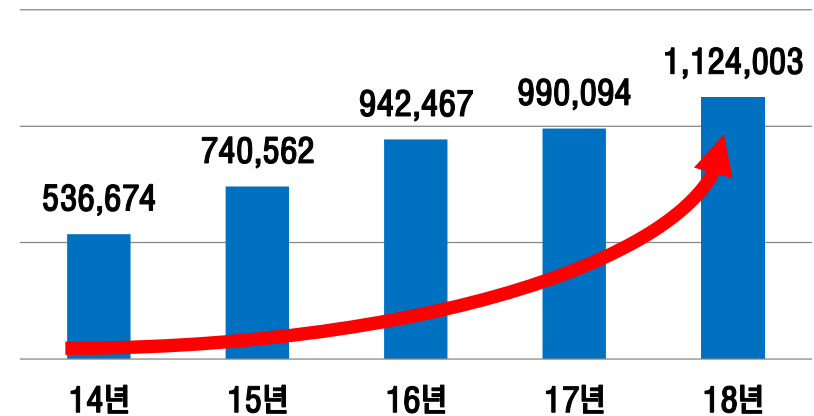


Maintenance and Achievement of CORS(Continuously Operating Reference Station)

- Installation in average of 40km interval
- Covering about 1,700 km² per station

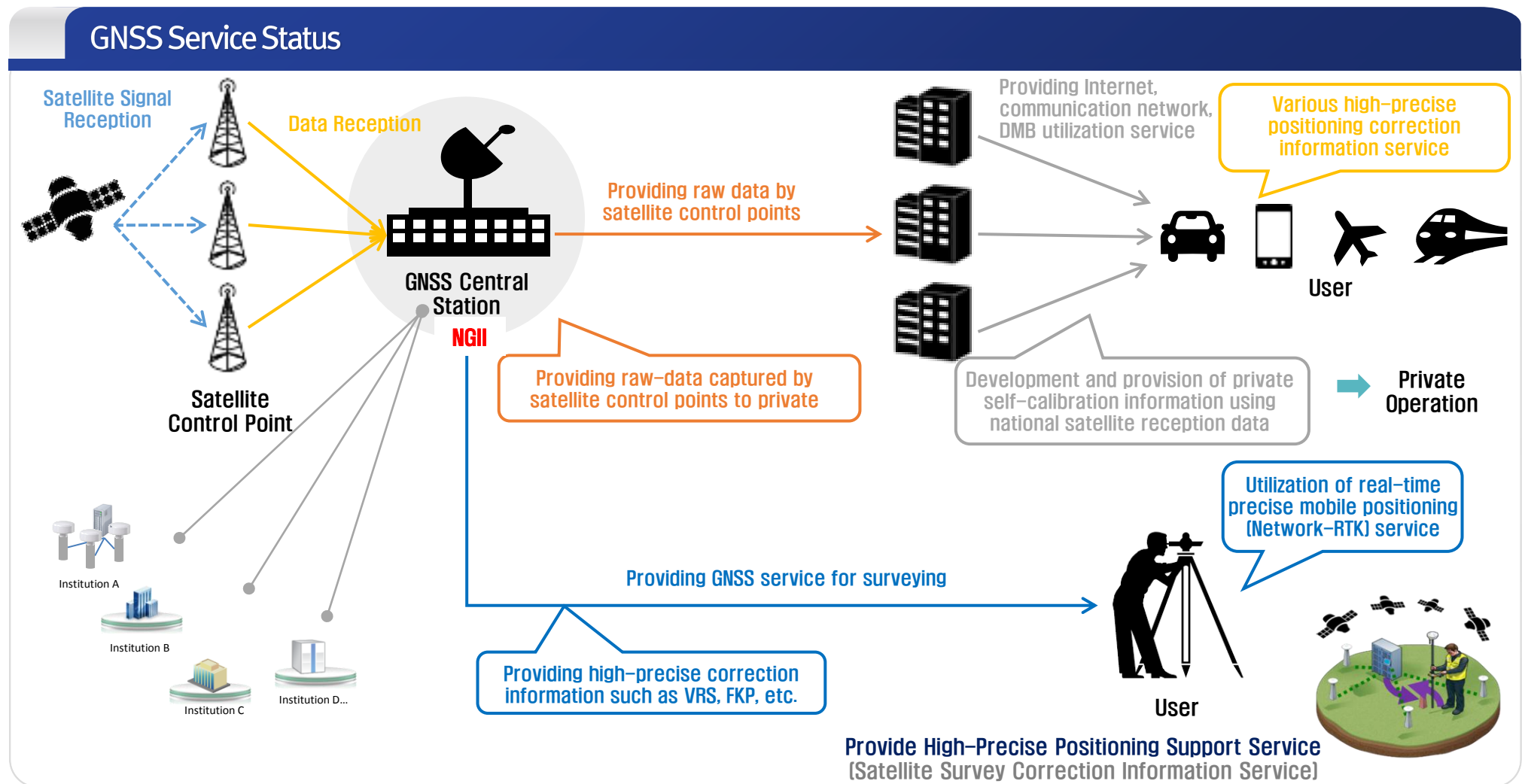


Service Users Increasing,
As Data Quality Increasing

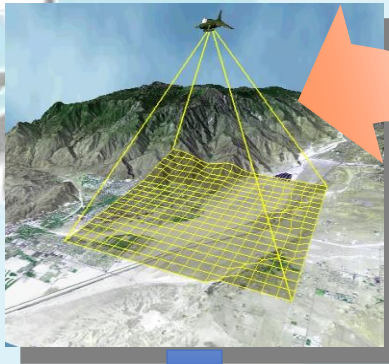


Maintenance and Management of CORS(Continuously Operating Reference Station)

› Integration of **170** GNSS data from **8** different institutions.



