

# The Long-Term Plan for Basic Survey and the GSI Research and Development Basic Plan

**Toru NAGAYAMA, Yoshihisa SERIZAWA**

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## Abstract

*The Geospatial Information Authority of Japan (GSI) established its Long-Term Plan for Basic Survey and the GSI Research and Development Basic Plan in April 2014. The LT Plan gives the objectives of basic surveys and the measures of GSI to achieve these objectives. Meanwhile, the RD Plan gives the direction for research and development implemented by GSI. Based on these strategic plans, GSI applies itself on its work. This article presents the highlights of these two important plans toward the realization of geospatially enabled society in Japan.*

## 1. Introduction

The Geospatial Information Authority of Japan (GSI) established the Long-Term Plan for Basic Survey (hereinafter “LT Plan”) and the GSI Research and Development Basic Plan (hereinafter “RD Plan”) in April 2014.

The LT Plan has legal grounds in Article 12 of the Surveying act: “The Minister of Land, Infrastructure, Transport and Tourism shall make long-term plans concerning Basic Surveys<sup>1</sup>. The plan provides the objectives of basic surveys<sup>1</sup> and the measures of GSI to achieve the objectives. It is expected to realize a geospatially enabled society by avoiding redundancy in public surveys<sup>2</sup> and assuring survey accuracy through GSI’s survey work such as providing geospatial information.

The RD Plan is decided by the Director General of GSI. It provides the direction for research and development projects implemented by GSI, with a view to contributing to promoting the LT Plan.

Both plans are the fundamental guidance for

all the works of GSI. Metaphorically speaking, if all the products and outcomes were compared to planting flowers, the LT Plan and the RD Plan would be compared to soil and fertilizer respectively.

This article presents the highlights of these two important plans to seek the understanding of readers. The full text of the LT Plan and the RD Plan can be found at the website of GSI (Geospatial Information Authority of Japan, 2014a; Geospatial Information Authority of Japan, 2014b).

## 2. Long-Term Plan for Basic Survey

### 2.1 Background of establishment

#### 2.1.1 Changes of the major topics of past LT Plans

The LT Plan was revised approximately every ten years from 1953, the starting year of the First LT Plan, until 1994, the starting year of the Fifth LT Plan, reflecting the needs at that period. Thereafter it has been revised every five years in response to rapid changes in society, technology, and administrative needs. The changes of the major topics in past LT Plans are shown in Table 1.

The 1953 First LT Plan identified procurement of survey equipment as one of the major topics, in addition to concrete works such as maintenance of control points and map compilation and aerial photographs. It is particularly noted that procurement of surveying equipment was thought an urgent need, because in that days Japan faced material difficulty after World War Two.

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1 basic surveys: fundamental national surveys implemented by GSI defined in Article 4 of the Surveying Act

2 public surveys: surveys for public purposes, funded by national or local government, defined by Article 5 of the Surveying Act

**Table 1** Changes of the major topics in past LT Plans

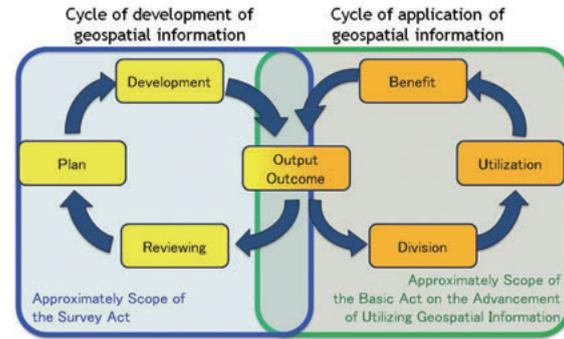
The 1 <sup>st</sup> L-T Plan	1953	Control points	Map compilation, aerial photographs	Procurement of survey equipment	
The 2 <sup>nd</sup> L-T Plan	1964	Control points	Basic maps	Thematic maps	Promoting utilization and publication of maps
The 3 <sup>rd</sup> L-T Plan	1974	Control points	Basic maps	Thematic maps	Promoting publication of maps
The 4 <sup>th</sup> L-T Plan	1984	Control points	Basic maps	Geographical Survey	Providing information
The 5 <sup>th</sup> L-T Plan	1994	Control points	Basic maps	Geographical Survey	Providing products
The Revised 5 <sup>th</sup> L-T Plan	1999	Control points	GIS fundamental data, Basic map	Geographical Survey	Digitalizing and providing products
The 6 <sup>th</sup> L-T Plan	2004	Positional information basis	Fundamental digital geospatial data	Developing and applying geographical information for disaster prevention and mitigation	
Previous L-T Plan	2009	Developing geospatial information	Applying geospatial information	Cooperation and R & D for developing and applying geospatial information	

After the previous L-T Plan established in 2009, the volume number (1<sup>st</sup>, 2<sup>nd</sup>, ...) has not been prefixed to the name of the plan.

