

Appendix

Imagery, remote-sensing and geographic information systems: capabilities and practices of the United Nations Monitoring, Verification and Inspection Commission*

Introduction

1. The United Nations Monitoring, Verification and Inspection Commission (UNMOVIC) has made extensive use of remote-sensing and geographic information systems as part of its inspection planning tools and information/data management and analysis. The technological advances in software of recent years and the increased commercial availability of satellite imagery have allowed UNMOVIC to build up an independent information-gathering, search and analytical capability not previously available.

Remote sensing

2. Remote sensing is the science of acquiring information from a place or area without having an actual physical presence. This is achieved by sensing and recording reflected or emitted energy from the object in question. The image type employed depends on the goal to be achieved. For example, in preparing an on-site inspection it requires mapping and locating all structures and facilities within the area of interest. In the past, UNMOVIC was heavily dependent on Member States for imagery and the interpretation of it. The advantages of using commercial satellite imagery include self-reliance, flexibility and the timely delivery of information.

Inspection planning and data gathering

3. To prepare for an inspection or for data gathering, it is now possible to have, in a relatively short time, global high-resolution imagery of the areas of interest. Commercially available imagery now has a resolution of 0.60 metres. This compares with 10-metre resolution in 1991 when the United Nations Special Commission was established and 1-metre resolution in 2000 when UNMOVIC was set up. Resolution is a measure of the smallest object that can be determined by the sensor, or the area on the ground represented by each picture element (known as a pixel). Examples of the end product at different levels of resolution follow (see figures A.1-A.3 below).

* Imagery derived from the Quickbird satellite and obtained by UNMOVIC from Digital Globe.



Figure A.1 Spatial resolution, 10 metres

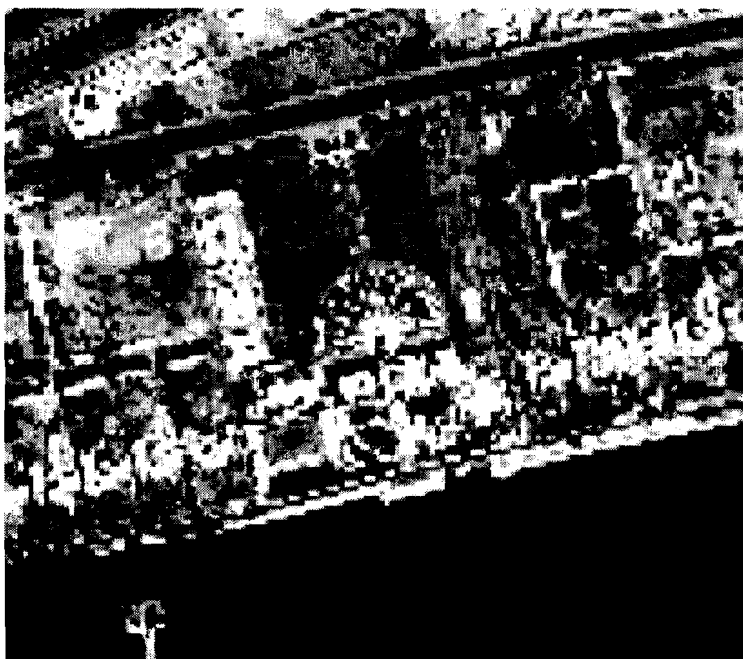


Figure A.2 Spatial resolution, 5 metres



Figure A.3 Spatial resolution, 1 metre

4. Primarily, the imagery used for mapping and for creating line diagrams by UNMOVIC is derived from satellites whose spatial resolutions are 1 metre and 0.60 metre. Other satellites with a coarser spatial resolution are also used. As these larger spatial resolution images are able to produce an overview of bigger districts or the entire country, they are ideal for producing maps or diagrams with a larger scale.

5. The information gathered from the imagery results in the determination of the status of a site (activity), its layout and dimensions and possible function of particular structures. The UNMOVIC standards for producing these types of maps has been shared with the United Nations Geographic Information Working Group for possible wider use by other United Nations bodies that may take advantage of remote-sensing technology. UNMOVIC has recently provided technical assistance to produce maps derived from satellite imagery for the Department of Peacekeeping Operations in order to map borders. The standards developed by UNMOVIC were applied to the resulting product. There is continuous cooperation with the International Atomic Energy Agency as well as exchanges of imagery.

Monitoring capabilities

6. In addition to the mapping of sites in Iraq, remote-sensing data captured by satellites can be used to monitor specific sites over a certain period of time. Computer software has been developed that can search for changes in the physical configuration of sites or areas within two or more specific satellite images from different time frames. However, the value of this for short-term monitoring can be

limited by the fact that satellites pass a certain point of the Earth only at a particular time. This “revisiting time” varies between platforms. Some satellites have a revisiting time of one day, whereas other satellites revisit the same area every few days.

