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COUNTRY REPORTS

REPORT OF THAILAND ON CARTOGRAPHIC ACTIVITIES

Submitted by Thailand **

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Report of Thailand on Cartographic Activities
During the Period 2003 – 2006

This country report of Thailand presents in brief the cartographic activities during the reporting period 2003 – 2006 performed by various government organizations namely Royal Thai Survey Department, Hydrographic Department, Department of Mineral Resources, Royal Irrigation Department and Electricity Generating Authority of Thailand.

The Royal Thai Survey Department (RTSD)

The Royal Thai Survey Department is the national mapping organization under the Supreme Command ,Ministry of Defense responsible for surveying and producing topographic maps of Thailand in support of national security, spatial data infrastructure and other country development projects. The work done during 2003 to 2006 is summarized as follows.

1.Topographic Products

1.1Topographic Map Series L7018

In 2004, RTSD completed Thailand L7018 Recompilation Project. It was the production of the new map series L7018 comprising 830 sheets of 1 : 50,000 scale digital topographic line maps of Thailand, using WGS 84 datum. Replacing the former L7017 series, this series is the 1: 50,000 topographic base maps of Thailand primarily for national defense and government uses. It was anticipated that in 2006, 210 sheets in the middle part of Thailand will have been revised using SPOT5 imagery.

1.2Topographic Map Series 1501

Topographic map of Thailand series 1501 at a scale of 1:250,000 including 45 sheets covering Thailand had been revised and made available in a vector format. The production sources are 1:50,000 scale map series L7018 and DETED2

1.3 City Map of Bangkok

The city map of Bangkok at a scale of 1:50,000 had been revised and published in 2003 for the public.

1.4Tourist Map of Bangkok

In 2004, RTSD published the A4 sized book of Tourist Map of Bangkok at a scale of 1:25,000 showing interesting places of Bangkok with the most updated transport information.

2.Geodetic Activities

2.1 Horizontal Control Network

2.1.1 Status of GPS network before the mega- thrusted earthquake on 26 December 2004

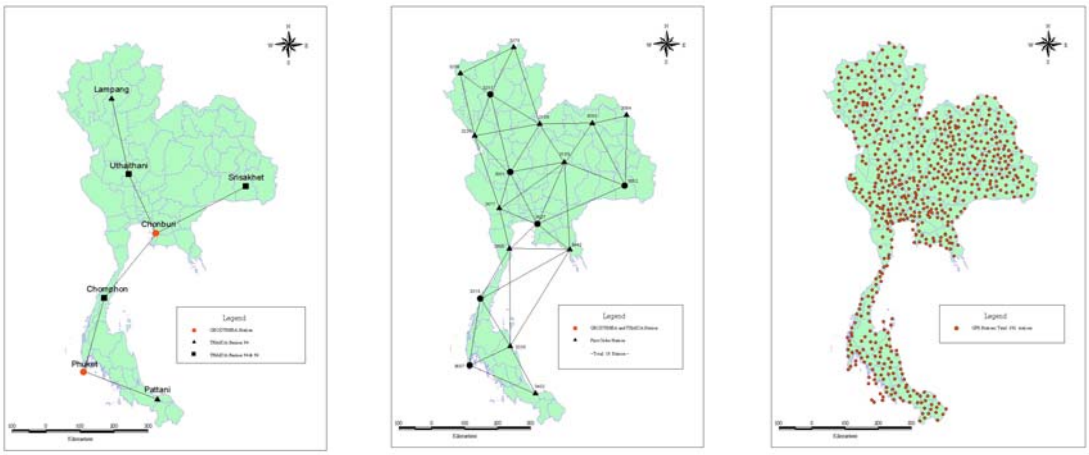
Geodesy and Geophysics Division, the Royal Thai Survey Department (RTSD) is responsible for the establishment of Geodetic Network in Thailand using the Global Positioning System. The GPS observations have been performed since 1991 and its networks have been continuously developed until now. Moreover, RTSD had participated in various international projects of GPS observations.

The results coming out from the participation in the various projects make the GPS Thailand Network acquire not only the observed data but also the accurate and reliable control stations. As a result of this, Geodesy and Geophysics Division, RTSD has performed the network adjustment covering the whole country in order to make the network not only become more accurate and reliable but also reach the unity. The Network of RTSD is divided into 3 levels as follows :

1) Reference Frame (Zero Order Network) being used for the project on monitoring tectonic motions, THAICA and GEODYSSEA Projects consisting of 7 stations namely GPS 3001 Uthai Thani province, GPS 3052 Srisaket province, GPS 3217 Lampang province, GPS 3315 Chumphorn province, GPS 3405 Pattani province, GPS 3427 Chonburi province and GPS 3657 Phukhet province. Reference coordinates are in ITRF system during the time of 1996.3.

