



## GENERATION OF TRUE ORTHOPHOTOS

By

M. ETTARID, A. AIT M'HAND, R. ALOUI  
Department of Cartography and Photogrammetry  
Institut Agronomique et Vétérinaire Hassan II, Rabat, Morocco

FIG-Cairo

14-22 April 2005

## Why orthophotos

- Alternative to line mapping
- Larger flexibility
- Shorter production time
- Eye pleasing document
- Huge amount of information
- Less expensive than line mapping
- Gaining more importance with digital techniques and development of GIS

FIG-Cairo

14-22 April 2005

## Disadvantages of usual orthophotos

- usual orthophotos are based on 2.5 D digital terrain models
- ➡ **Disadvantages:**
  - Buildings might lean over other areas (obscuring other data)
  - Imperfect superimposition of vector data due to displacements and occlusions
- ➡ **Solution:** in addition to DTM, 3D building models must be introduced ➡ **True orthophotos**

FIG-Cairo

14-22 April 2005

## Occluded areas

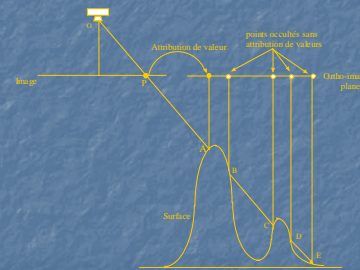


FIG-Cairo

5

14-22 April 2005

## Double mapping

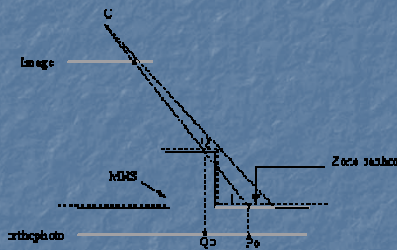


FIG-Cairo

6

14-22 April 2005

## Generation of true orthophotos

- **Generation of true orthophotos is based on the following steps:**
  - Orthogonal projection using DSM that take into account sudden elevation changes of man made objects
  - Detection of occluded areas
  - Merging of adjacent photos to fill in the gaps (blind spots)

FIG-Cairo

14-22 April 2005

## IAVDOP Software

- **Tools:**
  - C++ language
  - Visual Basic
- **Method:**
  - Z-Buffer
- **Evaluation:**
  - Aerial photos (1/7500, dpi)
  - Digital terrain model + digital building model (stereo plotting file)
  - Vector data (stereo plotting file)

FIG-Cairo

14-22 April 2005

## Methods

- **Methods:**
  - Z-buffer method
  - Dense digital terrain model
  - Merging orthophotos of buildings and terrain
  - Orthophotos from a sequence of oriented images

FIG-Cairo

14-22 April 2005

## Z-buffer method

- an image matrix, with same resolution as the image, is created and initialized with a predefined background value.
- Each pixel is filled with the corresponding Z distance, but only in cases where the existing Z value is greater than the current value.
- Hence, only pixels whose rays don't intersect any other feature in their way back to the perspective centre are considered.
- The occluded areas are also automatically marked as part of the orthophotographic production.

FIG-Cairo

14-22 April 2005

## Z-buffer method

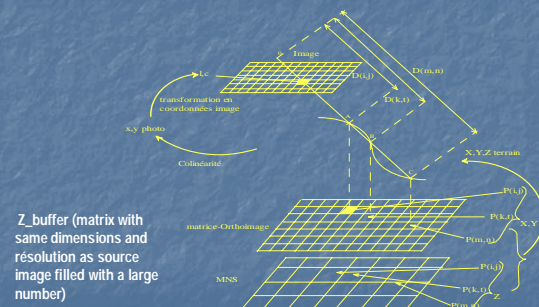


FIG-Cairo

14-22 April 2005

## Z-buffer method

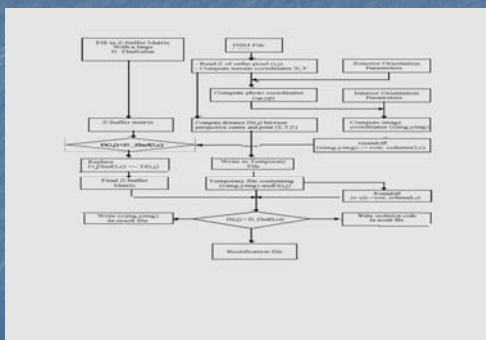


FIG-Cairo

14-22 April 2005

## Methodology flowchart

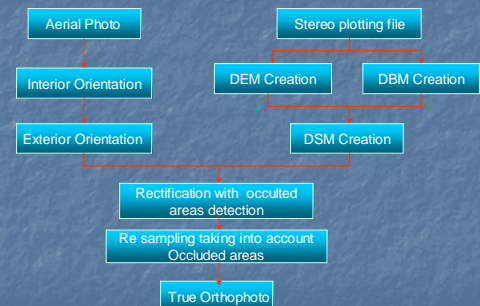


FIG-Cairo

14-22 April 2005

## Presentation of the software

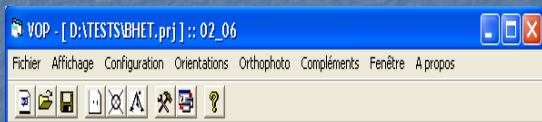


FIG-Cairo

14-22 April 2005

## Presentation of the software

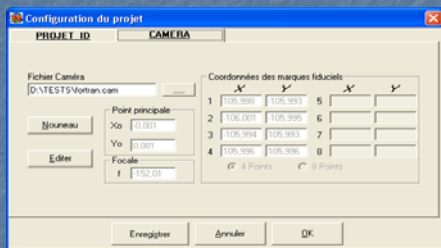


Interface for data entry

FIG-Cairo

14-22 April 2005

## Presentation of the software

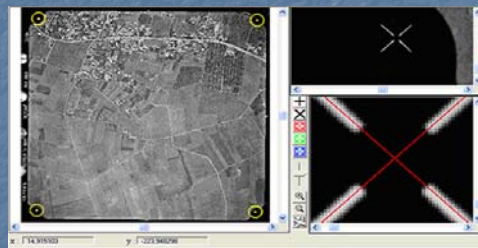


Interface for data entry

FIG-Cairo

14-22 April 2005

## Presentation of the software

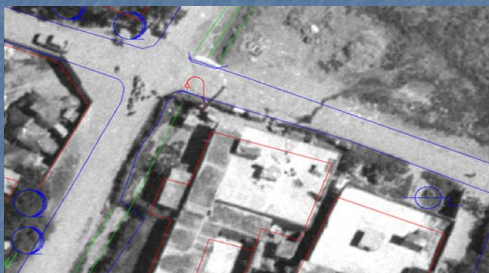


Fiducial and GCP measurements

FIG-Cairo

14-22 April 2005

## Evaluation



Superimposition of vector data on usual orthophoto

FIG-Cairo

14-22 April 2005

## Evaluation

Buildings superimpose well to vector data →  
 ✓ good rectification



FIG-Cairo

14-22 April 2005

## *Conclusion*

---

- True orthophoto eliminates defects of usual orthophoto
- Effort necessary to create the DBM or to collect a satisfactory DTM is the main limitation in the production of true orthophotos.
- Another disadvantage is that additional endlap is required.
- Because of the cost true ortho should be limited to densely populated urban areas with taller structures or a mix of true and usual orthophotos