



UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS

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)**

UN Cartographic Section (GIS Centre in UNLB, Brindisi Italy)

Presented by:

Francisco Iguialada, Cecile Marechal, Phil Hughes, Francis Mugambi





UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS

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

UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS



Workflow Processes: Geospatial Mapping Infrastructures in Peace Operations

1-QA/QC IMAGERY ACCURACY:
Triangulation & Orthorectification

2 Orthorectification & Image Processing

3 Feature Extraction & Interpretation

Interpretation Help
Russian maps 1:200K
Bern university maps, Africover
etc...(Collateral Info)

1 Imagery Ordering Data Preparation

2-QA/QC CONTENT:
Interpretation & Imagery Content Extraction

4 Editing Features & Vector correction

3-QA/QC TOPOLOGY:
Application of Rules

5 Cartographic Prod. & Printing

Vmap2 Geodatabase

4-QA/QC CARTO PRODUCTION:
Conformity Cartographic Outputs

PLTS for ArcGIS 9.2
Defense Solution

6 GeoDatabase Preparation & Quality Control

Vmap2 GDB

Overall Final QA/QC & GDB Harmonization

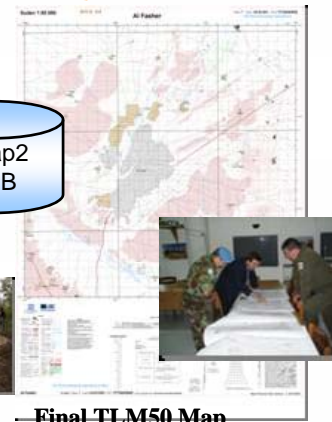
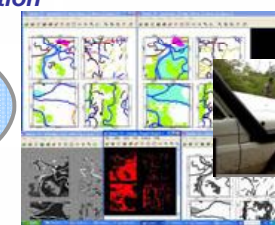
7 Verification & Field checks (quadrats)



Final Image Maps
1:100k and 1: 50K

Subsets Images
(Imagettes with GPS)

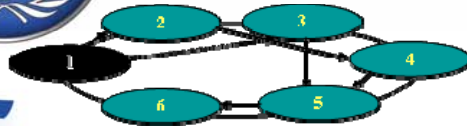
5-QA/QC FIELD VERIFICATION:
Location, Field interpreted-Content & Overall QA



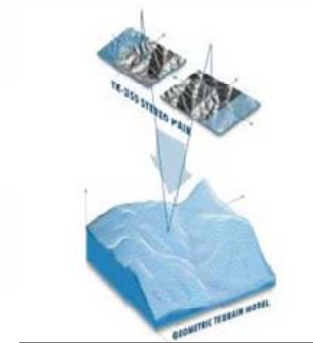
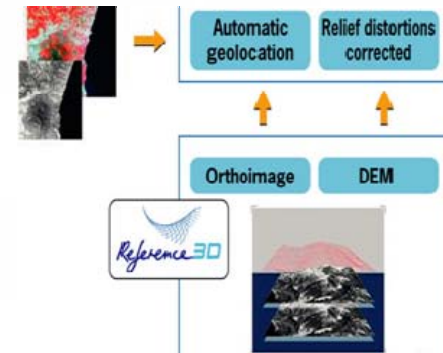
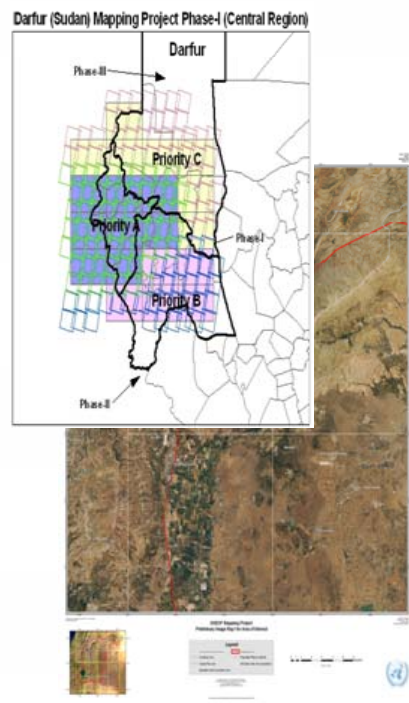
Final TLM50 Map
1: 50K scale

UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS

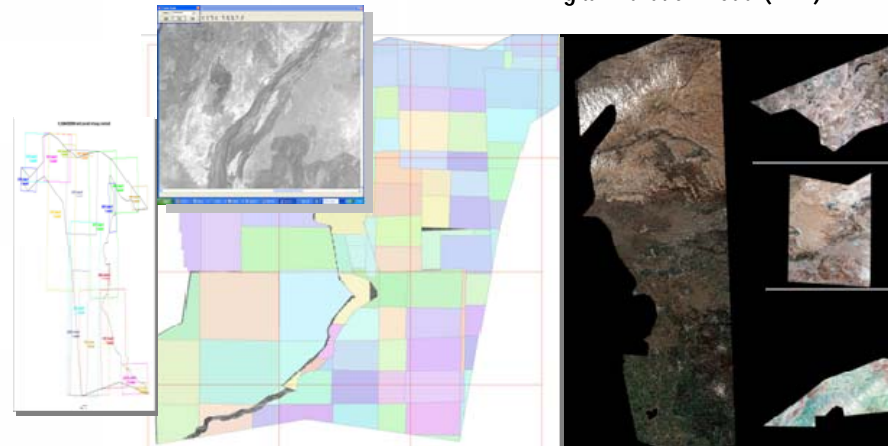


Workflow Processes: Image Ordering & Data preparation



Spot Reference -3 D 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)



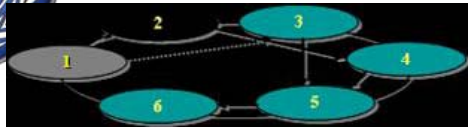
Spot or LANDSAT images forming an IMAGE MAP

UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS



Workflow Processes: Orthorectification & Imagery Processing



2. Finding Control Points

3. Compute Triangulation / BLOC of Images

4. Results Triangulation + DEM

5. Compute single ORTHOIMAGES

6. VERIFY Proper Fit & Errors

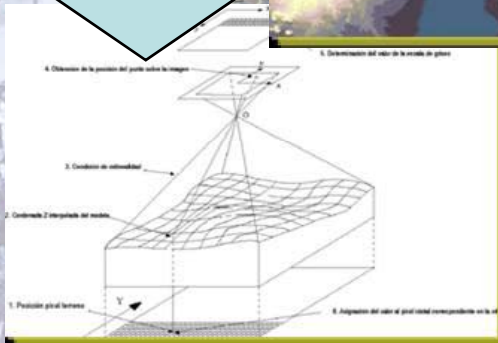
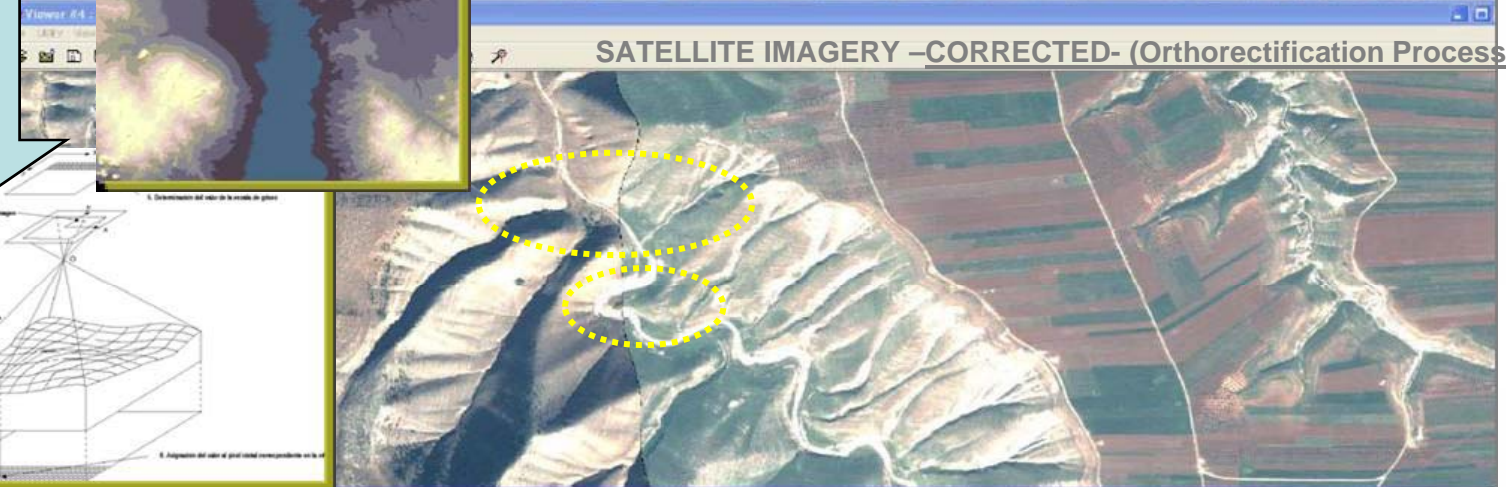
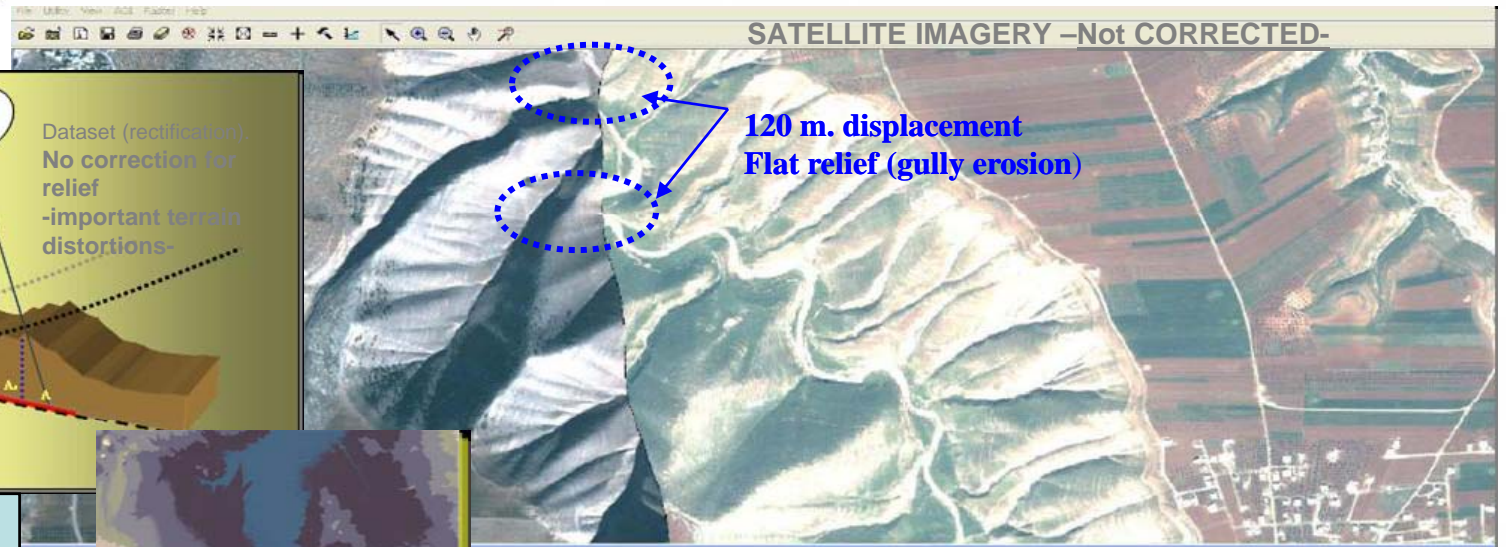
7. Create MOSAICS for Interpretation and FEATURE EXTRACTION

UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS

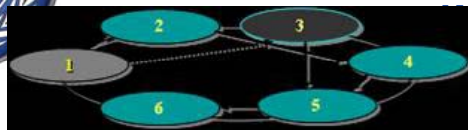


Workflow Processes: Orthorectification & Imagery Processing

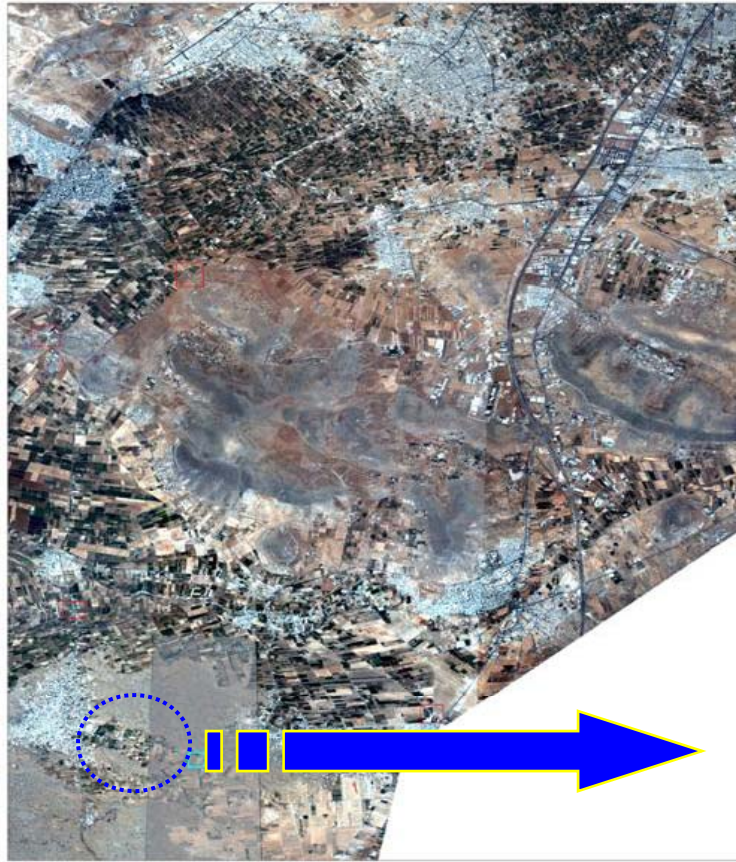


UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS



Workflow Processes: GPS Field Survey (Reference points)



3. GPS measurement & calibration



4. Location references & Photos



2. Extract "square area" around the point for easy location

UNDOF MAPPING PROJECT
GPS SKETCH SHEET

GCP #: N3156 W-13 | DTG: 28-Nov-05

GPS ANTENNA HEIGHT: 2.35 M	SKETCH #:	OF
Comments: 022732 N 022712 N 0220m		
Point 1: 4832 N 50400 W Distance: 12.0m		
Point 2: 4807 N 50322 W Distance: 12.0m		
Point 3: 4809 N 50350 W Distance: 18.5m		
Point 4: 4810 N 50350 W Distance: 18.5m		
Start collecting: 0502 End collecting: 0505		
COLLECTED BY: ALBERTO S. SOTO	CHECKED BY: SCHUCHER, GPT	