2) Primary Network (First Order Network) It is determined in Class A as standardized by FGCC. This network which is extended from the Zero Order Network was first observed in 1999. There are 18 stations included in the First Order Network (including 7 stations as specified in item 1). The interval in each station is about 250 kilometers.

3) Secondary Network (Second Order Network) It is determined in Class B as standardized by FGCC. This network is extended covering the entire country with the total of 692 stations. The said network has been observed from 1991 until 2002. The interval in each monument is about 20 – 50 kilometers.



Reference Frame Primary Network Secondary Network

Fig. 1 GPS Network of Thailand

In conclusion, before the mega-thrusted earthquake on December 26th, 2004 the RTSD GPS Network is highly reliable and consistent with FGCC's standard. All stations from GEODYSSEA and THAICA Projects in ITRF system during the time of 1996.3 are used as the Control stations.

However, RTSD Reference Frame of GPS stations are also used for studying the geodynamics with DEOS, the Netherlands Institute. By using more than ten years (1994 – 2004) GPS data from the campaigns, it found that these stations move eastward about 3 centimeters per year, or it might say that Thailand move eastward about 3 centimeters per year as shown in Fig. 2.

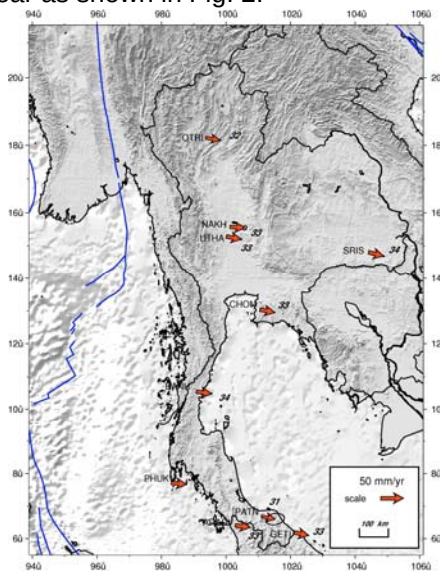


Fig. 2 Thailand 1994-2006 Horizontal Velocities in ITRF-2000

2.1.2 Deformation of GPS network due to the mega-thrusted earthquake on 26 December 2004
The Mw 9.3 mega-thrust earthquake on 26 December 2004 off the coast of North Sumatra, has resulted in large co- and post-seismic motions throughout SE Asia. As a result, also the geodetic network of Thailand has been deformed. The THAICA network has been regularly observed with GPS since 1994. Therefore the continuous tectonic motions in Thailand, which is located on the Sundaland block are well known. The last GPS campaign prior to the mega-thrust earthquake took place in October 2004 as part of the EU-ASEAN funded SEAMERGES project. Shortly after the earthquake, the GPS campaign was repeated in February 2005 to determine the co- and post-seismic. The entire THAICA and GEODYSSEA GPS database on Thailand was (re)processed, using the Precise Point Positioning strategy of the JPL GIPSY software package. Data from the International GPS Service (IGS) were included, to obtain the positions and velocities of the Thai sites in the International Terrestrial Reference Frame (ITRF) solution of 2000. The coordinate time series of the Thai geodetic network span up to a decade and each GPS campaign averaged position was determined with an absolute horizontal accuracy of 3 to 5 mm in ITRF-2000. This resulted in absolute steady-state velocities prior to the earthquake with uncertainties below 1 mm/yr. The earthquake resulted in co-seismic displacements, ranging from 27 cm in the south, 8 cm in the center, to about 3 cm in the north and east of Thailand. The postseismic motion already increased further these displacements at each location by 25% in only 50 days. The post- seismic motion is time dependent with an exponential decay rate, and will be clearly detectable for at least 0.5 year in the north and east of Thailand, and up to 1.5 year in the south. The relative position changes in the national Thai geodetic network can finally reach up to 50 cm or even more if more large aftershocks like the Mw 8.7 earthquake in Sumatra occur. Additional GPS re-measurements are required to model the post-seismic motion better, and determine accurate time dependent transformation parameters between pre- and post-earthquake network coordinates.

Updating the geodetic network for Thailand will not be an easy task. The entire network is still further deforming as a result of the post-seismic motion.

