Geospatial Mapping Infrastructures in Peace Operations

Generation of Topographic Line Maps (TLMs) 50k according to NATO Vmap2 format in several peacekeeping Area of Operations (AOO)

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Geospatial Mapping Infrastructures in Peace Operations

Need for Geospatial Products (Maps, images & GPS measurements). The international community facing humanitarian, peacekeeping and crises response situations is constantly requiring geospatial products to meet day-to-day operational needs.

Current situation is in terms of **basic-level of mapping**:
- Geographic information can not be “improvised” and must be planned for creation and acquisition.
- Essential information needs to locate and understand the relationships of certain “events” in relation to situation developments.
- Understanding the impacts of field situations on the operations.

Cooperative Action must be considered in Mapping to:
- maximize product results,
- reduce response time
- enhance interoperability
- make datasets available
- boost standardization

A JOINT METHODOLOGY with AGREED PROCESSES is KEY to SUCCESS
Geospatial Mapping Infrastructures in Peace Operations

Vmap2
GDB
Workflow Processes: Geospatial Mapping Infrastructures in Peace Operations

1. **Imagery Ordering & Data Preparation**
   - QA/QC IMAGERY
   - Interpretation Help
   - Russian maps 1:200K
   - Bern university maps, Africover etc...
   - Colateral Info

2. **Orthorectification & Image Processing**
   - Feature Extraction & Interpretation
   - Editing Features & Vector correction

3. **Feature Extraction & Interpretation**
   - Cartographic Prod. & Printing
   - GeoDatabase Preparation & Quality Control
   - Verification & Field checks (quadrats)
   - Final Image Maps 1:100k and 1:50K

4. **Cartographic Prod. & Printing**
   - QA/QC CARTOGRAPHIC OUTPUT
   - Application of Rules
   - PLTS for ArcGIS 9.2 Defense Solution

5. **GeoDatabase Preparation & Quality Control**
   - QA/QC CARTOGRAPHIC OUTPUT
   - GeoDatabase
   - Vmap2 GDB
   - Subsets Images (Imagettes with GPS)
   - Overall Final QA/QC & VDB Hamonization

6. **QA/QC CARTOGRAPHIC OUTPUT**
   - Conformity Cartographic Output
   - Final TLM50 Map 1:50K scale

7. **Field Verification**
   - Location, Field interpreted-Content & Overall QA
Workflow Processes: Image Ordering & Data preparation

Spot Reference - 3D Product formed by:
1) DEM with 20m grid size and 2) Orthoimages (5m resolution).

Russian TK-350 images Used for Generating a 10m grid size Digital Elevation Model (DEM)

Spot or LANDSAT images forming an IMAGE MAP
Workflow Processes: Orthorectification & Imagery Processing

1. Finding Control Points
2. Compute Triangulation / BLOC of Images
3. Results Triangulation + DEM
4. Create MOSAICS for Interpretation and FEATURE EXTRACTION
5. Compute single ORTHOIMAGES
6. VERIFY Proper Fit & Errors
7. Create MOSAICS for Interpretation and FEATURE EXTRACTION
Workflow Processes: Orthorectification & Imagery Processing

Dataset (rectification). No correction for relief - important terrain distortions -

SATELLITE IMAGERY –Not CORRECTED–

120 m. displacement
Flat relief (gully erosion)

SATELLITE IMAGERY –CORRECTED– (Orthorectification Process)
Workflow Processes: GPS Field Survey (Reference points)

1. Workflow process diagram with six steps:
   - 1. Unknown area
   - 2. Extract “square area” around the point for easy location
   - 3. GPS measurement & calibration
   - 4. Location references & Photos
   - 5. Additional process steps (not fully visible)
   - 6. Final process step

2. Extract “square area” around the point for easy location

3. GPS measurement & calibration

4. Location references & Photos

Note:
1. Unknown area: This area is not clearly visible in the image.
2. Extract “square area”: This step is visible in the diagram.
3. GPS measurement & calibration: This step is visible in the diagram.
4. Location references & Photos: This step is visible in the diagram.
5. Additional process steps: These steps are not fully visible in the image.
6. Final process step: This step is not visible in the image.
Workflow Processes: Feature Extraction & Imagery Interpretation

1. Selection of thematic Layers (VMAP2 schema) application of interpretation criteria according to MIL-T-89301A adopted Standard
2. UN Technical Manual for Feature Extraction & Editing (with ESRI-PLTS).
3. Drawing imagery-derived features adding “attributes” (e.g. paved, unpaved, width, etc...)
4. Verification & guidance with various other collateral information sources.
5. Identification of initial interpretation errors and data conciliation with adjacent map sheets “continuity of features”
UNITED NATIONS
DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS

Workflow Processes: Error checking, editing & validation

1. Editing the Data
2. Editing the topology (attributes of the data)
3. Attribution of errors
4. Assess Spatial quality Errors
5. Create Error tables
6. Building a Quality Control Grid
7. PLTS Defense Review tools

Error Table !!!

Error Identification !!!
Identification & Correction of Errors !!!

Checking OLD Maps versus NEW Products (QC) !!!

Errors !!!
Errors !!!
Errors !!!
Workflow Processes: QA/QC (GDB Checks)

1. Creation of a consistent and fully usable GeoDBASE
2. Creation and Addition of the 3D interpretation (for further GIS Analysis)
3. Checking annotations & Attributes
4. Verification Workflow, Map Rendering & Symbology issues
5. Final attribute tests and connectivity between map sheets
6. Quality control and Full Statistical Assessment (GPS points missing – Survey Not Completed)
7. Statistical assessment of imagery quality (x,y,z)
8. Statistical assessments of editing errors (% reliability)

Difference Between GPS (Survey heights and DEM_SPOT and DEM_TK350)
Difference Between GPS (Survey heights and X value in Orthoimage)
Workflow Processes: Summary QA/QC for overall production

1-Imagery Accuracy:
- Triangulation and Ortho-rectification vs. GPS field measurements

2-Content:
- Content checks are divided into two steps
  First stage: A trusted QC reviewer (GIS Centre staff) performs a visual empirical check on the area, pointing out the different errors found. These errors will mainly be a question of criteria of interpretation, and should mean a general guideline for corrections.
  Second stage: once corrections are made, a random area check is performed. The purpose of this random area check is to evaluate the final quality of work found. The check is performed in detail, in a random total area of approx. 10% of the map sheet.

3-Topology:
- The topologic checks will be performed based on the general VMAP2 topology rule set

4-Carto:
- Some edits have a cartographic mean, and are checked in a different process. The carto-edition could be divided in two stages:
  - Map Content: Inside the map content we include both features and labels
    a. Features: A series cartographic errors are checked. Features are not allow to overlap, as this would decrease the readability of the map. If necessary, a DB is extracted from the central DB, and edits are performed in order to match this criterion.
    b. Labels: Labels of features are checked to see if they comply with TLM50 specifications.
  - Map Metadata: Surrounding the map contents, other map elements have to be included and checked

5-Field Verification:
- Interpreted Content and Overall Quality Assurance of Products
- Assessment of the interpretational accuracy and reliability of the VMAP2 maps using statistical sampling.