In the 1963 Second LT Plan, and the following plans up to the 2004 sixth LT Plan, topics were set focusing on concrete geospatial works, such as maintenance of control points, compilation of basic maps and thematic maps, and implementation of geographical surveys. Guided by these LT Plans, GSI carried out its works for development and provision of geospatial information, and contributed to national development and improvement of physical infrastructure.

As the Basic Act on the Advancement of Utilizing Geospatial Information was established in 2007, Japan decided to head for further development and improvement of society through promotion of the utilization of geospatial information. In order to realize the objectives of this act, GSI is required not only to develop and provide, but also to take into account promoting utilization of geospatial information (Fig. 1). This paradigm shift made the major topics of the previous LT Plan in 2009 identified based on the life cycle phases of compilation, provision, and utilization of geospatial information.

The main topics of the 2014 LT Plan established -presented in this article- were also set focusing on the life cycle of geospatial information.

**Fig. 1** Life cycle of geospatial information

### 2.1.2 Background of the LT Plan establishment

Recently it is becoming more important to promote utilization of geospatial information, as utilization of digital data has become easier owing to the progress of information and communication technology (ICT), and it is imperative to make administrative works more efficient due to cuts in the budget and staff in the public sector. Based on this background, GSI defined a vision of desired society for the 2009 LT Plan, and have carried out the plan since then.

However, unanticipated changes occurred in society recently. These changes included: increased public awareness of disaster prevention and mitigation with the tragic experience of the 2011 Tohoku earthquake and tsunami; emerging needs for geospatial information due to further progress of ICT; and launching new administrative and private services dealing with such needs. In addition, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) audited policy and measures conducted by GSI in 2013. The audit results reaffirmed that it is important to continuously compile and provide geospatial information, to create an environment for facilitated geospatial information application, and to support relevant institutions and administrative agencies in the field of disaster prevention and mitigation.

The above mentioned movements led GSI to establish a new LT Plan, before the expiration year (FY<sup>3</sup> 2018) of the 2009 LT Plan.

<sup>3</sup> Fiscal year in Japan starts in April.

## 2.2 Highlights of the LT Plan

### 2.2.1 Planned period and the structure of the LT Plan

The LT Plan was established on April 9th 2014 with a planned period from FY 2014 to FY 2023.

The structure of the LT Plan is shown in Fig. 2. At first, the LT Plan defines a vision of desired society to be realized by GSI as well as relevant public and private agencies. Next, the LT Plan introduces two priority strategies and necessary measures of GSI which collectively contribute to realization of the vision. Finally, the LT Plan defines a short-term plan to carry out the plan, and a follow-up mechanism.

The following sections explain the vision of the desired society, the priority strategies and measures of GSI, and the short-term plan and the follow-up mechanism.



Fig. 2 Structure of the LT Plan

### 2.2.2 The vision of desired society

The LT Plan defines a vision of the desired society which will be enabled by geospatial information utilization.

The vision consists of the following five societal perspectives. These perspectives, listed below, were modified in the 2009 LT Plan, reflecting the background mentioned in 2.1.2 (Fig. 3).

1) A society that maintains a healthy land environment in national territory

“A society that maintains a healthy land environment in national territory” is a perspective carried

over from the 2009 LT Plan. Promotion of utilization, improvement, and maintenance of national territory through utilization of geospatial information is identified as the policy issue of this perspective.

2) A society that assures safety and security

“A society that assures safety and security” is a perspective that is also carried over from the 2009 LT Plan. Creating self-reliant and energetic regions is also considered under this perspective. Protecting citizens’ lives and property through geospatial information application is identified as the policy issue of this perspective.

