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**GENERALIZATION OF TOPOGRAPHIC DATABASE
FOR SERVING GEOSPATIAL DATA FOR MILITARY
AND SOCIO-ECONOMIC TASKS IN VIETNAM**

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**GENERAL STAFF - VIETNAM PEOPLE'S ARMY
DEFENSE MAPPING AGENCY**

CONTENT

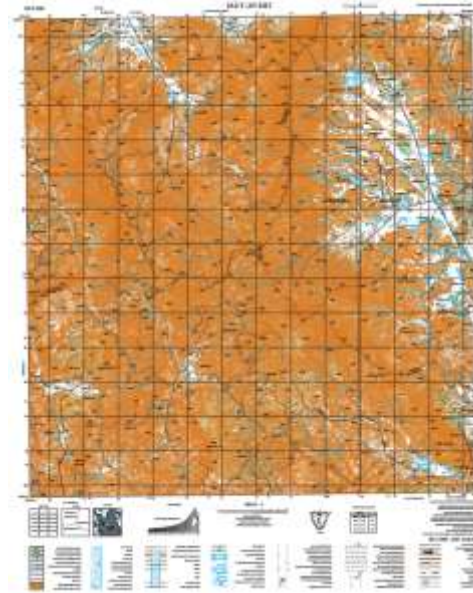
- I. APPLICATION OF GEOSPATIAL TECHNOLOGY IN VIETNAM
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I. APPLICATION OF GEOSPATIAL TECHNOLOGY IN VIETNAM NATIONAL DEFENSE AND SECURITY

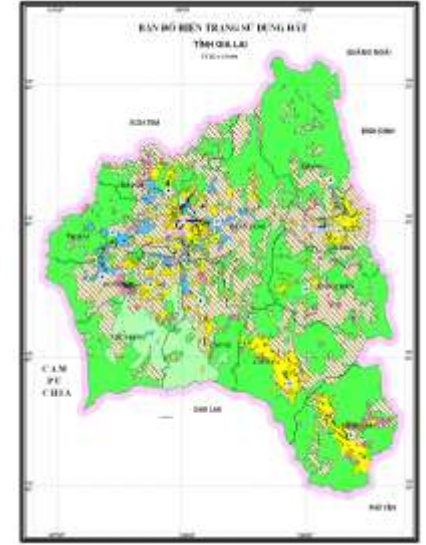
- Defense Mapping Agency/General Staff - Vietnam People's Army (DMA) is the leading strategic military agency in the domains of military topography and geographic information. The DMA has a mandate to ensure the topography and geographic information for military missions as well as other missions of the Vietnam Army.
- In recent years, the Defense Mapping Agency has been focusing aggressively on the research, development and application of advanced science and technology in its specialized fields. The most remarkable field is the development of geospatial technology, serving the military topography tasks. Some achievements include:

1. Modern remote sensing technology:

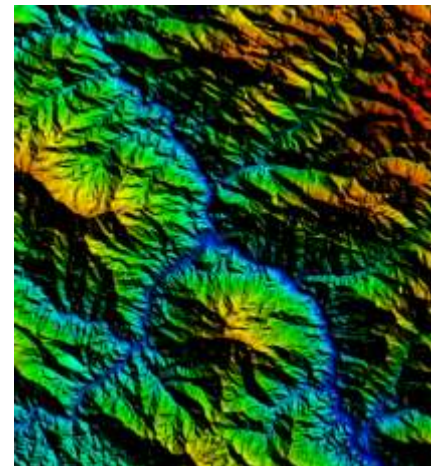
- It has been developed and applied effectively in many fields, especially in the field of national defense and security...
- The DMA has applied satellite imagery of different categories to build topographic databases and military geographic information, which improve the effectiveness of military topography activities.
- Using satellite images for the purposes of:
 - Establishing, updating: Maps, topographic databases and geographic information;
 - Analyzing, extracting thematic information;
- Creating DEM from aerial stereo images and satellite imagery;
- Applying UAV in high-precision mapping, 3D mapping...