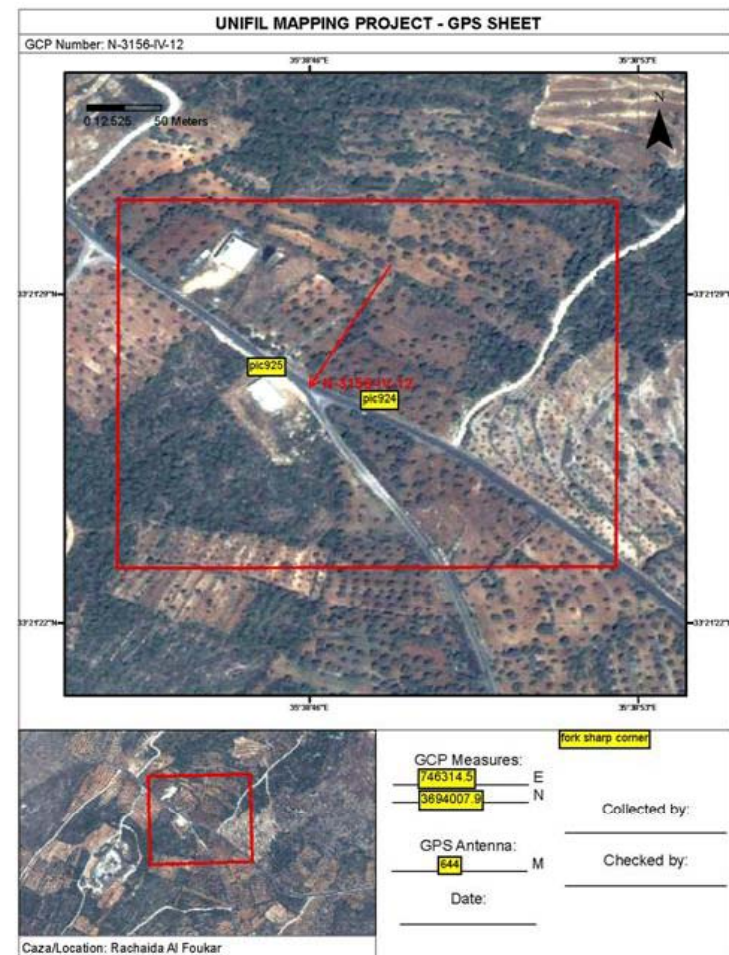
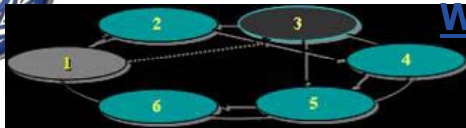
- Notes
1. Ensure you place north arrow on sketch (magnetic north - compass).
 2. Ensure you note on the sketch the locations that photos are taken of the collection site from, including distance and bearing.
 3. Ensure you get someone else to check the sketch before you leave the collection site.

UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS



Workflow Processes: GPS Field Survey (Reference points)