Producing the Various Imagery Data



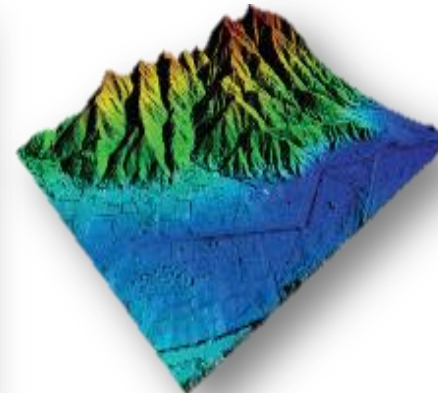
Orthophotograph



Aerial Photogrammetry DB



3D Geospatial Information



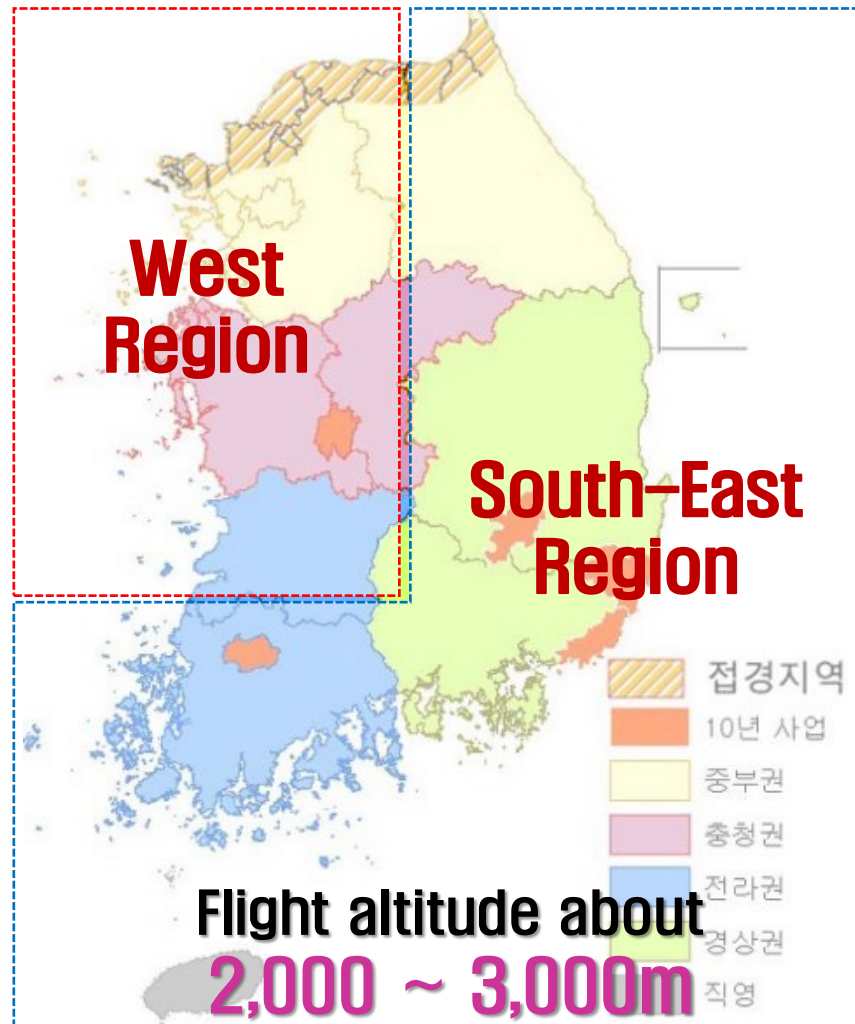
Digital Elevation Model



UAV(Unmanned Aerial Vehicle)

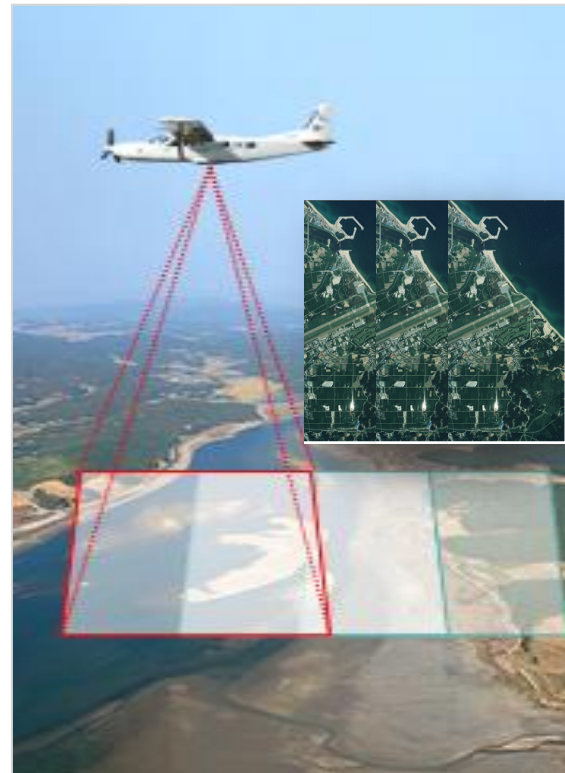
Producing the Various Imagery Data

- > The whole country is divided into **two regions**, and each region is aerial photographed at **25cm** resolution per year



Time Series Aerial Photograph Services

- Comparison and analysis of topographic changes using time series orthophotograph and aerial images.