Topographic database & maps



Thematic maps



DEM



3D maps

2. Satellite positioning technology:

- In the development of the topography military domain, geodetic is one of the cornerstones. Today, many scientific and technological achievements are being applied extensively in military operations with the aim of meeting modern combat criteria quickly, promptly and accurately.
- For decades, the defense mapping agency has studied and applied the **Global Navigation Satellite System (GNSS)**, which fundamentally changed the field of military geodetic in Vietnam. A wide range of basic research, applied research and manufacturing research related to GNSS technology have been developed and gained many good results.
- The DMA has completed the construction and put into operation the positioning and navigation infrastructure based on GNSS, including many DGPS systems, located in Vietnam national territory and some islands under Vietnamese sovereignty.
- As a result, GPS/DGPS positioning and navigation systems integrated with electronic nautical charts (ENC) have been installed comprehensively for vessels of Vietnam Navy, Vietnam Coast Guard and Vietnam Fisheries Resources Surveillance, contributing to the improvement of maritime safety and to the fight for national sovereignty.



GPS/DGPS navigation system installed on military vessels

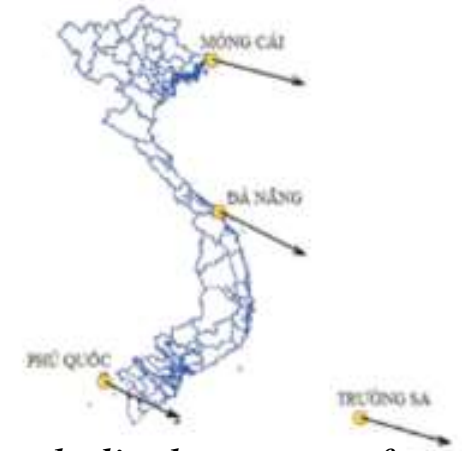
2. Satellite positioning technology:

Base on the exploitation of GNSS technology and the DGPS systems, the DMA has:

- measured and constructed a geodesic control grid of different grades to support the production of military topographic maps,
- measured and constructed the construction of control grid for military use;
- reseach displacement of continent
- design and manufacture of positioning, navigation and surveillance systems which are installed for military vehicles;
- study on the local Quasigeoid model for positioning and direct navigation via GNSS technology of the Army.
- reseach troposphere, ionosphere



Maritime Navigation



Reseach displacement of continent

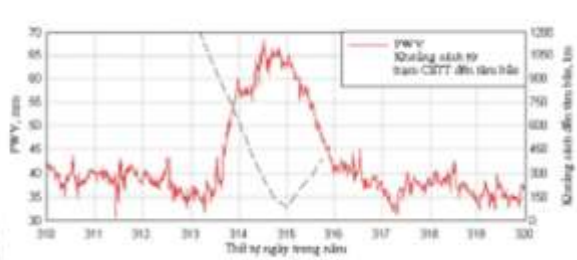
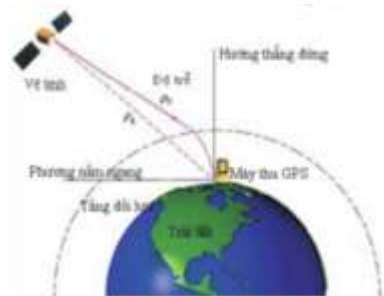