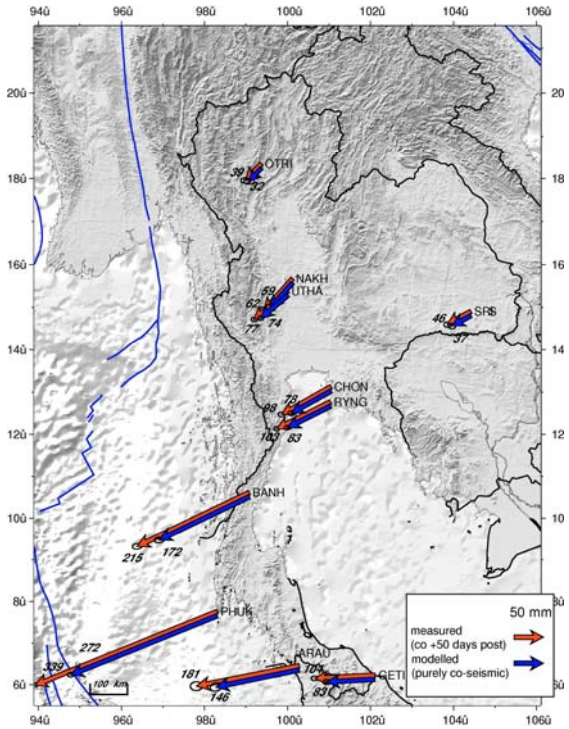


Fig. 3 Co- and post-seismic deformation measured at GPS Reference stations

2.1.3 Status of GPS network after the mega-thrusted earthquake on 26 December 2004
After the mega-thrusted earthquake on 26 December 2004, RTSD had to perform GPS re-observations on the Network as follows :

1) Reference Frame (Zero Order Network) The previous 7 GPS stations were re-observed repeatedly by 3 times in 2005 and 2 times in 2006 (until now) in order to define the new coordinates of the stations and velocities of the Thai sites in the International Terrestrial Reference Frame (ITRF) solution of 2000**.**

2) Primary Network (First Order Network) The previous 18 GPS stations were re-observed once in 2005 and readjusted to Reference Frame in the International Terrestrial Reference Frame (ITRF) solution of 2000. These 18 GPS stations were observed once again in 2006 in order to investigate the deformation in the GPS network that it should be determined in Class A as standardized by FGCC.

3) Secondary Network (Second Order Network) This class of the GPS network had been re-designed and performed the GPS observations by selecting some suitable GPS stations in the network. Partly GPS network in the southern and the northern part of Thailand had been performed in 2005 and 2006 respectively.

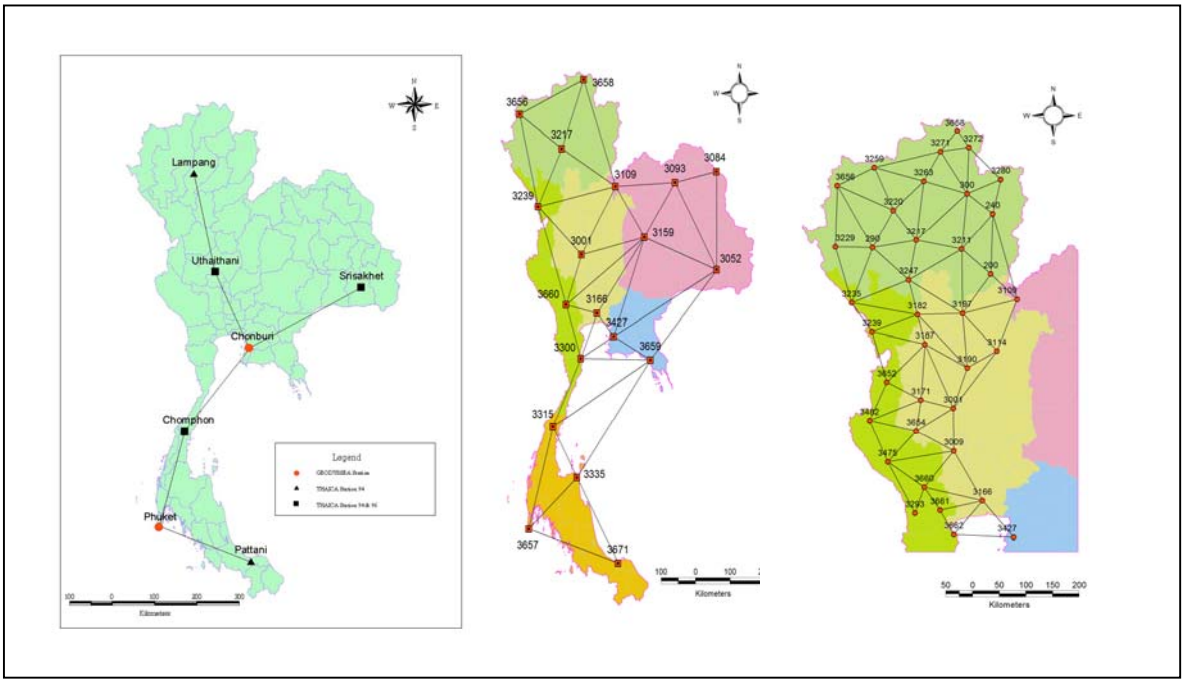


Fig. 4 GPS Network after the mega-thrusted earthquake on 26 December 2004

2.2 Vertical Control Network

The network of first order leveling was extended from the tidal datum (Mean Sea Level) at Ko Lak (BMA.) to every part of the country. The first order leveling is carried out to densify the network every year. All observation data in the leveling network were prepared and adjusted simultaneously in 2003. In 2004 – 2006 the first order leveling is still carried out in every part of the country to densify the network