- Aerial photograph and management since liberation (**1945**) to current (**2019**)

→ for **74 years**

- Hold **615,792 sheets**
 - 1960~1970s: 19,143 sheet
 - 1980~1990s: 78,015 sheet
 - 2000~Present: 518,634 sheet

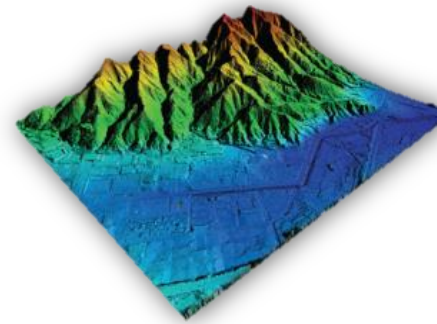
Producing the Various Imagery Data

Status of Image Data



Orthophotograph

- Orthogonal Image from aerial Photography
- 40cm : **10,598** km² ('05~)
- 25cm : **297,635** km² ('10~)
- 12cm : **12,351** km² ('08~)



DEM (Digital Elevation Model)

- DEM from the Lidar Survey or using topographic taxonomy
- **220,000** km² nationwide DEM completed
(5/10/30/90m)
- **1m** under construction



3D Terrestrial Model

- 3D Terrestrial Model from the convergence between DEM and Orthogonal Image
- Established about **3,282** km²



UAV

- Operating 2 UAV
- UAV Technical **Education**
- Establishing related **regulations**

Various Types of Map

Various Scales of each type of Map

Paper Map

- 1/5,000, 1/10,000, 1/25,000, 1/50,000

Digital Topographic Map

- 1/1,000, **1/5,000**, 1/25,000

1/250,000 Regional Map

- 1/250,000

Complete Map of Korea

- 1/1,200,000, 1/2,000,000 (Multiple Language)

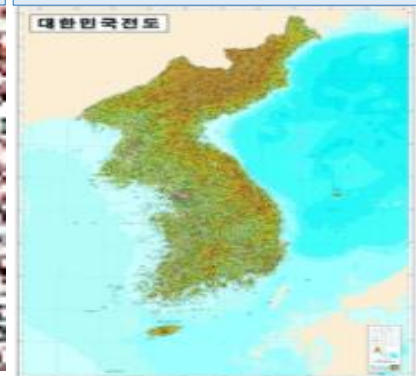
Vicinity Map of Korea

- 1/3,000,000 (Multiple Language)