National geodesic control gric

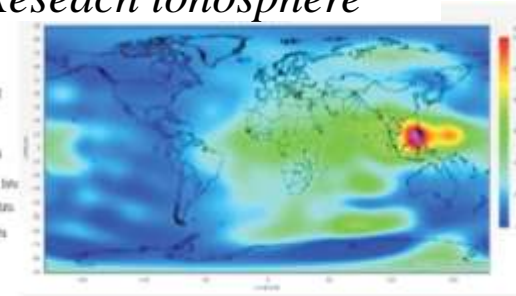


Military vehicles Navigation

Reseach troposphere

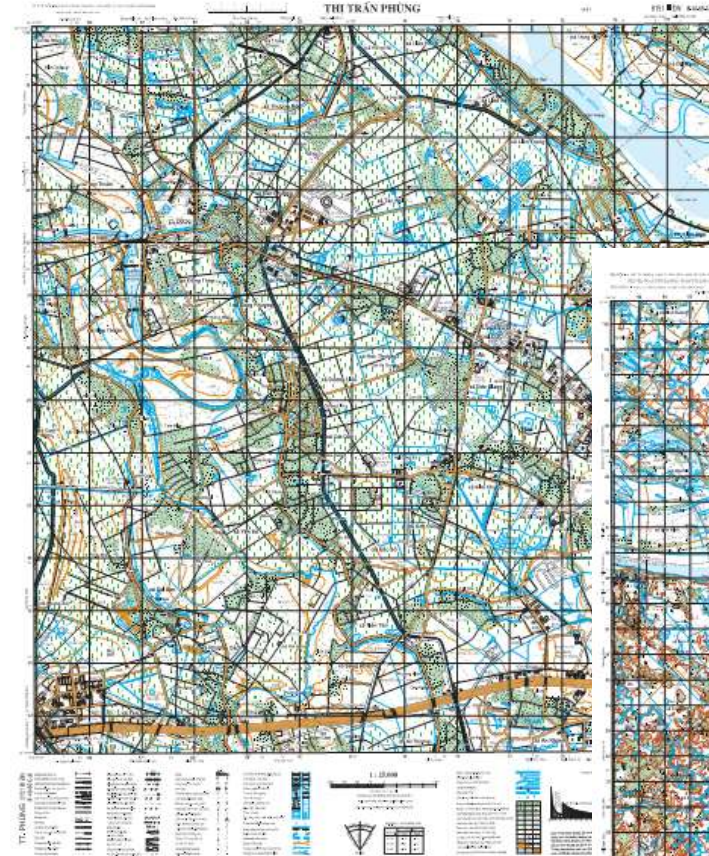


Reseach ionosphere

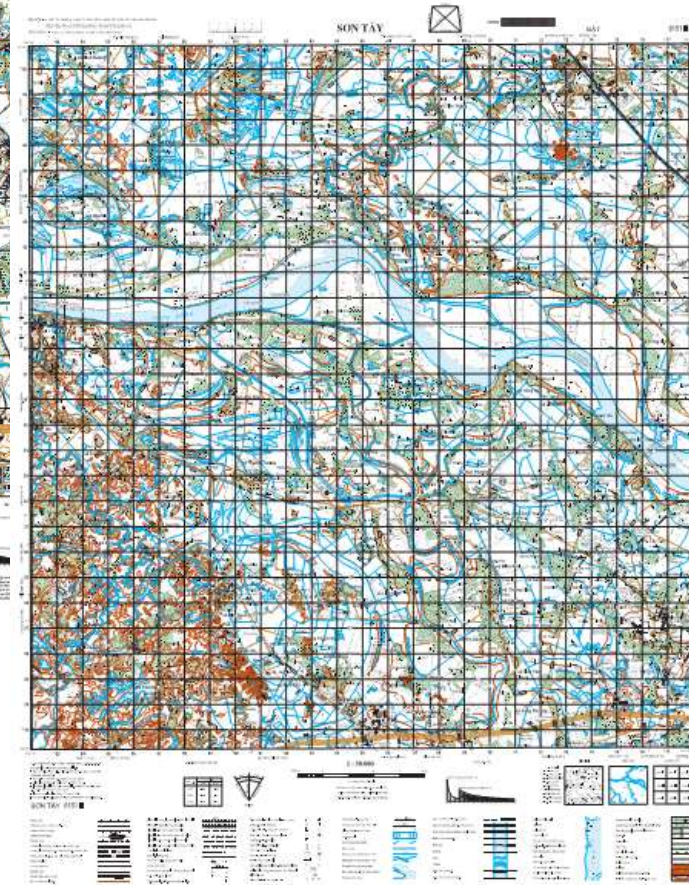


3. Geographic information system technology (GIS):

- The Defense Mapping Agency has actively applied the latest achievements of GIS technology to create new products that are used for both national defense and security and socio-economic purposes.
- Through to GIS technology, a series of scale maps of 1/10.000 to 1/1.000.000 have been established, greatly enhancing the quality of military topography for the Army, especially maps of areas with big changes in terrain and geographic location have been updating, adjusting and adjusting in a timely manner.