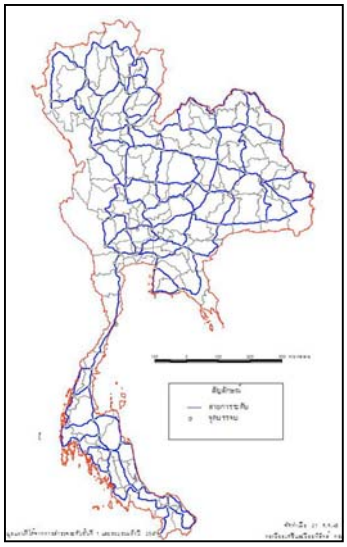


Fig. 5 First order leveling network of Thailand

2.3 Geodesy and Geodynamics Research by GPS Observations.
Pursuant to the coordination between the RTSD and DEOS, Delft University, Netherlands , both sides are interested in high accuracy geodetic coordinates to derive the velocity estimates of plates motion and site ties for GPS stations in and around Thailand. The GPS permanent station was set up at Survey school, RTSD in April 2005.

Fig. 6 RTSD-DEOS GPS permanent station at Survey School, RTSD

The station installation was successful, and the station now provides high-quality dual-frequency GPS measurements. The first batch of GPS data from the new RTSD-DEOS GPS base station (RTSD) was successfully analyzed. Although the station is located in the center of Bangkok, the GPS data quality is very good, and no signs of noise in the GPS measurements was observed. Therefore, the daily coordinates are of high accuracy (within 2 mm for the horizontal position), and after 10 days already resulted in absolute ITRF-2000 coordinates which are better than 5mm for the horizontal and 20 mm for the vertical position. The station is very well suited for fixing the Reference Frame for GPS network of Thailand. Also the station will allow a continuous monitoring of the post-seismic motions in Bangkok related to the 26th December 2004 and the 28th March 2005 earthquakes in Indonesia, which have deformed the landscape of Thailand.

2.4 Participation in Regional Geodetic Campaigns
RTSD took part in the APRGP campaign on GPS observations nearly every year. Five stations from the THAICA stations and two GEODYSSEA stations were observed during the campaign as shown in Table 1, and the data were submitted to APRGP.

YEAR	LAMP	UTHA	SRIS	CHON	CHUM	PHUK	PATN	Remark
2003	X	X	X	X	X			
2004								No observations
2005	X	X	X	X	X	X	X	GPS data at UTHA has only L1
2006								To be observed in October 2006

Table 1 GPS observations in the APRGP campaign

3.Map Information Center

3.1 Introduction
Therefore, since MIC b egan operations in 1995, especially during 2002-2006, many vital tasks in front of and behind scenes have been carried out successfully. A few of all MIC tasks are discussed in details of each task as following:

3.2 Royal Project Participation

Since four years ago, MIC of RTSD as one of participates in Royal Project Operation, has realized several Royal tasks mentioned in details as follows:

1)Royal GIS Project Realization

In Thailand, His Majesty the King usually uses RTSD topographic maps for planning his people's welfare improvement projects. Therefore to celebrate 60th anniversary the King's accession to the throne and to release his hard working, RTSD under the general director initiates to develop Geo-information Systems as the King's Supporting systems for His Majesty's planning in several ten of Royal Projects because Geo-information is the important basic tools for all spatial planning. In the first step, MIC distributed all available RTSD geospatial information to the King and his royal servants for Royal project. The project completion and operation launch will be expected soon.

2)Ancient Map Renovation

Under Her Royal Highness Princess Maha Chakri Sirinthon's attention to renovate naturally-decaying ancient maps for historical research proposes for the next generation. MIC has been honorably-assigned by digitalizing all ancient maps. (See Figure 1)

Figure 1 Processing of Ancient Map Renovation

3)Arrangement of Basic Map Use's Training Courses for Royal Servants of the Office of His Majesty's Principal Private Secretary

Annually, therefore there are several thousands of Thai's suffering release letters to His Majestic though the Office of His Majesty's Principal Private Secretary. Then, this office is in charge of assistance of screening and proposing those problems further to His Majestic for his final making-decision. RTSD topographic maps are as the important tool or evident for clear and vivid problem's analysis. To strengthen their map usage skill of staffs of the office, MIC with heart-full attention completed arrangement of map usage courses for staffs of the office or Royal servants during September2005.