3) A society in which transparency and reliability of the public sector are improved through utilization of public data

“A society in which transparency and reliability of the public sector are improved through utilization of public data” is a newly identified perspective. This derives from the increased importance of administrative efficiency due to changes in social situation and public needs and subsequent new public and private services. Contributing to optimization of administrative works by application of geospatial information is identified as the policy issue of this perspective.

4) A society in which people can lead prosperous and comfortable lives embracing application of new technology

“A society in which people can lead prosperous and comfortable lives embracing application of new technology” is a revised perspective from the 2009 LT Plan by adding the progress of new technology by the private sector. Contributing to improvement of citizens’ wellbeing and social benefit through geospatial information is identified as the policy issue of this perspective.

5) A society that is energized by launch of new businesses

“A society energized by launch of new businesses” is carried over from the previous LT Plan, with additional aspects of self-reliant and energetic regions. Contributing to enhancing economic vitality through geospatial information utilization is identified as the policy issue of this perspective.

These five perspectives conform to the vision of a desired society enabled by geospatial information. The

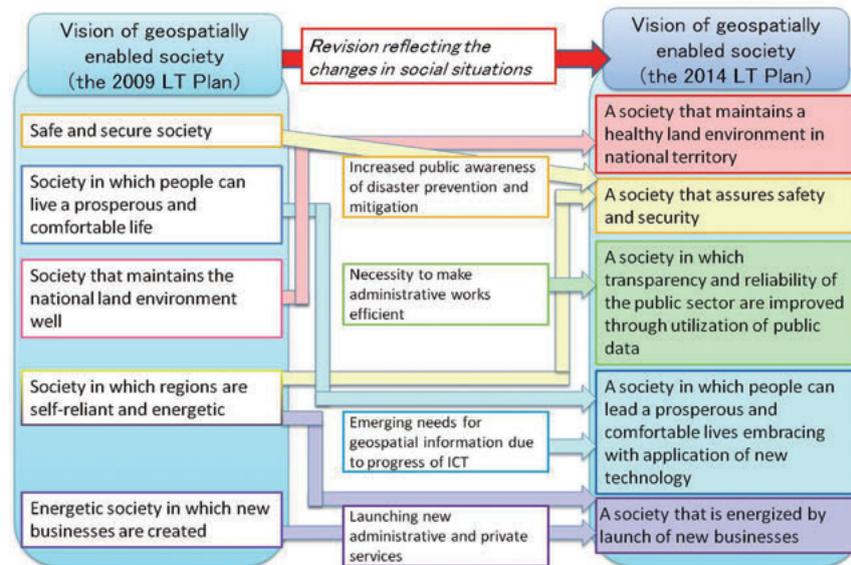


Fig. 3 Vision of desired society

vision is expected to be collectively realized by the efforts of GSI and relevant agencies.

### 2.2.3 Priority Strategies and Measures of GSI

The LT Plan introduces two Priority Strategies to realize the vision as well as measures of GSI to commit to the strategies. Fig. 4 shows the Priority Strategies and the measures of GSI.

The following two strategies are identified as Priority Strategies.

- Priority Strategy no.1

Capacity building for development and utilization of geospatial information (CB Strategy)

- Priority Strategy no.2

Promotion of distribution and utilization of publicly owned geospatial information for the creation of new industries and the improvement of citizens' wellbeing (PDU Strategy)

CB Strategy is initially applied to the disaster prevention and mitigation field in which people are interested. Both strategies require multi-actor partnerships and research and development for development and application of geospatial information.

#### (1) Measures of GSI for CB Strategy

The policy issues concerning CB Strategy are: to enhance the geospatial information literacy of all citizens;

to narrow the gap in levels of geospatial information measures among administrative agencies; and to share the best practices on utilization of geospatial information.

With regard to these policy issues, the LT Plan sets the measures of GSI for CB Strategy. They are: to continuously develop and provide geospatial information which indicates the situation of national territory; to support other administrative agencies appropriately and efficiently to develop and provide geospatial information within the framework of the public survey system; to grasp and provide risk information on national territory; and to develop and provide information about the situation of national territory during disasters.

#### (2) Measures of GSI for PDU Strategy

The policy issues which PDU Strategy is concerned with are: improving accessibility and availability of geospatial information; making geospatial information open to the public; and applying new technologies such as the Quasi-Zenith Satellite System (QZSS), a Japanese navigation satellite system currently being deployed.