1/5,000 National Base Map



Complete Map of Korea



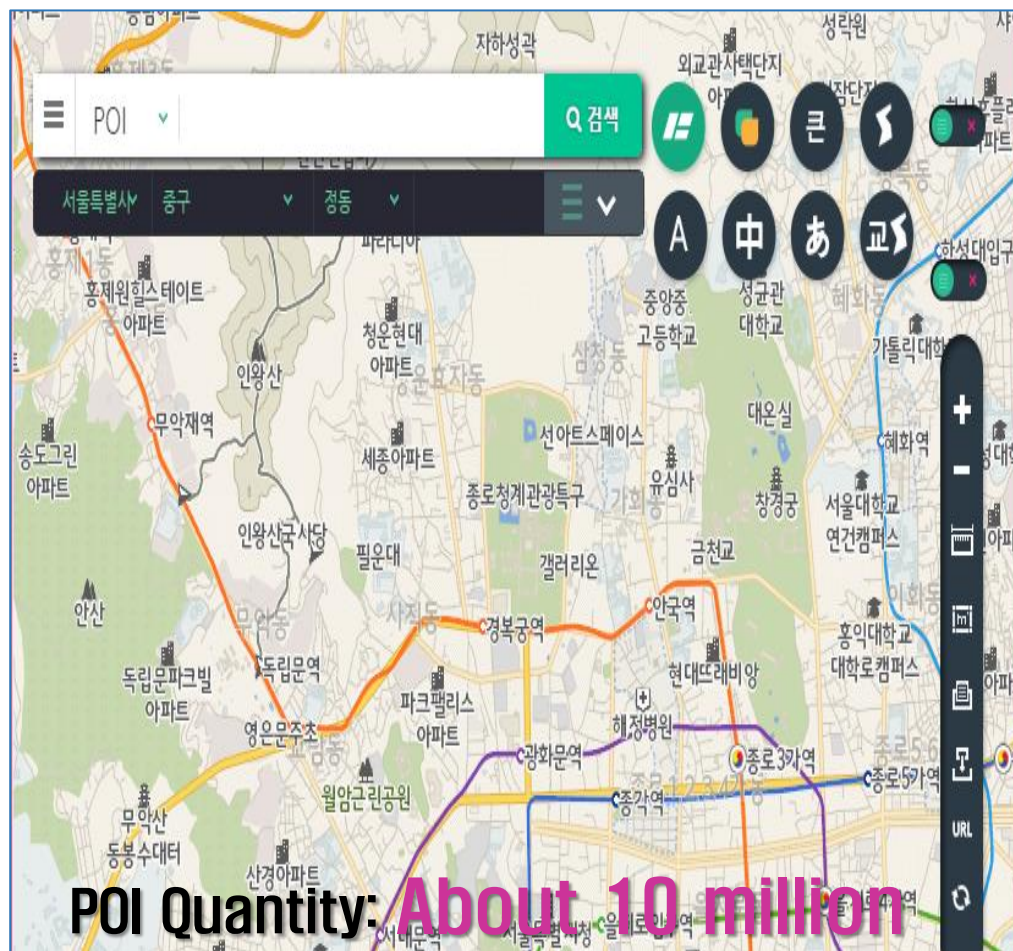
Vicinity Map of Korea



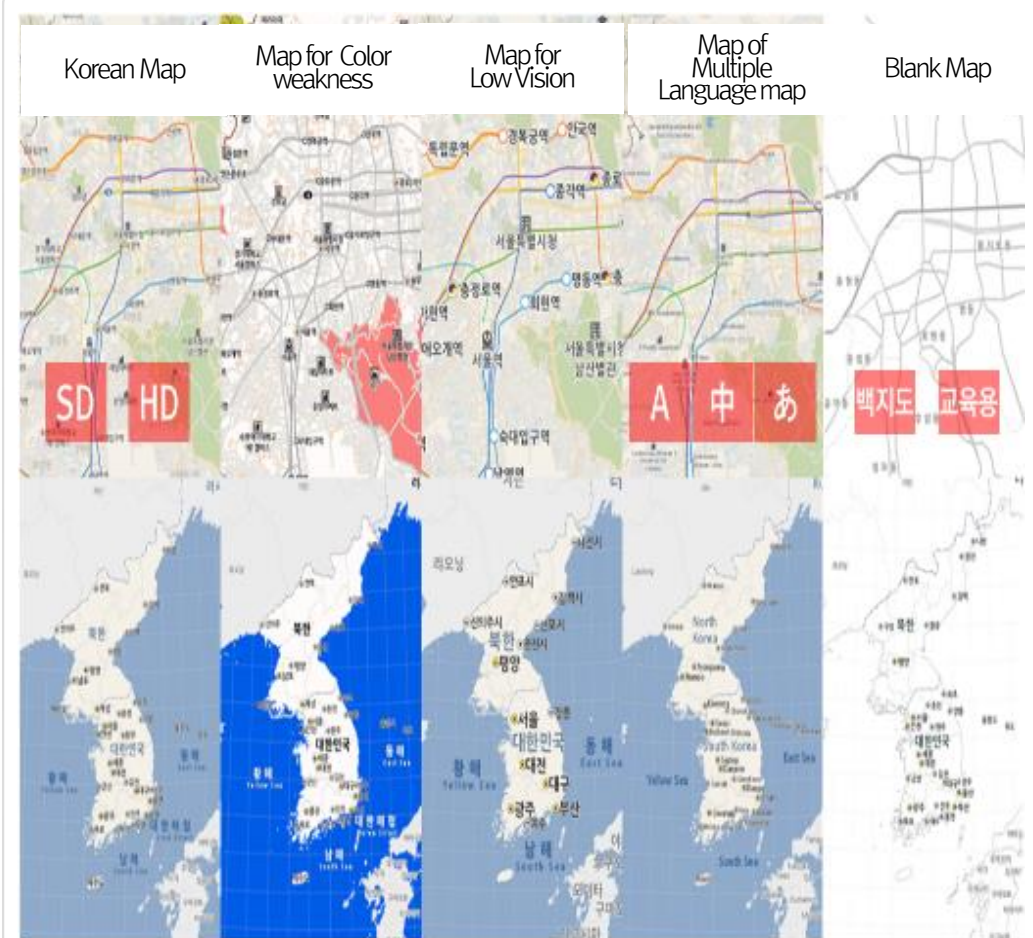
Various Types of Map

➢ NGII provides Web-Map data and service

Web - Map and POI Service



Various Web-Map Services



Various Types of Map

Customized Map service (On-map)

- ☑ Create my own map with on-map through utilizing various functional free tool-bar



Free
Tool-bar

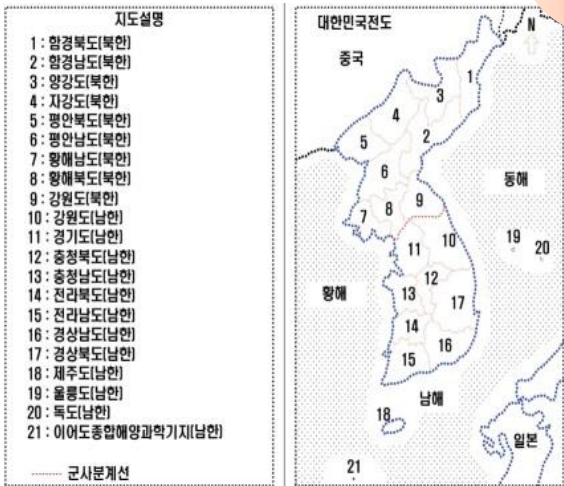


About **6 million** Map
Served and Downloaded(~ 18.6)

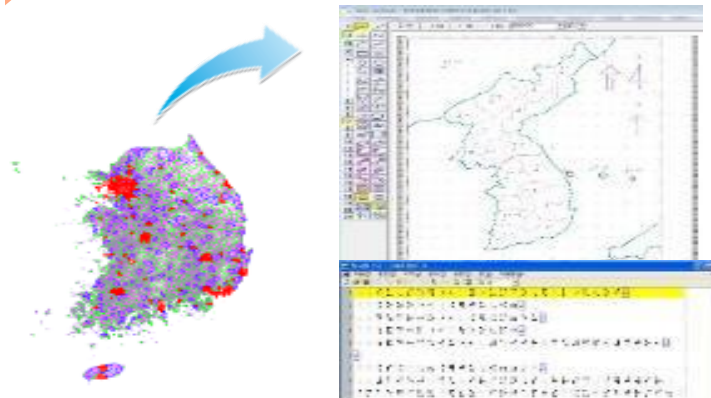
Various Types of Map

- Provide geographical resources for socially weak by producing **tactile map** and **color blind map**.
- Integration with seamless digital map, POI information, and facilities for pedestrian, etc.

Produce tactile map (Present)



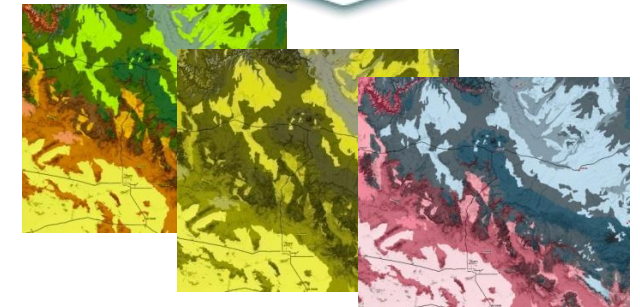
Auto-changing technology (Future)



Color blind map



일련번호	기복범위	Hyconometric unit	Red	Green	Blue
1	4000 이상		198	164	207
2	1800-4000		198	131	68
3	800-1800		222	178	107
4	500-800		244	230	104
5	200-500		229	226	156
6	0-200		195	202	102
7	depression		150	163	90
8	0-1000		234	244	251
9	-1000--2000		222	233	246
10	-3000--4000		207	224	242
11	-4000 이하		193	216	239