Recent findings

7. While sites in Iraq were being monitored for updates through satellite imagery, it was detected that some sites subject to monitoring by UNMOVIC had been cleaned up and equipment and material had been removed from the sites (see figures A.4 and A.5 below). In other areas, whole buildings that had previously contained equipment and materials subject to monitoring had been completely dismantled. The work continues to cover all known sites in Iraq.

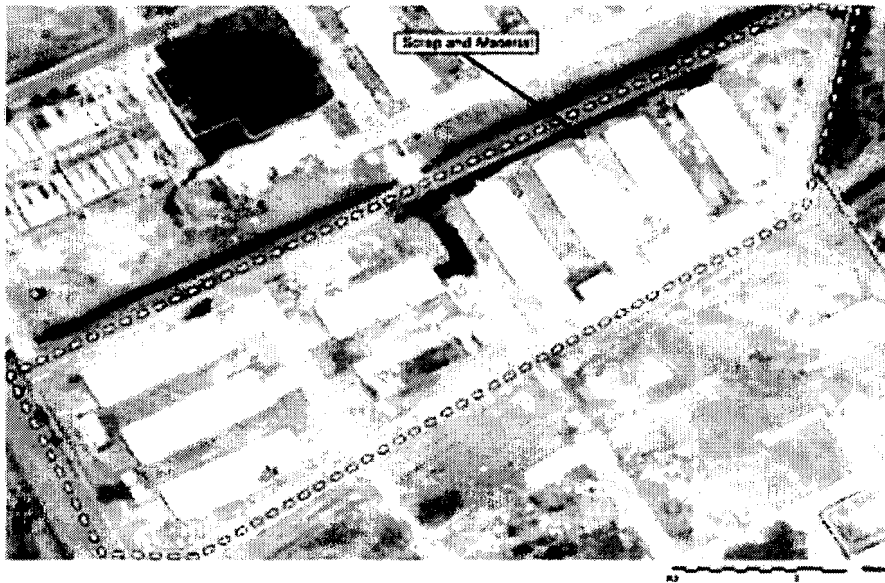


Figure A.4 Shumokh store site overview (28 May 2003)

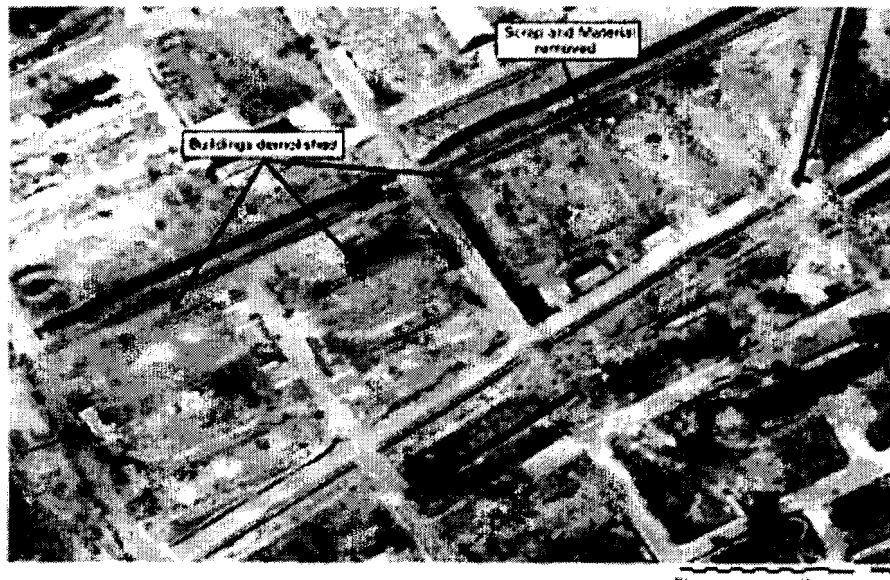


Figure A.5 Dismantled Shumokh store site
(22 February 2004)

Geographic Information System

8. The Geographic Information System is a commercially available computer software system capable of storing, analysing, capturing and displaying geographically referenced material from the Commission's various databases and is used extensively by UNMOVIC. All the available information about a particular geographic site or area (maps, photographs, imagery, inspection reports, etc.) is pulled together and made available to the analyst. GIS and remote-sensing techniques are combined to create customized information layers in the various maps and line diagrams produced. The information extracted from the imagery can be directly linked to the existing database through data links. It can be used for data management and for the production of overview maps, specific maps, boundary maps and line diagrams from the Commission's extensive collection of maps, imagery and other data.