- GIS and applications have been transferred by the Defense Mapping Agency to all military units for training and maneuvering at different levels.



Scale 1:25.000



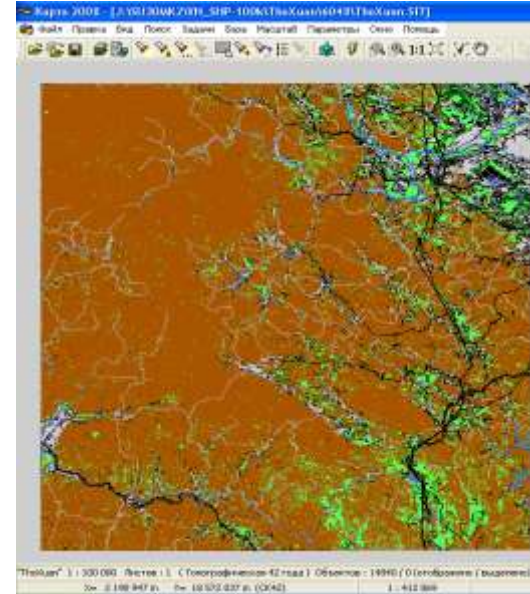
Scale 1:50.000

3. Geographic information system technology (GIS):

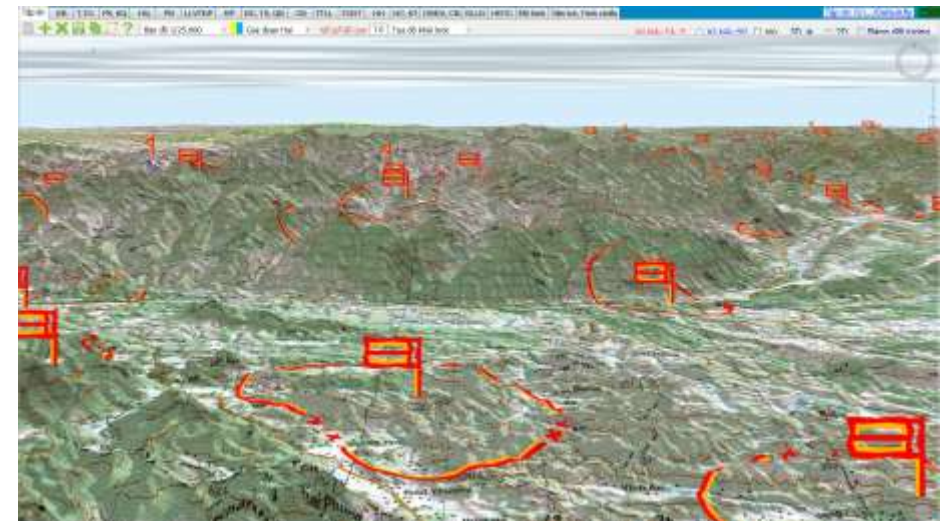
■ In order to improve the efficiency of exploitation and use of new equipment and weapons, the Defense Mapping Agency is currently focusing on:

- ✓ building a military geographic database;
- ✓ programming applications, developing tool sets to support the military staff works in military topography, creating and presentation of combat documents on the 2D and 3D topographic maps.

in order to shorten the operation time and effectively support training and practice in the Army.