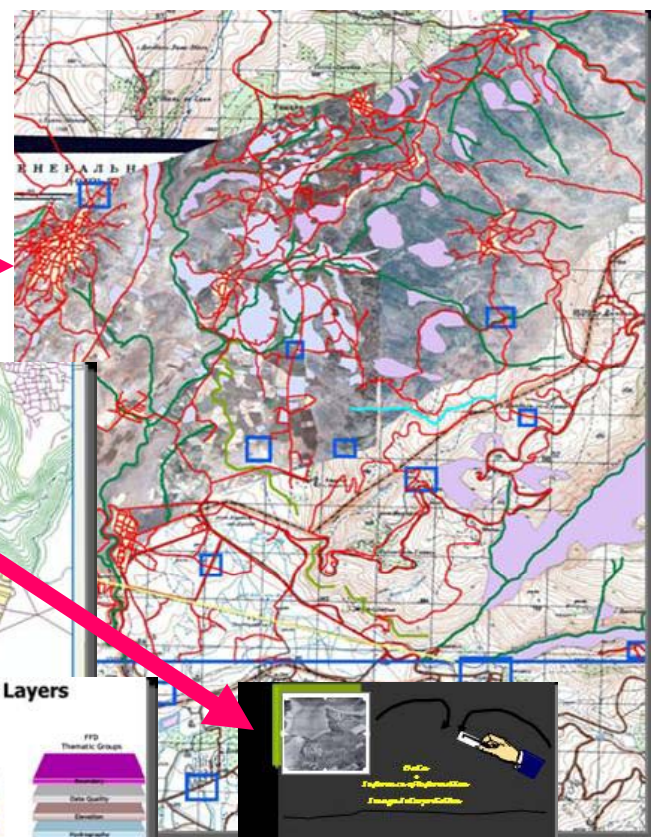
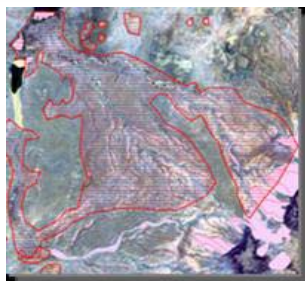
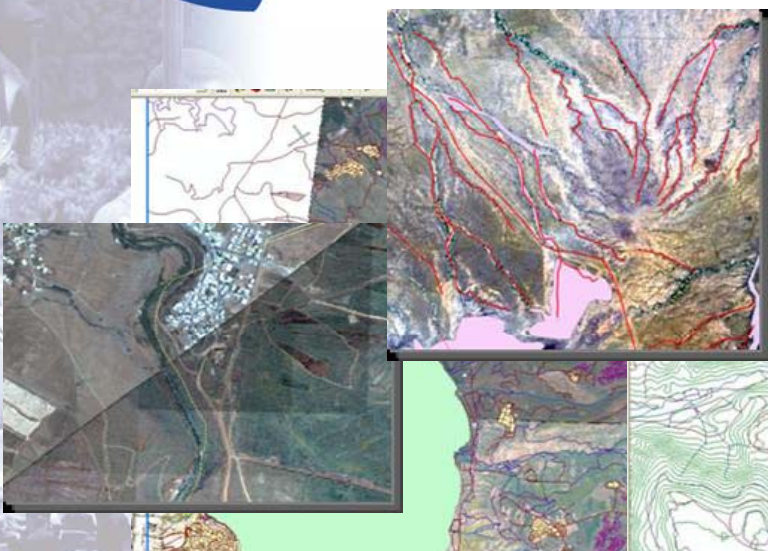
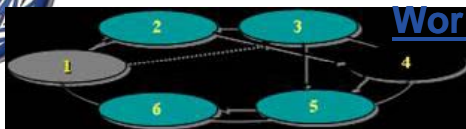




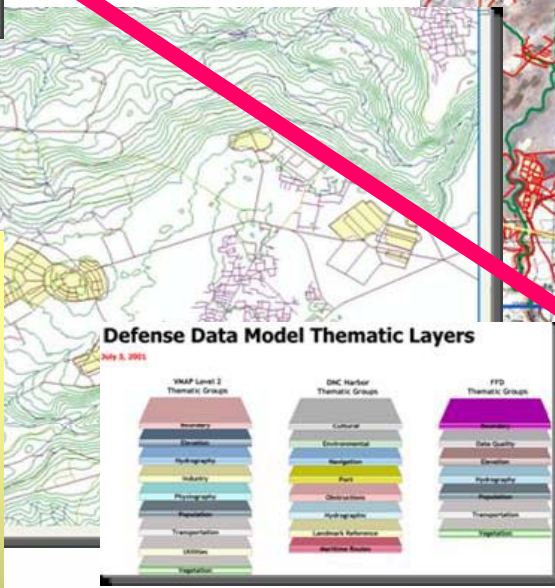
UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS

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"

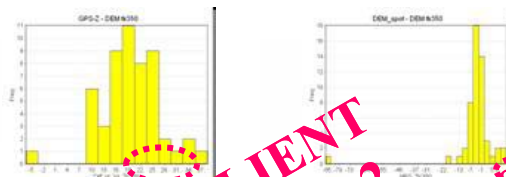
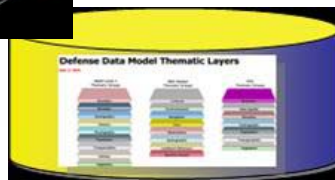
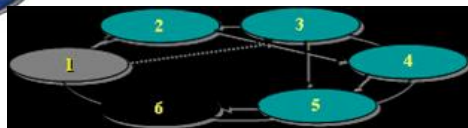


UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS

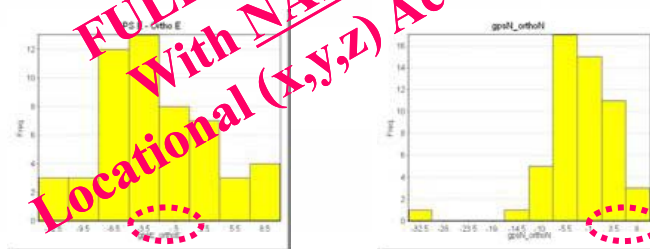


Workflow Processes: QA/QC (GDB Checks)



Difference between GPS Survey heights and Digital Elevation Model (DEM_SPT and DEM_1K350)

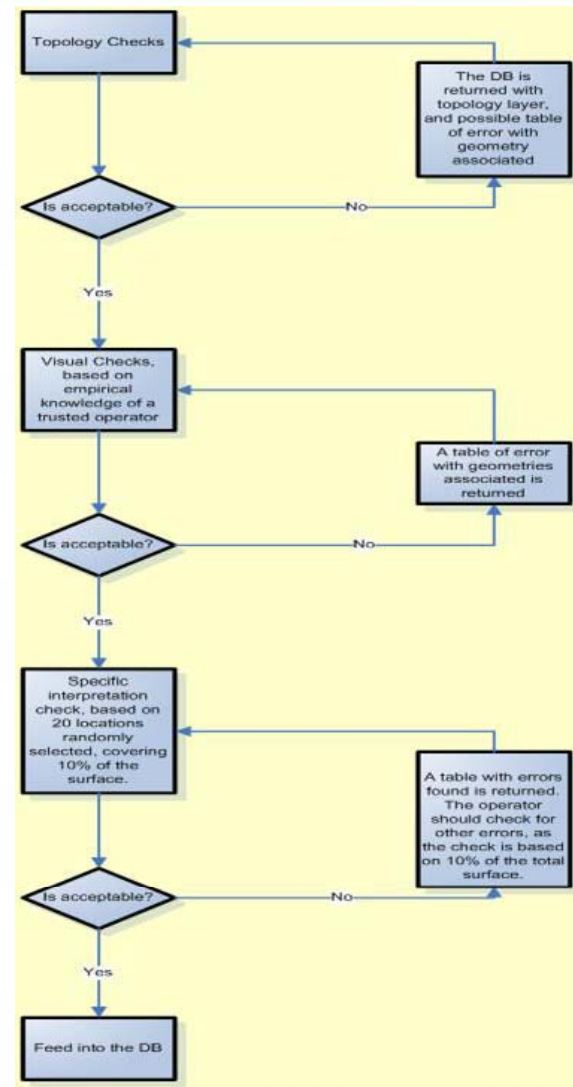
Difference between GPS (Survey heights and Y value in Orthoimage)



Difference Between GPS (Survey heights and Y value in Orthoimage)

1. Creation of a consistent and fully usable GeoDBASE
2. Creation and Addition of the Physiography layer from 3D interpretation (for further GIS Analysis)
3. Checking annotations & Attributes (Local names etc..)
4. Verification Workflow, Map Rendering & Symbology issues
5. Data reviewer PLTS software run in all map sheets
6. Final attribute tests and connectivity between map sheets

1. Quality control and Full Statistical Assessment (GPS points missing – Survey Not Completed)
2. Statistical assessment of imagery quality (x,y,z)
3. Statistical assessments of editing errors (% reliability)



FULLY COMPLIANT
With NATO VMAP 2
Locational (x,y,z) Accuracy Levels



UNITED NATIONS

DEPARTMENT OF FIELD SUPPORT
DEPARTMENT OF PEACEKEEPING OPERATIONS

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.