



Practitioner's Guide:

Map Production Using Aerial Photographs / Satellite Imagery



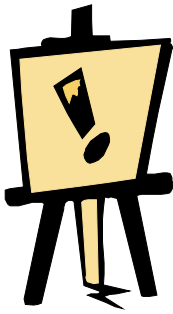
Deutsche Gesellschaft für
Technische Zusammenarbeit
(GTZ) GmbH



Bundesministerium für
wirtschaftliche Zusammenarbeit
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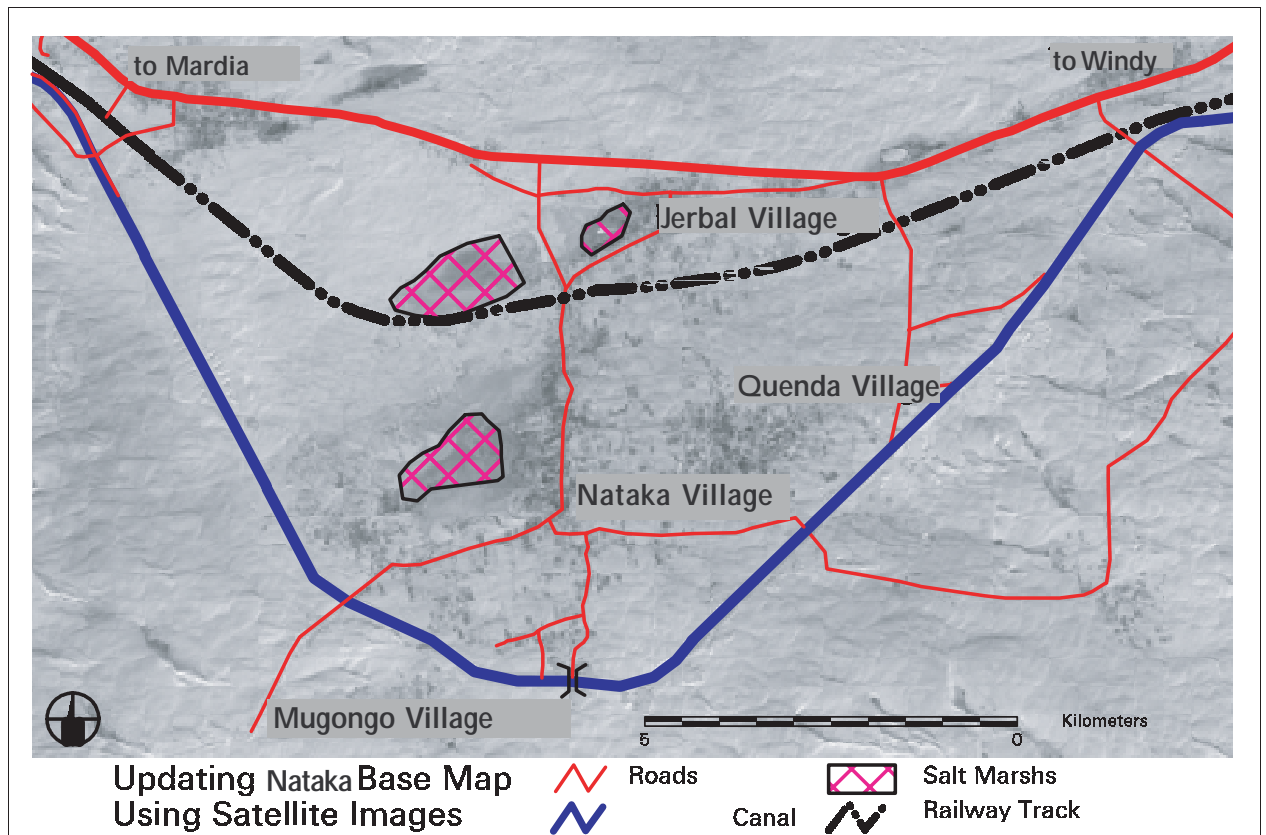
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Brief Description



In many regions in Developing Countries topographic maps are not easily available or they are of low quality. Factors affecting the low quality of maps include the fact that the maps are out of date or some or many features are not displayed in the correct way, mostly due to incorrect procedures of data collection or classification. Updating the existing GIS data is important in order to improve the accuracy of the maps and thus the planning documents. Satellite images and aerial photographs present a view of the features of the earth and they offer a useful method for improving existing maps or for creating new maps. Maps are updated by digitizing the features from the satellite images. The technical procedures for improving the accuracy or creating new maps largely depend upon the availability of map data and aerial photography / satellite images. Field verification of the precise classification of identified features extracted from aerial photographic and satellite data has to be undertaken on the ground. This is commonly referred to as “ground-truthing” and it requires on-site inspections.