With regard to these policy issues, the LT Plan sets out measures of GSI for PDU Strategy. They are: to support other administrative agencies to improve accessibility, availability, and usability of their own geospatial information; to develop human resources

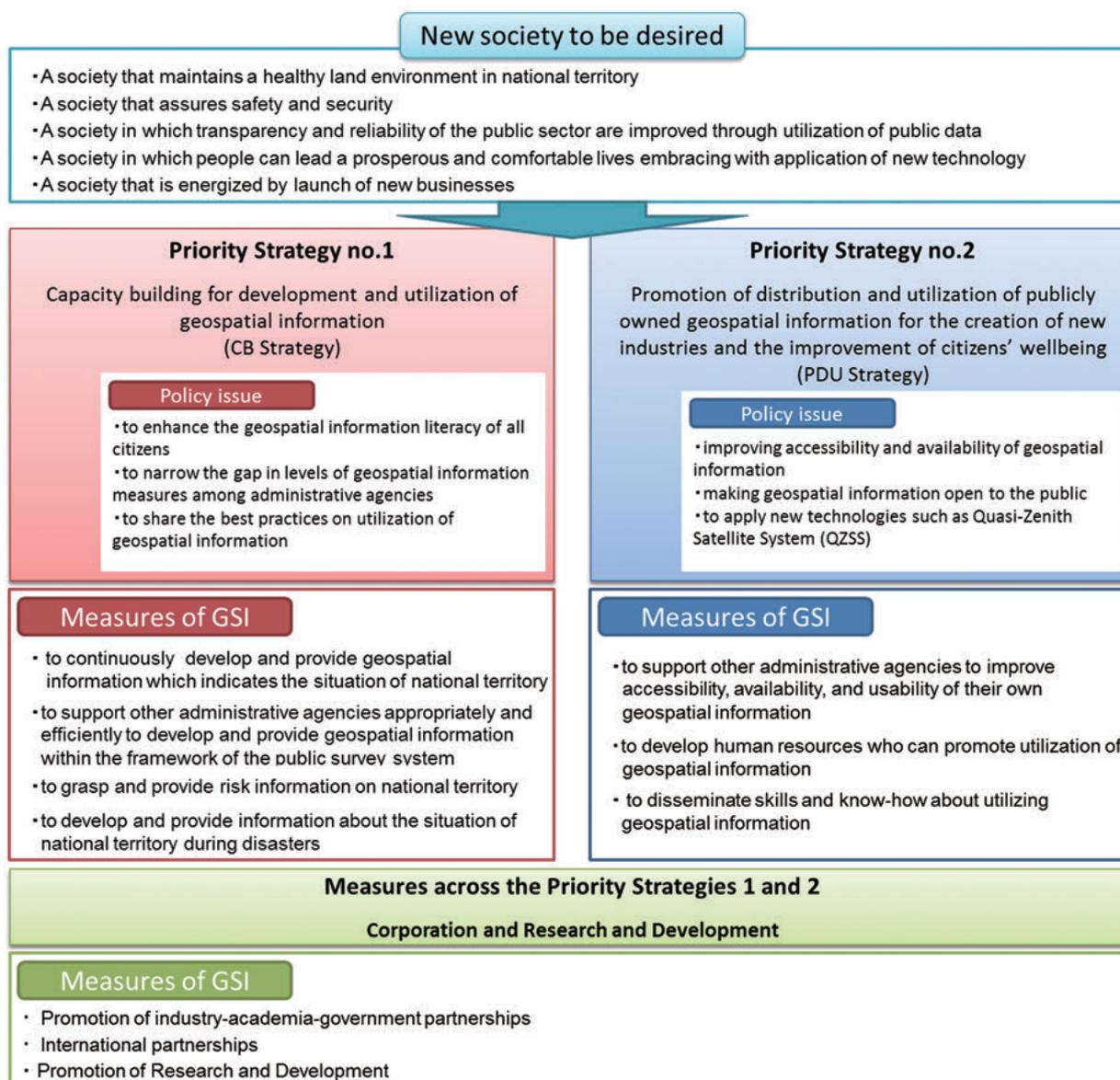


Fig. 4 The priority strategies and necessary measures of GSI

who can promote utilization of geospatial information; and to disseminate skills and know-how about utilizing geospatial information. Carrying out GSI's measures for improving the usability of geospatial information is also intended to create new industries through the application of new technologies, such as QZSS.