Various Types of Map

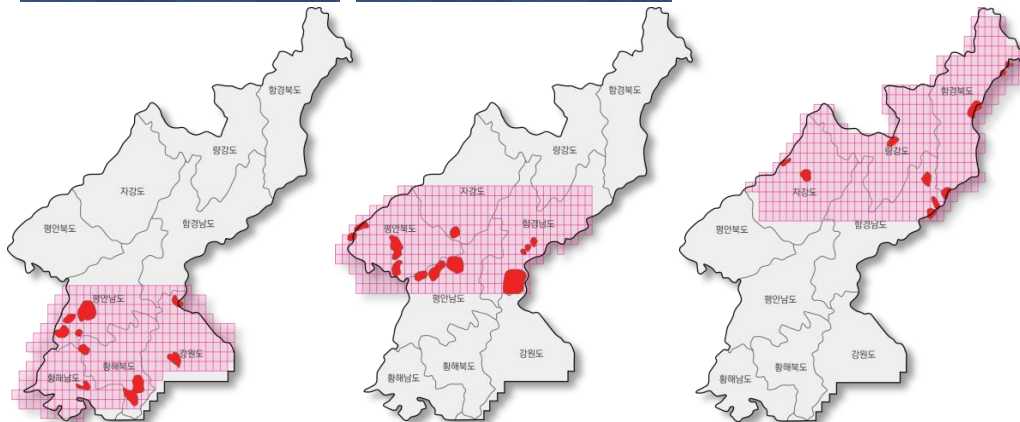
- Regarding North Korea and the borders with which it cannot get aerial photographs, 1/5,000 and 1/25,000 digital topographic maps produced by using satellite imagery.

Plan for producing Geospatial Information in North Korea

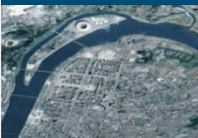
Hwanghae-do Region
39,000 km²

Pyongan-do Region
33,000 km²

Hamkyung-do Region
52,000 km²



Orthographic Image



(2.5m / 50cm)

Digital Topographic Map



(1/25,000 / 1/5,000)

On-Map



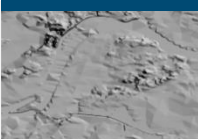
(Ortho+Topographic)

Paper Map



(1/25,000)

DEM



(Grid 10m / 5m)

Map Book Publication

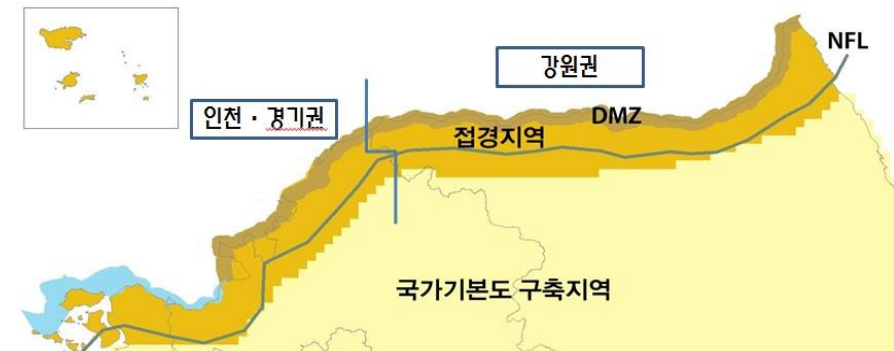


(Paper)

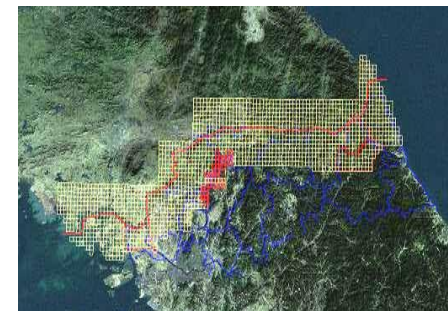
Map of North Korea



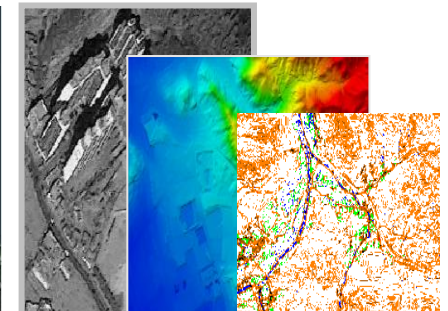
Plan for producing Geospatial Information in Border Area



Border Area Digital Topographic Mapping Index Table



Border Area Satellite Status



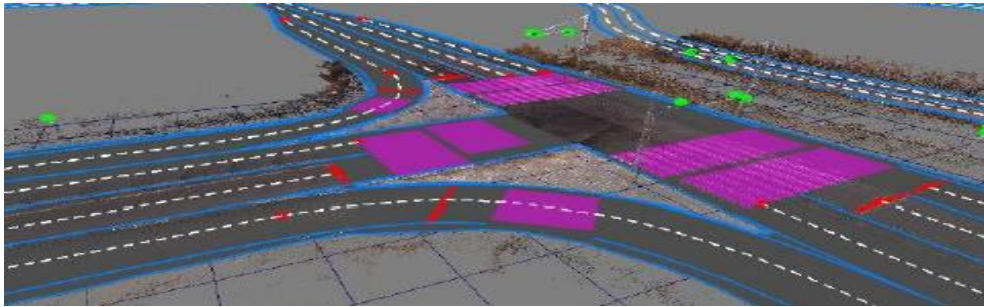
Establishment of newest Geospatial Information in Border Area

Producing Various Geographic Information

> **For Commercialize Autonomous-car**, Produce High Definition Maps with **25cm** accuracy.