4)Exhibition for HRH Princess Maha Chakri Sirinthon's RTSD Visiting for 120th RTSD Establishment Anniversary

In September 2005, RTSD arranged the celebration of 120th RTSD establishment anniversary. In this special occasion of RTSD, HRH Princess Maha Chakri Sirinthon kindly accepted RTSD's invitation. On her RTSD's visiting date, it is honored and appreciated of all RTSD's staffs because HRH Princess Maha Chakri Sirinthon was interested in every portion of Exhibition by spending time over much his assigned schedule. (See figure 3)

Moreover, some selective MIC's officers as well-trained experts in Geo-information Applications are pleased to present their royalty to periodically serve H.M. King and H.M. Queen Activities of their people's sustainable welfare development and sufficient economy during Their Majesties visiting of Thai people in rural area through Thailand.

Figure 3 HRH Princess Maha Chakri Sirinthon's RTSD visiting for 120th RTSD establishment anniversary

3.3 Digital Map Service

RTSD's Geospatial Information Distribution for the public
During 2002-2006, MIC is one particle but vital supporter of national and social developments by planning with our products. Even though all products which MIC distributes values not so expensive, (approximately 32,000,000 bath or 800,000 US$ in total Geo-data value during 2002-2006), all RTSD products would cause certainly more effective and accredited assistances of all planning projects upon RTSD's products in figure 4

Figure 4 Example of Product from MIC

3.4 Government supporting for national development and national problem resolution
MIC of RTSD is sometimes assigned directly from Royal Thai Government, The Parliament and The Court to participate some national or sensitive problem solutions. Some examples of tasks are exampled as following:

- Pasak Basin flooding and drought management by using Geospatial Information application

- Short course Arrangement of Geo-information application training for DSI officers

- Approval of illegal Land Proclamation in National Park Area Violence under Court ordering.
Inaccuracy and ambiguous map is able to be a dark-hole for illegal Land Proclamation in the national parks. Therefore, processing of case is not simple as civil cases. Therefore, by order of civil court, some RTSD's mapping elite from MIC has been assigned to be in charge of this mission since 2000 in case consideration of illegal land proclamation.

3.5 NSDI Participation
To figure out above problems, three properties of Geo-informatics infrastructure are compulsorily realized: Geo-information sharing, National Spatial Data Infrastructure and GIS clearing house.

Geo-informatics Sharing
The way of finding out this problem is accordable arrangement of all stake holder agencies in terms of MOU. This property is going on stage. On behalf of RTSD, MIC is also one of all stake agencies under National GIS committee to determinate National GIS direction and policy of Thailand. The other approach is campaign of same GIS standard through ISO. In GIS realm, there are several ISO standards regarded such as ISO/TC 211 etc. In Thailand, National Standard Office is host of National GIS standard administration in form of National GIS standard committee of Thailand. Also on behalf of RTSD, MIC is assigned to be a member of the committee.

National Data clearing house
By Cabinet' s resolution for fulfillment of National Data clearing house within 2005, twin nodes of National Data clearing house are defined and installed at RTSD and GISDA. At RTSD, MIC is in charge of clearing house's installation within 2005. National clearing house are depicted in Figure 5

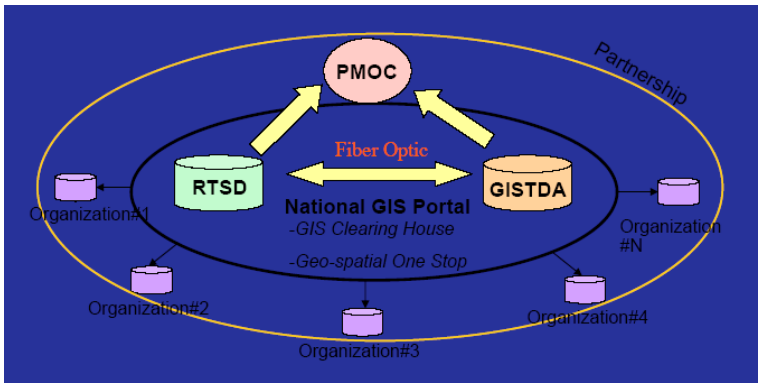


Figure 5 Concept of National GIS Portal supporting MIS of Royal Thai Government

In the next further step, existing governmental MIS will be linked with the National Clearing House finally for expandable support in a variety of Governmental missions.

3.6 Data support for Crisis management
Undeniably MIC is compulsory to conduct releasing of all available RTSD geo-information and analysis results from R&D section. Few eminent example of this MIC task are mentioned as below:

Southern uprising release
To support related national security agencies, MIC of RTSD is in charge of supporting all available, developing and consulting ways of Geo-information for insurgency release solution.