### (3) Measures of GSI for both Priority Strategies

The LT Plan sets measures of GSI for both Priority Strategies. They are promotion of industry-academia-government partnerships and international partnerships, and research and development. The emphasis of the measures is based on the recognition that GSI's

commitments alone cannot realize the strategies.

Meanwhile, strategies without implementations are a pie in the sky. Therefore, the LT Plan provides GSI with a short-term implementation plan to check on its own activities

#### 2.2.4 Short-Term Implementation Plan and Follow-up Measures

The LT Plan stipulates that GSI establishes a short-term implementation plan. The short-term implementation plan defines concrete implementation tasks and their allocated budgets. GSI implements its measures based

on this plan. Once a year, GSI revises the plan to follow up its implemented measures and reset its short term objectives.

GSI calls a short term implementation plan an “Action Plan”. An Action Plan defines concrete implementation tasks and the allocated budget of GSI during the next one year, considering its vision and scheduled measures for three years. Although the planned period of an Action Plan is three years, it is revised every year. Hence, an Action Plan is a rolling plan (Fig. 5). In the wake of revision, GSI follows up its own activities. In addition, the LT Plan can be revised before its expiration if required, to deal with rapid changes in society.

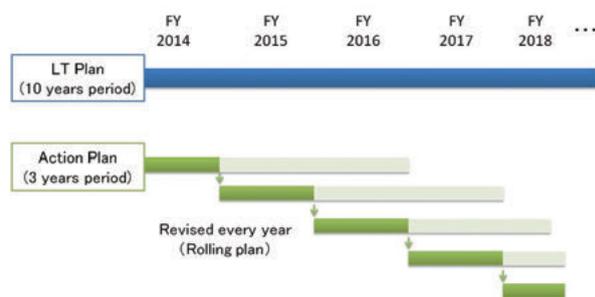


Fig. 5 Planned periods of the LT Plan and a series of Action Plans

### 3. GSI Research and Development Basic Plan

#### 3.1 Background of establishment

##### 3.1.1 Recent social situation

The 2011 Tohoku earthquake and tsunami impressed again the menace of natural disasters. Experience of this unprecedented disaster made Japanese society recognize that a great deal of research and development for disaster prevention and mitigation is still necessary.

Meanwhile, economic contraction partly due to decreasing birthrate and an aging population has been regarded as an important problem in recent years. To solve this problem, value-added and efficient production systems have been sought through applying information and communication technology (ICT) and scientific results. Owing to this advancement, efficient survey work and facilitated distribution and utilization of geospatial information have been taken for granted.

GSI has committed its resources to research and

development which contribute to conducting effective surveying, developing and utilizing of geospatial information. GSI’s research and development cover a wide area, ranging from basic studies to practical research.

From the point of view of geospatial information, GSI sees it as necessary to conduct research and development which contribute to disaster prevention and mitigation, and to solving economic contraction due to a decreasing birthrate and an aging population, and not limited to just conducting effective surveying, compiling and utilizing of geospatial information.

#### 3.1.2 Background of RD Plan establishment

The previous RD Plan was established in 2009, with planned period from FY 2009 to FY 2013. The plan was revised once in 2012 and expired in March 2014.

Based on a review of the outputs, outcome, and challenges remaining of the previous plan, as well as provision of the LT Plan and public needs for research and development, GSI established the new RD Plan in April 2014. The planned period of the new RD Plan is five years from FY 2014 to FY 2018.

The following sections will present highlights of the RD Plan.

### 3.2 Highlights of the RD Plan

#### 3.2.1 Planned period and Structure of the RD Plan

The RD Plan was established on 25 April 2014, with planned period from FY 2014 to FY 2018.

The structure of the RD Plan is shown in Fig.6.