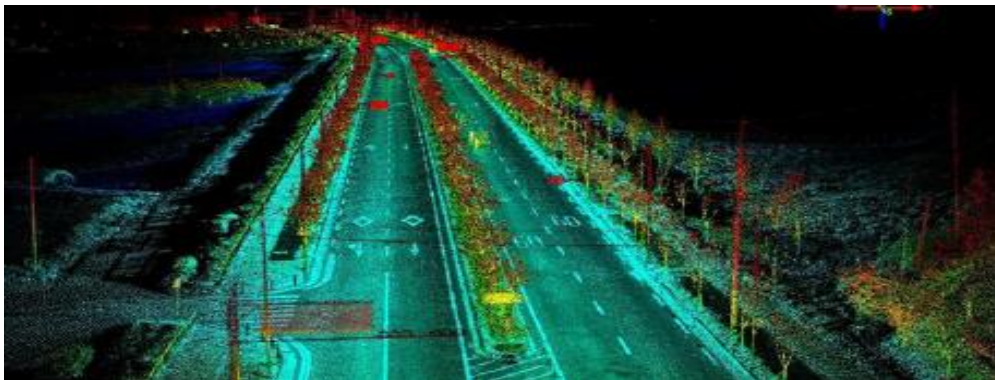
Precise Road Map (Vector Data)

- Selection of autonomous driving route, recognition of long-distance driving information, etc.



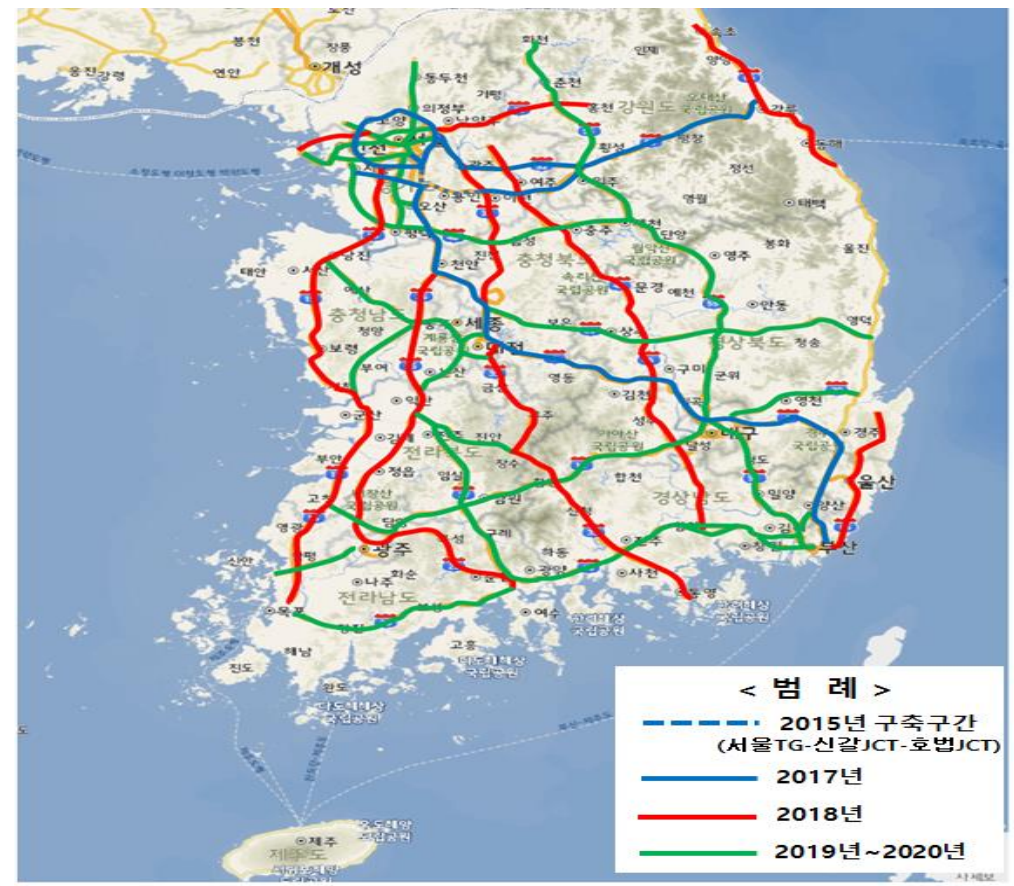
Point Cloud Data (Raster Data)

- Position correction by autonomous vehicle algorithm



Service

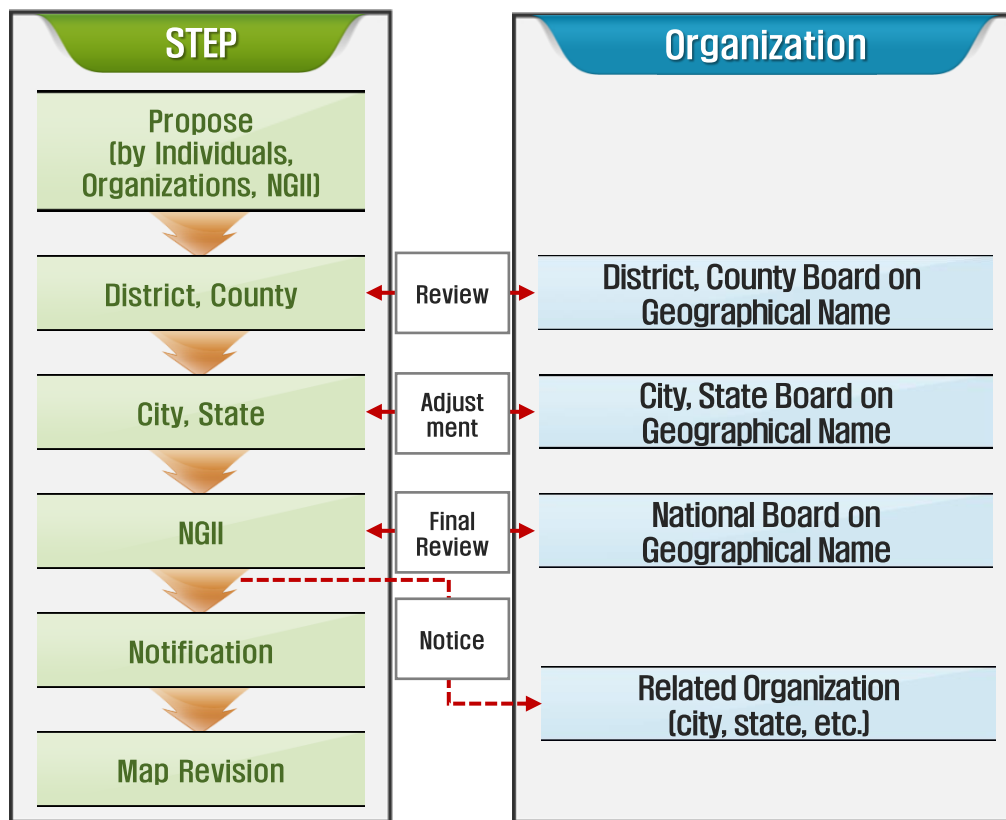
- Produced an Express highway(7 sections), General road(37 section)
- Total status of High definition maps : 1,742km