Map 1: Updated base map using satellite images



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Proposed Main Users

Technical staff, planners and GIS technicians.



Purpose of the Method



Ultimately, detailed regional or local level development plans require the use of accurate and updated maps. In regions where the maps are either out of date or they are not available updated maps can be produced using satellite images and/or aerial photographs. Satellite images can be acquired relatively cheaply on the international market in contrast to aerial photography that often requires specialized flights to be undertaken. The objective of procuring the satellite images is to acquire adequate data (i.e. in terms of scale and quality) needed for the mapping exercises that are both economically viable and efficient. The subsequent production of maps can be achieved in a short period of time at a low cost in terms of personnel and resources. However, there is a clear relationship between availability of time, technical capability, resources available and the ultimate quality of the maps produced. The planner needs to strike a careful balance between these variables.

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Advantages



- ▶ High quality and updated maps can be produced in a short period of time.
- ▶ Further analysis of satellite images can be done using the right GIS software, (e.g. land cover analysis).
- ▶ Ease with which the maps can be stored digitally and the subsequent quick reproduction or replication of the maps whenever they are needed.
- ▶ Digital spatial datasets can be easily exchanged with any institution or organization.
- ▶ Field surveys are reduced to the level of spot-checks, therefore time-consuming surveys covering the entire area are no longer necessary.
- ▶ Aerial images can be used as a basis for discussing the local conditions and situation during participatory planning exercises.
- ▶ The technical development of computer's capabilities and capacities grows rapidly and opens up new opportunities for processing large amounts of high resolution satellite imagery.

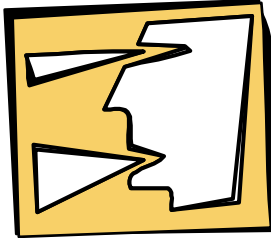
Limitations



- ▶ Costs of the initial purchase of satellite images may be compounded by additional costs involved in regularly purchasing updated satellite images.
- ▶ Considerable effort is required to manage the data and information. For example, the inclusion of meta databases, correct documentation of technical procedures, selection of data that needs to be exchanged both within and between institutions and determining which data should be published and made freely accessible: all has to be planned and managed.
- ▶ Highly qualified and specialized personnel are needed to process, interpret and verify the data. The personnel need to have a sound knowledge of rectification procedures, projection systems, cartographic skills, planning techniques and GIS functionality skills in order to be able to produce good quality maps.
- ▶ Qualified personnel are often difficult to recruit. Personnel need specialized training that in turn increases their market value. Low public sector pay means that they cannot be retained. More affluent private sector companies subsequently recruit trained personnel which again leads to a shortage!
- ▶ The higher the resolution of the satellite images, the higher the volume of data that has to be processed, e.g. doubling the ground resolution implies a quadrupling (i.e. four times) higher volume of digital data. This often implies that computer hardware has to be upgraded or new equipment has to be purchased to handle the data volumes; thus further increasing the overall costs involved in producing accurate maps.
- ▶ Appropriate GIS software capable of handling the data and information has to be purchased.

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Principles and General Procedures



The technical procedures for producing maps using satellite images or aerial photographs are in reality quite complicated and it is necessary to refer to the appropriate literature for detailed description of processes involved. The following procedures are designed to provide a general overview of the main steps required to produce a base map using satellite images:

1. **Identify the map features** that are necessary for the planning process (e.g. physical features, settlements, contour lines, roads, rivers, etc.).
2. Determine the necessary **scale** (e.g. 1:50.000, 1:100.000); **accuracy** and **classification** of the data required.
3. Identify **institutions, organizations** or even private companies that have the necessary information (i.e. secondary sources) and who maybe willing to **provide the data**. Examine the data they have available (i.e. research of their meta data bases) and derive the data needed for the maps that should be developed. If no data is available, continue with step 4.
4. **Purchase** the required satellite imagery / aerial photography.
5. **Develop / adopt technical procedures** for extracting required information from satellite imagery (pre-processing, rectification, image enhancement, classification) using a pilot area.
6. **Digitise and update the map features** according to standardized routines.
7. Assess and **improve the quality of map data** through selected **ground surveys** and field verification and **cross-check the information with other maps**.
8. **Reclassify** the map data, if deemed necessary.
9. Carefully **document the technical procedures** that were used to develop the new or updated maps.
10. **Share the new map data with other institutions or organizations** who either participated in the whole exercise or who have an interest in using the newly developed maps.