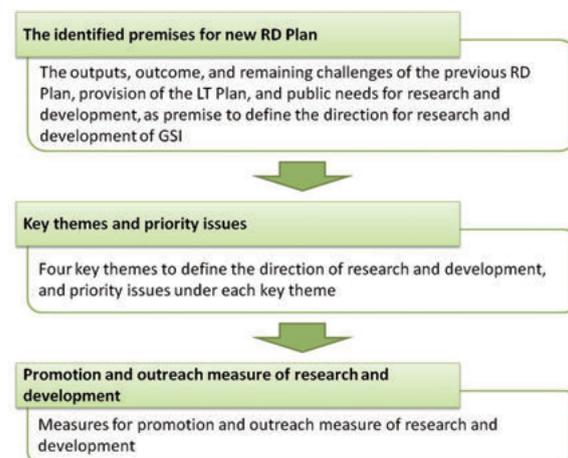


Fig. 6 The structure of the RD Plan

Firstly, outputs, outcome, and remaining challenges of the previous RD Plan, provision of the LT Plan and public needs for research and development are proposed in order to define the direction for research and development of GSI. Next, RD Plan sets four key themes to define the direction of research and development, and identifies issues to which GSI should commit as priority. Finally, RD Plan defines measures for promotion and outreach of research and development.

### 3.2.2 The identified premises for the RD Plan

#### (1) Output, outcome, and remaining challenges of the previous plan

The outputs, outcome, and remaining challenges of previous plan are clarified based on mid-term report of RD Plan in August 2012, and advances of research and development thereafter. This section presents only remarkable topics.

Outputs and outcome include: usefulness of research and development results which contributed to development and provision of geospatial information at the time of the 2011 Tohoku earthquake and tsunami; outreach of knowledge gained from research and development to the public through academic journals and conferences; and provision of a database on Digital Japan Basic Map, the framework national map data maintained by GSI, into which many kinds of geospatial information are integrated.

Remaining challenges include: insufficient demonstration of achievement of geospatial services for the 2011 Tohoku earthquake and tsunami; effective public relations activity for research and development; introduction of policy dimensions into research and development in the field of geospatial information; application of new technologies such as QZSS and ICT equipment; appropriate budget allocation for participation in foreign academic conferences; and development of external human resources taking advantage of GSI's plentiful human resources and facilities.

#### (2) Provision of the LT Plan

The new LT Plan sets two Priority Strategies to realize its societal vision as well as measures of GSI to commit to the priority strategies. Details are given in

section 2.2.3 in this article.

#### (3) Public needs

The RD Plan identifies public geospatial needs as: solving social problems and creating an affluent society through enabling of geospatial information; promoting research and development contributing to space use, such as application of QZSS; making the geospatial information possessed by administrative agencies open; preventing and mitigating disasters by predicting earthquakes and volcanic activity; and developing and providing geospatial information during disasters.

### 3.2.3 Key themes and Priority issues

Based on the premises mentioned in section 3.2.2, RD Plan sets four key themes to define the direction of GSI's research and development, and priority issues under each theme. A schematic image of key themes is shown in Fig. 7. Priority issues under the key themes define issues to be taken as priority (Fig. 8).

The four key themes are:

Key theme no.1

Research and development to enhance development and utilization capability

Key theme no.2

Research and development to create a geospatially enabled society in the next generation