Managing the Geographical Names

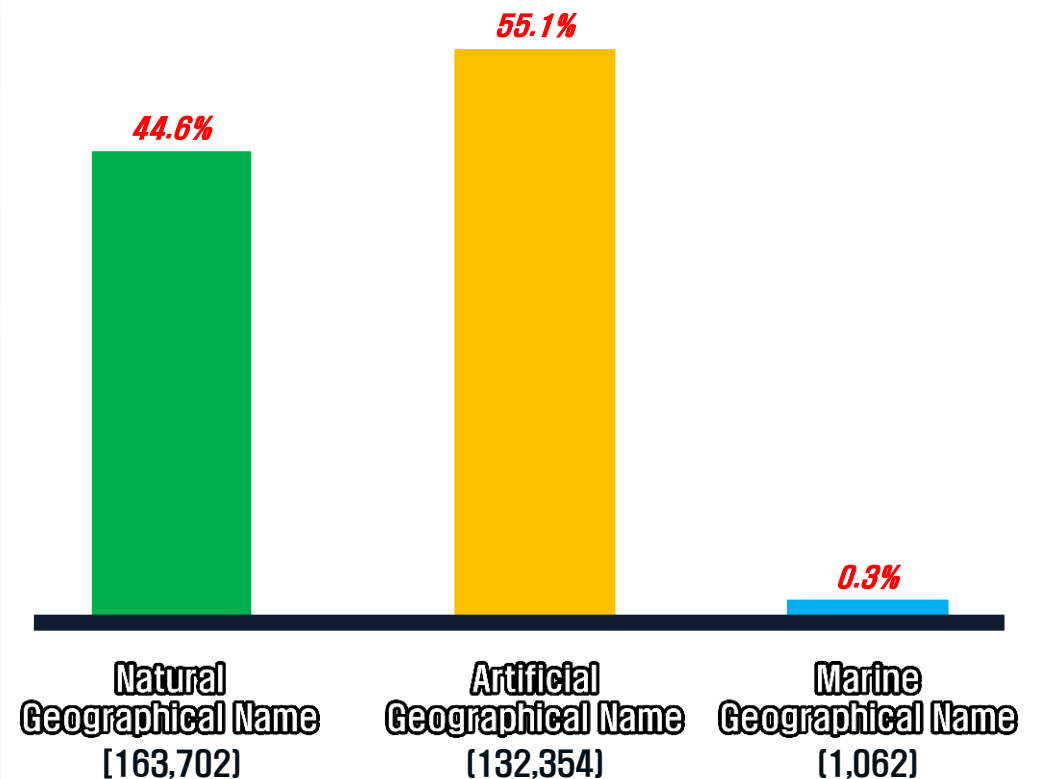
Approval Process of Geographical Names

- Establishment of Geographical Name maintenance system for activation of Geographical Name tasks.



Management of Geographical Names

- Management of Geographical Name to utilized the name as unified by discovering Japanese remnants, different names etc.



Efforts in International Society

- > NGII deals with the overall activities for National Geographical Names.

Revising the Incorrect Names

Researching the Japanese vestige Name

구한말 한글	구한말 한자	임제시대 한자	고시지명	고시지명 한자	변칭	변칭 한자
가동리	可東里	佳東里	가동	佳洞		
가막동	佳莫洞	可幕洞	가막골		가막동	可幕洞
가야산	伽耶山	伽椰山	가야산	伽椰峰	가야산	伽椰山
가업산	迦業山	伽業山	가업산		가업산	迦業山
가장동	可壯洞	佳壯洞	가장동	可莊洞		
가정	柯亭	佳亭	가정	佳亭		
개척리	蓋尺里	蓋尺里	개자		개척	蓋尺

The World map written in Multiple Language

Publishing the Atlas

- Publish the official Atlas of Republic of Korea that includes information on the territory, history, natural environment and humanity environment of Korea by statistical map, etc. and distribute it to overseas embassies and libraries.