Tsunami Case
MIC of RTSD with maximal potential and all available RTSD geoinformation have distributed and additional generated necessary information for related organization of Post-tsumani affected releasing. This full-heart mission remains still the affected area will be recovered and resilient into the normal condition. Some released information is shown in figure 6.

Figure 6 18 3D-Visualization on affected area: example of RTSD products supporting through MIC (Cont.)

3.7 Consulting Role
MIC staffs also under the general director's vision and commands, all staffs are able to be formed as Ad-hoc or special task forces of geospatial expert term to promptly response urgent missions, especially hot issues that are able to use GIS application. During 2002-2006, officially and informally MIC has given consulting for approximately several hundred of organizations and people. MIC's consulting covers varied Geoinformation-related knowledge and skills.

3.8 Additional Project

MIC has sometimes been requested to figure out or implement no-standard or unsolved Geo-information problems original from uncertain method of mapping. Some on-going project is mentioned as following:

Ministry of Education's School geospatial information database implementation

In mid of 2006, Thailnad's Ministry of Education or MOE requested MIC to implement MOE's school spatial database. This project completion will be expected in end of 2006.

3.9 International Cooperation

RTSD as well as MIC is not alone in international Geo-informatics communities but always walks together and shares knowledge and experience technically with many close colleague federal mapping agencies worldwide. Some example of firm relation of RTSD is mentioned as below:

NGA-RTSD cooperation

During 2002-2006, on behalf of RTSD, MIC and NGA remains very public-advantageous Geo-information project, called "Reformatted new Topographic Map of RTSD implementation"to adapt available new Topographic Map of RTSD for GIS-supportable data by adding attributes and On-line distribution with the method of "Feature Layer Database (FLDB)" The project is expected to complete and launch data distribution in the end of 2006.

3.10 Human Capital Management

Human capital is very vital for success or fault of organization. Then all MIC's fulfillment depends on human capital. Therefore MIC has conducted continuously development of human capital and staff-skill improvement into several approaches. Detail of those approaches is listed as follow:

Long-life learning program

To step forward into Knowledge-based organization in the next decade, MIC staffs are always promoted to long-life learn and self study not only their professional-related knowledge but also general issues in a variety of media such Internet etc.

Under-graduated and graduated program

During 2002-2006, few MIC's staffs graduated Doctoral and Master Degrees with excellent study performances. Such staffs are important human capitals for implementation of more progressive MIC as the leading accredited agency of Geo-informatics.

Student training program

MIC is pleased to be a volunteer to train academic and practical Geoinformation application for students from several universities during summer break. Fulfillment of this mission indicates achievement of those students in their professions. Especially, during 2002-2006, students who got-trained from MIC are able to seek good jobs of Geo-informatics professionals.

MIC Public-Accredited as Digital mapping and GIS knowledge center.

MIC is honored and accredited as the usual terminate of academic tours from people of varied of fields such as high-school students to cabinet members etc. for digital mapping and geo-information applications.

3.11 MIC's Research and Development activities

MIC not only is in charge of maintaining mission of RTSD's geoinformation distribution but also Research and Development conduct. Objective of MIC's R&D operation is to find out optimal solutions of present existing problems in map service line and realize new concepts of geospatial data applications fitted with Thailand in future.

Some successful R&D result is mentioned as following:

Under RTSD's general director's initiation, RTSD, since April 2006, Geoinformatics Space Technology Development Agency (GISTDA) and Chulalongkorn University have cooperated to develop like GoogleEarth, open-source Thai-fitted software with GISTDA and RTSD available Geospatial Information for easy access of Thai people without language or IT high skill barriers called "Digital Thailand". By very working hard of assigned staffs, this project is very promising and successful and will be launched in mid of 2006. Some parts of "Digital Thailand" software are depicted in figure7.

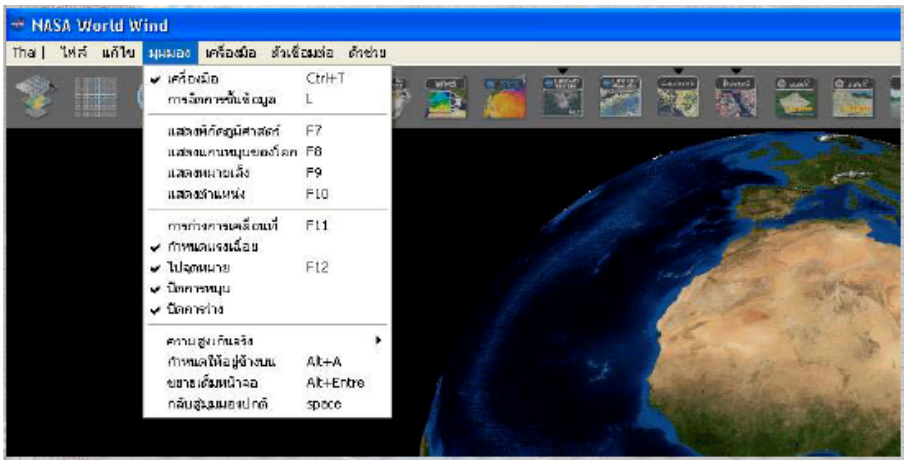


Figure 7 main menu of “Digital Thailand”