Topographic database for Jet Plane pilot training



Combat documents on the 3D topographic maps

II. PRODUCTION OF GEOSPATIAL DATA IN VIETNAM

1. The role of topographic databases in the Vietnam Army

- Topographic maps (paper and digital) are commonly used in Vietnam today, including maps ranging from 1/10.000; 1/25.000; 1/50.000; 1/100.000; 1/250.000; 1/500.000 to 1/1.000.000. Required by military tasks, annually these maps are updated, revised, republished and distributed for military use.
- The topographic database is established in accordance with the National Standard on Geographic Information System, which enables a wide range of applications in defense, public security and social security. In particular, the topographic database allows the conversion and installation into modern weapon systems that have been and will be invested by the Vietnam Army in the future, contributing to the improvement of the operation efficiency of the equipment in army training and operational readiness.

2. Map production and topographic database technology workflows in the past

▪ From 1995 to 2010:

✓ Using MicroStation platform

✓ **Materials produced by this technology were only maps, not geographic database.**

▪ From 2010 to 2015:

✓ Using ArcGIS platform (ArcGIS Desktop)

✓ Forming topographic database first, then extracting topomap.

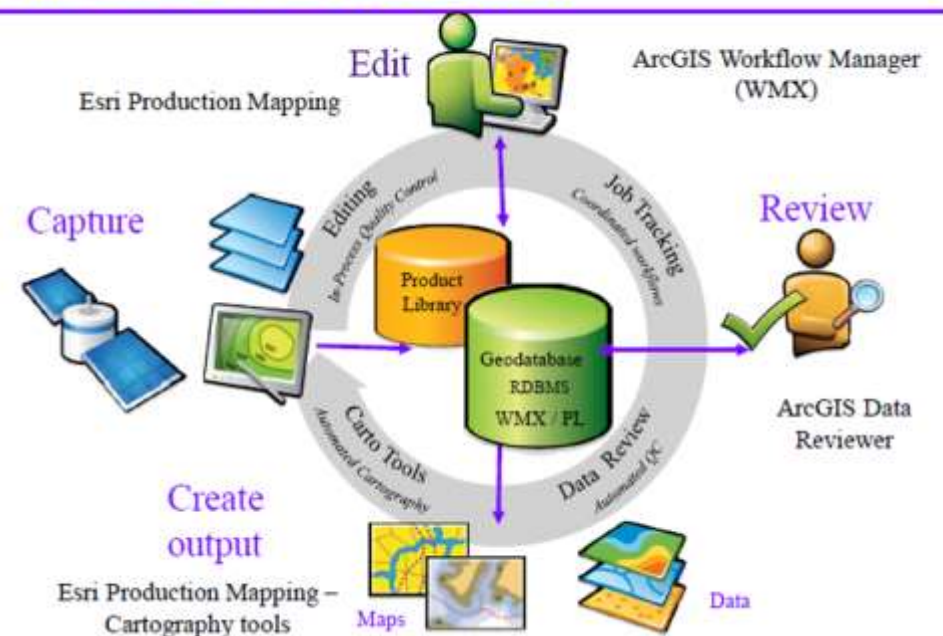
✓ **However, technological workflow was still quite limited: The production was still discrete on separate maps; without close connection in the production process; ...**

▪ From 2016 up to now:

✓ Using ArcGIS (**client-server model, centralized database**).

1. Topographic data is centrally managed in a unified database (in Oracle). The editors connect to the database in Oracle to creating, editing, updating of data.
2. Topographic map is cartographically represented from the standardized database. Maps are stored and managed consistently in the Production Library.