Key theme no.3

Research and development for disaster prevention and mitigation

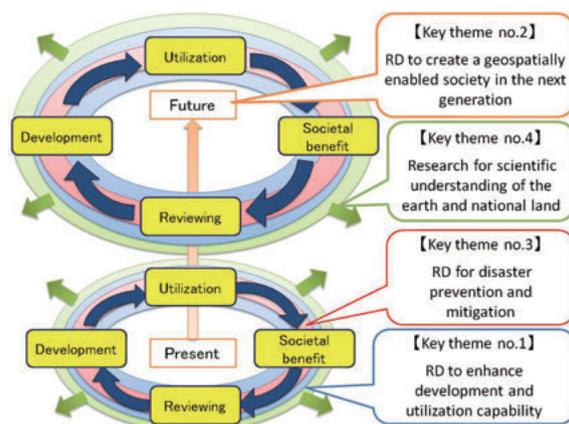


Fig. 7 Schematic image of key themes

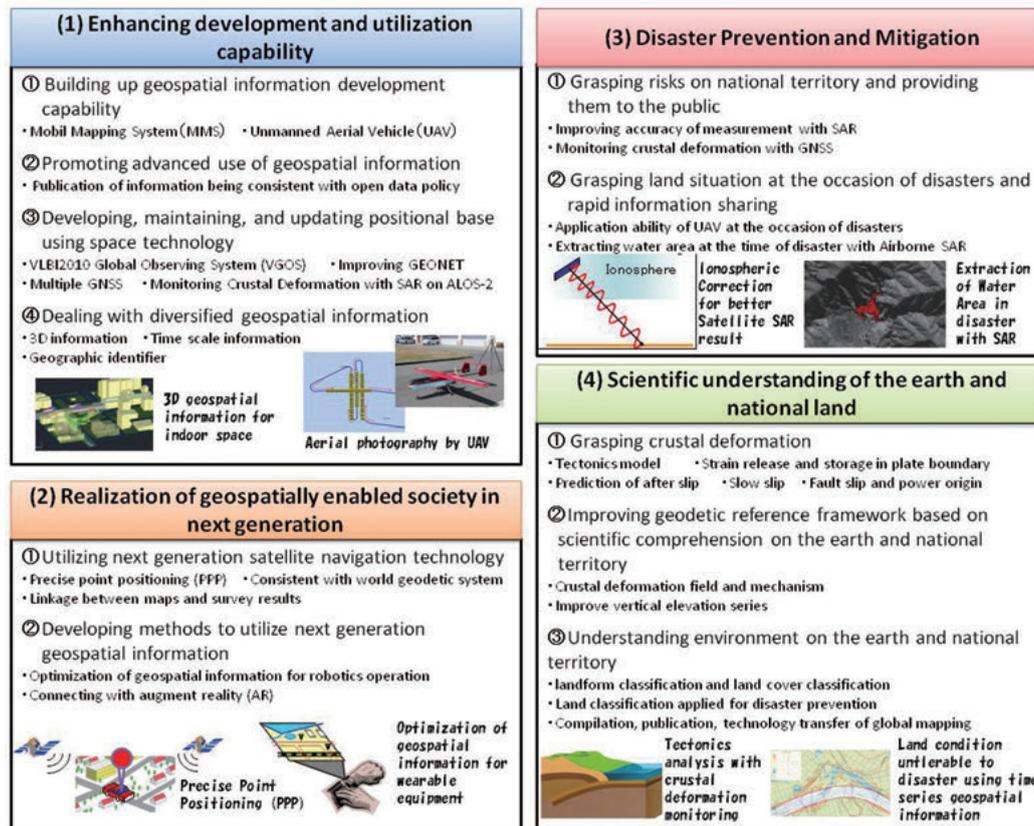


Fig. 8 Key themes and priority issues

## Key theme no.4

Research for scientific understanding of the earth and national land

**(1) Key theme no.1**

Key theme no.1 focuses on making the geospatial information management cycle effective and efficient. The cycle consists of development, utilization, societal benefit, and reviewing phase, as shown in the lower part of Fig. 7. The theme includes the following four priority issues.

- 1) Building up geospatial information development capability: GSI aims to establish effective methods of geospatial information development by adopting new technology such as Unmanned Aerial Vehicles (UAV) and Mobile Mapping Systems (MMS).
- 2) Promoting advanced use of geospatial information: GSI aims to develop effective and efficient methods for publication and dissemination of

geospatial information, consistent with an open data policy.

- 3) Developing, maintaining, and updating positional base using space technology: GSI aims to apply space technology, such as multi-GNSS (Global Navigation Satellite Systems) analysis and grasping crustal deformation using synthetic aperture radar (SAR) loaded on the advanced land observing satellite-2 “DAICHI-2” (ALOS-2).
- 4) Dealing with diversified geospatial information, such as three-dimensional information: GSI aims to develop methods to deal with geospatial information with a layered structure, three-dimensional information, and information with temporal attributes.

**(2) Key theme no.2**

Key theme no.2 focuses on enhancing the geospatial information management cycle in the next generation as shown in upper part of Fig.7. This theme includes the following two priority issues.

- 1) Utilizing next generation satellite navigation technology: GSI aims to cultivate the necessary knowledge to commit to research and development in the future in anticipation of next generation satellite navigation technology such as precise point positioning (PPP).
- 2) Developing methods to utilize next generation geospatial information: GSI aims to explore necessary knowledge to commit to research and development in the future to create a new application field of geospatial information, concerning social changes such as ICT progress and decreasing birthrate and aging population.

### **(3) Key theme no.3**

Key theme no.3 focuses on research and development in the disaster prevention and mitigation field. The field is symbolically shown in red circles in Fig.7. This theme includes the following two priority issues.