3.12. The next step of MIC role in next decades

Status and direction of MIC in next decades will still focus on main mission of RTSD’s geo-information and operate effective National GIS clearing house, however, to act as the regional and national leading Geo-information MIC role is still challenging question. Moreover, to run on unstoppable dynamics of a globalization, re-engineering of organization is unavoidable and laid out in advance. Therefore to prepare the organization in the next decade, MIC has investigated and foresighted in a few aspects as follow:

Re-adaptation of out-of-date related laws and regulations

In the present Air& ground surveying security regulation, even there were context modification but some context is still out-of-date and red-tape. MIC is unable to release some useful RTSD Geo-information conveniently for civilian aspect of development mission. From 2005, MIC expects takes a part of RTSD’s committee to correct public-urging problems. Soon optimal, present-current-fitted regulations will be enacted in E-society era.

Realization of MIC s’ e-Government core process

Under e-Government, MIC is going on the completion of e-Government core process. The next decades, MIC will be expected to on-line service fully upon related e-Government core process. Now some installation of e-Government is going on.

Knowledge-based society

As collecting professional experience and know-how in field of Geoinformatics for decade, thus all knowledge is manipulated systematically by KM processing. Therefore MIC avoidably is outlining “MIC’s KM toward next decade”. This project is very crucial assured bedrock of MIC not solely for further next MIC generation but also for public mass’s usage and learning of Geo-information.

3.13 Conclusion

In this report, some few successful performances of MIC during 2002-2006 are expressed. All of those examples take an important role in tremendous evolution of many aspects, social improvement such poor well-fare leveling under Royal projects of His Majesty by RTSD-information based planning etc. Moreover, based on present importance and fulfillment of MIC, Considerably, the center is required to unavoidably expand systematically with proposed new concepts of a future map-service organization for splendid growing of Geo-information demanding in near future.

For full version of the country report, please download at www.rtsd.mi.th

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Hydrographic Department

Hydrographic Department, Royal Thai Navy (HDRTN) is a national authority for various hydrographic services of Thailand. The main task is to provide services to serve navigational safety, defense requirement and country development. To support this role, HDRTN conduct the hydrographic survey in Thai waters in order to produce nautical chart covered Thai waters in the area of the gulf of Thailand and Andaman Sea. The activities and developments during the period of 2003-2006 are as follows:

1) Hydrographic Survey Activities

During the year 2003-2006 the HDRTN has conducted 24 hydrographic surveys .The results of this surveys were used for production of nautical charts and other charts used in the navy.

Type of survey	**2003**	**2004**	**2005**
Harbour survey	1	6	4
Coastal survey	4	2	1
Off-shore survey	-	-	-
Survey for update chart	-	3	3
Total	5	11	8

HDRTN is improving the hydrographic survey to meet the standard of the IHO (International Hydrographic Organization) by conducting survey based on WGS 84 datum and improving the harbour survey by using the multibeam echo sounder.

2) Paper chart production activities

The results of those surveys mentioned above were used to produce Thai's nautical charts and other related charts in Thai waters. The nautical charts produced during the year 2003- 2006 are shown as follows:

Type of production	**2003**	**2004**	**2005**
New chart	-	1	-
New publication	2	5	4
New edition	14	10	5
New print	5	-	2
Total	21	16	11

3) Electronic Chart Production

Electronic charts in Thai waters had been produced in the year 2003-2006 are as follow:

ENC band	**2003**	**2004**	**2005**
Overview	1	-	-
General	-	-	-
Coastal	9	1	-
Approach	-	-	3
Habour	-	5	5
Total	10	6	8

4) **Resurveying and Charting in the area effected by The Tsunami**

16 areas along the western coast of Thailand from Ranong province to Trang province were selected to be resurvey after the Tsunami in the year 2005 to collect data and update charts in each area as follow:

Area Effected by Tsunami	**Number of chart produced**
Ranong	2
Phang-nga	5
Phuket	2
Krabi	2
Trang	1
Satul	4
Total	16

Department of Mineral Resources, Ministry of Natural Resources and Environment
WWW.dmr.go.th

The Department of Mineral Resources(DMR) has the national responsibility for preparing and making conventional geoscientific maps, geological research and information to support sustainable development and disaster mitigation of the country.