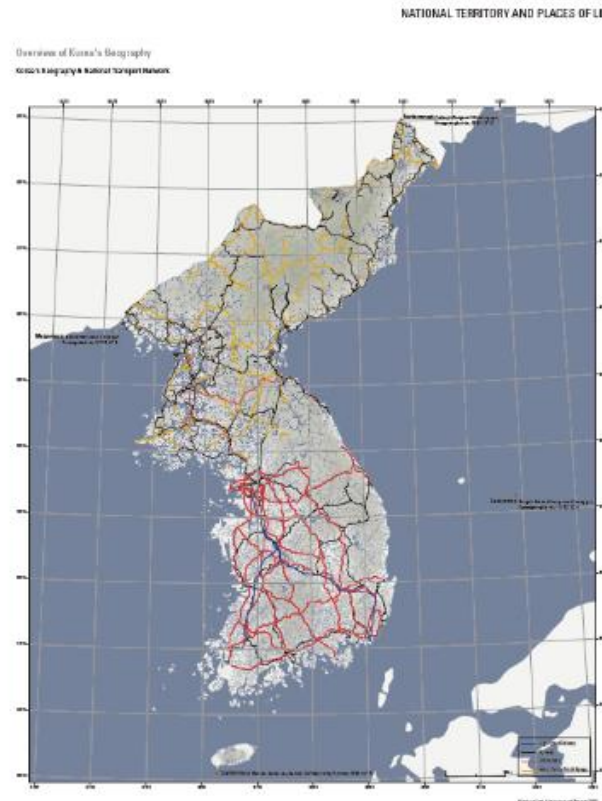
Atlas



The territory of the Republic of Korea consists of the Korean Peninsula and its adjacent islands as defined in the Constitution, and its area is 100,339 km² (38,722 sq. miles). The population of South Korea is 50,700,000, according to the 2018 National Population Statistics. It has more than 11.40 million urban residents alone are included. Considering that history is where people live, its natural environment is very important, including topography (i.e., mountains, rivers, and coasts), geoclimatic, landscapes, and the climate. These natural environments affect vegetation patterns, and people have built settlements adapting to these natural environments. The land of Korea in the 21st century was shaped by the historical culture of the 20th century, and also was significantly influenced by high-technology-oriented and environmental changes. The development of Korea involves the need to improve the quality of natural environments, and has brought the importance of public infrastructure. Transportation infrastructure has made interregional more dense, which was once hampered by mountains and rivers in all-

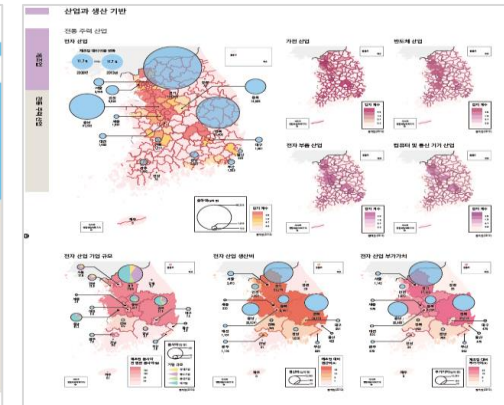
<p>Population 50,700,000 100.00%</p>	<p>Population 50,700,000 100.00%</p>	<p>Length of Coastline 14,184 km 100.00%</p>	<p>Surface Mountain 15,000 km² 100.00%</p>	<p>Climate Zone Temperate 100.00%</p>
<p>Area 100,339 km² 100.00%</p>	<p>Area 100,339 km² 100.00%</p>	<p>Number of Islands 3,200 100.00%</p>	<p>Number of Rivers 10,000 100.00%</p>	<p>Number of Lakes 1,000 100.00%</p>

014

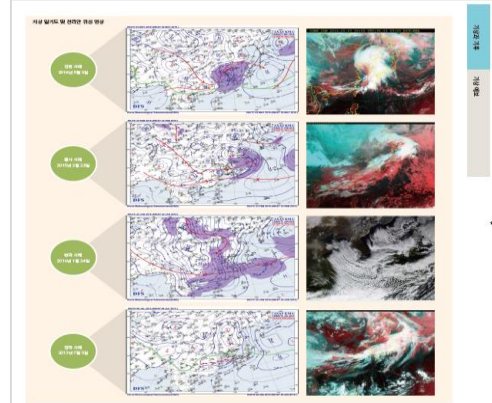


Overview of Korea's Geography

015



Humanity Environment



Natural Environment

International Cooperation and Major Activities

- NGII has taken part of international organizations in the field of geospatial information such as UN-GGIM, UNGEGN, ISO, IVS.

The first Plenary meeting of UN-GGIM ('11)



The 20th Plenary meeting of UNRCC-AP ('15)



UN-GGIM

United Nations – Global Geospatial Information Management

The Committee for coordination and cooperation on all issues related to geospatial information management

NGII was the first chair of UN-GGIM in 2011, and now Working as a vice-chair UN-GGIM-AP from 2016-2018

International Cooperation and Major Activities

Capacity Building Program

- NGII has operated the Capacity Building Course for the Surveying and Mapping Agencies of other countries since 2011 (**60** Countries, **105** Staff).



Modification of Geographical Name

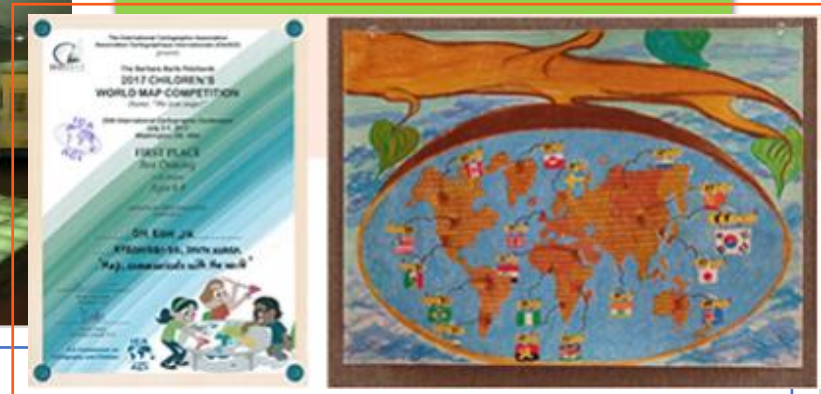
- NGII has signed MOU with **24** countries such as Russia, Netherlands, Nepal, USA, United Kingdom, and etc.
- Also, we have held periodical conference with Russia, China and Japan.



Overview of Map Museum



1st Award in ICA 2017



- Opening Date: 2004. 11. 1.
- The Primary Facilities : 3 Halls, the Field exhibition , etc.
- The Exhibits : the old Korean Map (116), the old overseas Map (538), the old Surveying Equipment (100) , etc.
- About **40,582** visitors a year



Guided Tour



Outreach Map
Museum Service



Children's Map
Drawing Contest



Special Ancient Map
Exhibition



Q & A



Thank You!