General Production Workflow



3. Strategy of database and topographic map production in the coming years

- Currently in the world and Vietnam, geodesic and cartographic agencies normally manage topographic databases at different scales. Managing such multi-scale databases has the advantage of quickly establishing topographic maps at different scales.
- However, multi-scale databases also have many disadvantages:
 - ✓ it is no consistence in data structure;
 - ✓ especially it requires high technical expertise to manage;
 - ✓ costly to maintain and time consuming to update and adjust.
- One of the current trends in developed countries is the creation of a unique database to make it as the basis for the establishment of smaller scale maps and datasets (thematic data) using automatic generalization.
- Automated generalization is an indispensable trend, as it is not only used for traditional mapping production but also for distributing multi-scale maps as required in digital environments because today spatial information is more available on digital devices than on paper maps.
- Recognizing that trend, the Defense Mapping Agency has done a lot of research to evaluate different software solutions for database construction and map generalization in the world, such as:
 - ✓ ArcGIS - USA,
 - ✓ Panorama - Russian Federation,
 - ✓ Lorick - France, ...

to orientate the production of topographic database to serve geospatial data needs for military and socio-economic tasks in Vietnam.

3. Strategy of database and topographic map production in the coming years

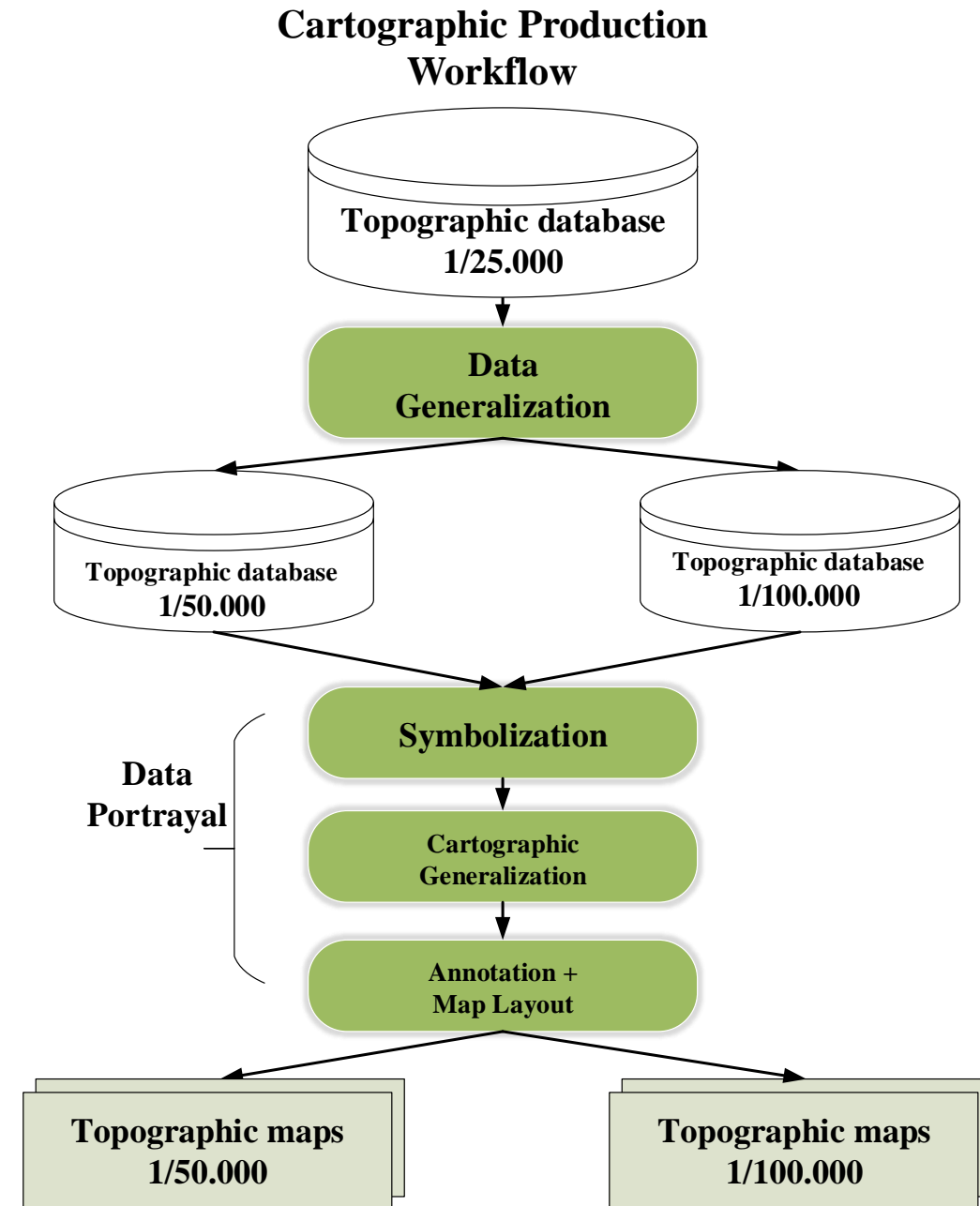
- Follow the traditional mapping technology (which is no automatic generalization), Vietnam could be able to complete the full maps at the scales of 1/25.000, 1/50.000 and 1/100.000: **After 10-15 years**
- The production time would be too long and it would take a lot of effort to create maps based on traditional technology and methods.
- But the Army requires that the topographic maps must be updated regularly: **Every 3-5 years.**
- In order to meet that requirement in that situation, to ensure the topographic data for the Army, the Defense Mapping Agency has changed the technological process to establish topographic database and maps in medium scales (1/25.000; 1/50.000 and 1/100.000).