During 2003 – 2006 the development of computer technology and map- making methods have already changed. Computer-aided cartography and office networking in GIS databases have been used in map compilation and publication. The **Geological Resources Atlas of Thailand 2005** is one product of this method. Several type of maps such as digital geoscientific geological, mineral resources, environmental geology and geological hazard etc., can be developed and produced on any request. The following are the activitie during 2003 to 2006

1.Geology

1.1Geological maps of Thailand at 1:50,000 scale, especially in southern part of the country affected by "Tsunami" on 26th December 2004. Approximately 150 sheets were compiled and produced with explanatory texts during the period and nearly 500 sheets are available as printed and digital.

1.2The geology related map in various fields, such as geological conservation resources maps for tourism, paleontology, and cave, etc.

2.Airborn Geophysic Maps (hard copy, digital maps and data)

2.1 Radioactivity Maps of Thailand
- Ternary
- Total Count (Ur)
- Potassium (%)
- Equivalent Uranium (ppm)
- Equivalent Thorium (ppm)

2.2 Magnetic anomaly map of Thailand

3.Mineral Resources

3.1 Metallogenic Map of Thailand

3.2 Mineral Resources Maps

- Mineral deposits
- Mineral potential
- Mineral occurrence
- Construction sand resources
- Limestone resources
- Industrial rock resources
- etc.

4.Mineral Contamination Risk Maps

- Saline soil in northeastern Thailand
- Distribution of arsenic and lead

5.Geohazard Maps in Thailand

- Earthquake risk zone
- Active fault and epicenter in Thailand and adjacent area(recorded since 1983 to 2005)
- Potential sinkhole area
- Landslide hazard
- Landslide risk
- Coastal change along gulf of Thailand and west coast(Andaman sea)
- Tsunami evacuation route maps

6.Environmental Geological Maps for regional planing

- Urban area in Nakorn Ratchsima province

7.GIS databases

7.1 During 2004 and 2005, DMR had developed a comprehensive network of GIS and relational database. Geology and mineral resources are available as digital datasets including aerial photographs and other fundamental geographic information.

7.2 At present the framework database, geological hazards, environmental geology and laboratories analyses(e.g. rock, soil, water, mineral) are being designed and managed in order to complete GIS database. These would facilitate production of information from the complete dataset and relational database which will also help the decision-maker in risk warning system.

<u>Royal Irrigation Department</u>

The office of Topographical and Geotechnical Survey (TGS) is responsible for survey and mapping for project planning, design, construction and improverment of water resources development projects of the Royal Irrigation Department (R ID) . At present, TGS is practically capable of meeting the requirement for survey and mapping within the Department. During the Reporting of October 2003 to September 2006, the achievement of TGS in the field of survey and mapping is summarized as follows:

1. Topographic Line Maps

TGS produces topographic line maps such as site plan map, headwork area map, project area map, reservoir map at scale vary from 1:500 to 1: 10,000. Generally, Photogrammetric method is employed for the study of feasibility of large scale water resource development projects. For medium and small projects topographic maps are usually prepared by using ground survey method. During the reporting period, TGS had produced topographic line maps covering approximately 8,821 square kilometers of which 3,675 sq.kms. by photogrammetric method, 4,376 sq.kms. using conventional ground survey (grid) method and 770 of sq.kms. of digital mapping using tacheometric method.

2. Photo Maps

Rectified photos at 1:4000 scale efficiently facilitate spot height survey and property boundary survey in the field. Spot heights and contours derived from conventional ground survey by using Theodolite and Levelling Theodolite or using Total Station Theodolite compile by civil engineering software and computer aid design after that property boundaries are drawn by hand or by computer aid design and then overlays together for the detailed design of on-farm development projects. Coverage area of photomaps within the reporting period is approximately 4,328 square kilometers.

3. Satellite Geodesy

Global Positioning System has been used in TSD since April 1991. The main objective of the utilization of GPS is to establish horizontal coordinates control in UTM grid system for photogrammetric survey as well as ground survey. However, GPS has also been used for photo control since 1998. During the reporting period, approximately 3,656 GPS stations and 900 photo control points were established.

Electricity Generating Authority of Thailand

Electricity Generating Authority of Thailand (EGAT) is responsible in generation and transmission of high power electricity in Thailand. Mapping activities in EGAT are mainly concerned in developing of electric power and transmission system as follows:-

In 2004

1. Topographic map scale 1:10,000 produced by ground survey in Songkhla power plant.
2. Geographic Information System (GIS) for maintenance of transmission system in Thailand.

In 2005

1. Photo map along Pai River from Amphur Pat to Thai – Myanmar border in Amphor Muang Mae Hong Son.
2. Topographic map of Sirindhon and Pak Mun reservoir produced by method of photogrammetry

In 2006

1.Map overlay from high resolution image “IKONOS” and topographic map scale 1:10,000 along Salawin River in Myanmar

2.Topographic map scale 1:1,000 covering Hutgyi dam site, approximately 6 km^2