- 1) Grasping risks on national territory and providing them to the public: GSI aims to explore necessary knowledge to grasp disaster risks on national territory and to provide risk information to the public. Risk information includes regular observation on crustal deformation.
- 2) Grasping land situation at the occasion of disasters and rapid information sharing: GSI aims to develop technology which can be applied during disaster such as UAVs.

### **(4) Key theme no.4**

Key theme no.4 focuses on research to seek scientific knowledge to potentially expand the activities of geospatial information management as shown in Fig.7. The green arrows symbolize this theme. This theme includes following three priority issues.

- 1) Grasping crustal deformation: GSI aims to explore knowledge to apply to research and development in relevant fields, such as an area-wide tectonics model around the Japanese archipelago.
- 2) Improving the geodetic reference framework based on scientific comprehension of the earth and national territory: GSI aims to deepen its knowledge to apply to improvement of geodetic

reference framework through understanding the crustal deformation field and its mechanism.

- 3) Understanding the environment on the earth and national territory: GSI aims to cultivate knowledge to apply to future forecasts of national territory through analysis of landform classification and land cover classification.

### **3.2.4 Research and development promotion and outreach measures**

The RD Plan also sets out promotion and outreach measures for research and development.

#### **(1) Research and development promotion measures**

Basically, five operation departments and the research department of GSI conduct research and development individually. Five operation departments mainly conduct activities under key themes nos. 1, 2, and 3. The research department mainly conducts research and development under key theme no.4. In addition, research and development coordinators are designated to coordinate research and development across the departments.

While the RD Plan has a planned period of five years, GSI establishes an annual research and development implementation plan every year. Following the implementation plan, GSI coordinates research and development in a concrete way.

Results of research and development are evaluated by “GSI’s Internal Evaluation Committee” composed of the board officers of GSI and “the Research Evaluation Committee” composed of external experts. Results of evaluation are reflected in the next year’s implementation plan, so that GSI can get full feedback on its research and development.

GSI makes best efforts to improve the environment for research and development from the view point of human resources, facility, and budget allocation, in order to maximize effectiveness and efficiency. In addition, GSI further seeks collaboration with administrative agencies, academia, and private sectors, both nationally and internationally, in order to explore new knowledge and technologies.

#### **(2) Research and development outreach measures**

The results of research and development of GSI are expected to benefit society. To this end, GSI will provide its results through the internet, mass communication media, conferences, lectures, and academic conferences and journals to relevant actors and the public.

GSI would also like to share its results through collaboration with administrative agencies, academia, and the private sector, both nationally and internationally.

Further, GSI would like to build human capacity of external experts as well as internal experts, based upon 145 years history of development and provision of geospatial information.

#### 4. Summary

The LT Plan was established on April 9th 2014 with a planned period from April 2014 to March 2024.

The LT Plan first envisions a new society to be realized by GSI and relevant public and private agencies. Then, the plan sets two priority strategies which define the direction to realize the vision as well as the measures of GSI which make up the priority strategies. The LT Plan also introduces a short term implementation plan which regularly follows up the measures implemented.

The RD Plan was established on 25 April 2014, with the planned period from April 2014 to March 2019.

The RD Plan first defines the premises for its foundation; the results and issues of the previous RD Plan; provision of the LT Plan and public needs for research and development in the field of geospatial information. These premises lead the RD Plan to set four key themes to define the direction of research and development of GSI, and the priority issues under each theme. Finally, the RD Plan defines promotion and outreach measures to implement research and development.

As the sole government authority in the geospatial field, GSI has been carrying out development of geospatial information, promotion of its utilization for disaster prevention and mitigation, and scientific research in relevant fields. As backbone strategies, the LT Plan and the RD Plan are expected to coordinate all activities of GSI. Following these plans, GSI wants to make a unique and indispensable contribution to society. In addition,

GSI wishes to contribute to the creation of social benefit through cooperation with the private, academic, and public sectors, with a view to realizing a geospatially enabled society.

#### References

Geospatial Information Authority of Japan (2014a): Long-Term Plan for Basic Survey, <http://www.gsi.go.jp/common/000099979.pdf>

Geospatial Information Authority of Japan (2014b): GSI Research and Development Basic Plan, <http://www.gsi.go.jp/common/000099980.pdf>