3. Strategy of database and topographic map production in the coming years

We concentrate on all resources including time, money, manpower and equipment to build and annually update the topographical database at the scale of 1/25.000 covering the Vietnamese territory.

- ✓ The 1/25.000 scale topographic maps are created directly from the 1/25.000 scale database.
- ✓ The 1/50.000 and 1/100.000 topographic maps are edited from the 1/50.000 and 1/100.000 database:
 - *The 1/50.000 scale database is automatically generalized from 1/25.000 database.*
 - ***The 1/100.000 database is directly generalized from 1/25.000 database.***

Thus, when we have done the 1/25.000 topographic database, we can also create 1/50.000 and 1/100.000 database at the same time.



3. Strategy of database and topographic map production in the coming years

- According to the client-server centralized production workflow in ArcGIS, the Database and topographic maps at the scale of 1/25.000 will be built and completed **in 3-5 years**.
- Then it takes **2-3 years** to complete the 1/50.000 and 1/100.000.
- The new solution following by ArcGIS platform will overcome the limitations of the previous topographic database production workflow.

Things need to do for the new production process.

1. Study and develop necessary Technical Regulations to organize the spatial data infrastructure (Technical Standards, General Criteria Norms for topographic database generalization for different scales, technological workflows for establishing, processing, updating data, checking product quality and storing terrain database, digital maps).
2. Develop and approve a unified System for Spatial Data Classification and Encoding.
3. Build up automatic generalization processes for databases and topographic maps (from 1/25.000 to 1/50.000 and from 1/25.000 to 1/100.000).

III. CONCLUSION

- In recent years, the Defense Mapping Agency has applied extensively geospatial technology for military topography application, advanced technological solutions in combination with appropriate information technology infrastructure, changing the production workflow from single and discrete model to centralized model, applying automatic generalization solutions which helps speed up the development of topographic databases and maps at different scales, ensuring the accuracy and serving effectively the requirements of the Vietnam Army.
- The transformation to the advanced production workflow is a revolutionary breakthrough in the production of geospatial data in Vietnam. However, we deeply understand that the establishment, management, updating and exploitation of multi-scale databases; automatic generalization of topographic maps are the issues that needs to be addressed comprehensively in the short term as well as in the up coming years.