Association for Information and Image Management
1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202

Centimeter

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 mm

Inches

1.0
1.1
1.25

2.5
2.2
1.8

MANUFACTURED TO AIIM STANDARDS
BY APPLIED IMAGE, INC.
INTERNATIONAL NUCLEAR SAFEGUARDS
INSPECTION SUPPORT TOOL

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DISCLAIMER
Introduction

The U.S. Department of Energy (DOE) is committed to developing technologies to meet escalating requirements for the International Atomic Energy Agency (IAEA) Non-Proliferation Treaty (NPT) monitoring and associated inspections. This commitment involves the customization and transfer of existing remote monitoring/information management technologies for use by the IAEA. This paper describes an information management system called INSIST—International Nuclear Safeguards Inspection Support Tool, which was developed by the Pacific Northwest Laboratory (PNL) to support the IAEA Action Team in its role of monitoring and verifying compliance under United Nations Special Commission (UNSC) Resolutions 687, 707, and 715.

Initial emphasis was placed on developing and deploying functionality and databases customized to support the Action Team. Throughout the design and customization of INSIST, emphasis was placed on information storage and retrieval capabilities for data gathered by the Action Team. In addition, PNL provided the Action Team with maps and satellite images and other relevant Iraqi databases to further facilitate the following activities:

• monitoring nuclear activities, facility operations, and nuclear material inventories
• assisting in inspection planning and training
• providing post inspection analysis
• providing onsite inspection support
• reporting on inspection findings.

Because this effort transferred existing DOE capabilities in information management, and demanded rapid development and deployment of a workstation at the IAEA in Vienna, existing capabilities were customized to provide the IAEA Action Team with a simple but effective tool for storing and retrieving inspection information. At all phases of this effort, interaction with the end-user was crucial to maximize user involvement in defining, prioritizing, and co-developing capabilities. The goal was to encourage the user to become an integral part of the development of future, more advanced capabilities. To achieve this goal, PNL staff have been working with the Action Team in Vienna to better evaluate technologies to support future needs.

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Workstation Description

The INSIST workstation provides multimedia data management to accommodate multisource inspection data. Information in INSIST is geographically referenced, providing an easy and effective tool for storing and retrieving world-wide maps, satellite and aerial imagery, conventional photography, site and facility information, inspection videos, and text. To do this, INSIST integrates analog (video) and digital processing techniques. Video uniquely provides rapid access and nearly unlimited storage capacity. In addition, because video has been developed for and deployed in the commercial market, it is inexpensive, familiar, and readily available technology.

INSIST was developed on a UNIX-based computer, linked to several video processing and input/output peripheral devices (Figure 1). When possible, equipment was selected to accommodate NTSC (U.S.) and PAL (European) video standards, and a switchable 220/110 power supply. A read-only videodisc player is used to retrieve videodisc maps and charts, and a WORM laserdisc recorder stores image-based inspection data (satellite imagery, photography, etc.). A specialized video card provides video display and processing on the workstation. Videotapes are displayed on the computer using a serial-controlled VCR. Text and graphics are input using a scanner and can be output with a color PostScript laser printer. For briefing purposes, the video signal can be routed to a large-screen T.V. monitor.

Figure 1. The IAEA Action Team's INSIST Workstation, a storage and retrieval tool for inspection data. INSIST has been in operation at the IAEA since August, 1993.
To make INSIST intuitive and comfortable for users, a major effort was undertaken to design a simple user interface. In keeping with the industry-wide migration to common graphical user interface (GUI) standards, PNL ported existing and customized features into an all-inclusive Motif interface. Users accustomed to other Motif or Windows programs will immediately be able to engage basic features and will be encouraged to explore the more advanced features of INSIST because of the ease of use and familiar feel of the INSIST interface. A great deal of attention was given to make navigation through the different data sets and features of INSIST as natural as possible with a minimum of requirements for learned commands or keyboard procedures. The majority of INSIST user interaction is performed with the mouse, which will allow both novice and experienced computer users the ability to develop a high level of expertise in interacting with INSIST's data sets. The importance of this strategy lies in the fact that many Nuclear Safeguards experts have limited experience using advanced computer systems.

**INSIST User Interaction**

The INSIST interface is shown in Figure 2. User information stored on a videodisc recorder is displayed in the video window at the top right of Figure 2. Examples of information include U.S. government-developed videodisc maps and charts, satellite imagery (Landsat, SPOT, and Russian 2-meter), aerial photography, conventional photography (primarily from on-site inspections), and live video.

The control panel is at the top left of Figure 2. This panel allows the user to configure and interact with INSIST and to control window displays. All controls are implemented using simple pull-down menus and pop-up action boxes. Command options allow the user to select country, area, or site of interest (FILE), to display image or map sets (SELECT), and to run commercial or customized application programs such as text retrieval (TOOLS). In addition, the control panel reports the active reference map and video image, the coordinates of the cursor, and the landcover category for the area under the cursor.

On the bottom left of Figure 2 is the reference window. This window contains a digital reference image which is used to retrieve and display information in the video window. Reference images are maps and diagrams ranging in scale from a world map to building diagrams. The reference maps provide the ability to zoom from the world scale to a specific area of interest. The reference maps used by the Action Team include official government maps, Iraq tourist-type country and city maps, and very specialized thematic maps (i.e., landuse, population density). In addition, specialized applications have been developed to retrieve inspection-specific information. An example is an equipment retrieval application in which a design graphic is used as the reference image. This application accesses equipment photographs and detailed design graphics. Another inspection-specific application is facility retrieval, in which a site or facility diagram is used as the reference image. Then, by selecting individual buildings from the site diagram, the user can view all information associated with selected buildings. In this way, an inspector who is unfamiliar with a site can become knowledgeable about individual buildings and rooms, their functions, and the reported impressions of visiting inspectors.
The INSIST User Interface. On the top-left is the control panel, providing access to INSIST's multimedia information, on the bottom-left is a digital reference map of Baghdad, and the top-right is a window displaying a Russian 2-meter satellite image of Baghdad.
A commercial text retrieval system has been incorporated into INSIST to provide intelligent text processing and management for the Action Team's extensive collection of inspection reports, declarations, documentation, and descriptions. The text retrieval system not only performs basic keyword searches, but allows the user to construct sophisticated queries. The information retrieved from these structured queries is ranked according to relevance to the topic queried. Future enhancements will focus on developing associations between INSIST's textual and geographically-based information.

**Current Status and Future Opportunities**

Since the deployment of the INSIST workstation for the IAEA Action Team, efforts have been concentrated on enhancing the database, demonstrating system functionality, training users, and gaining insights for future developments to meet Action Team needs. The success of the initial INSIST workstation was instrumental in implementing a follow-on project to develop and deploy a second INSIST workstation to support the 93+2 Programme at the IAEA. This workstation, which was deployed in January 1994, will support the field trials under the 93+2 Programme. Because of the extensive environmental monitoring requirements associated with the field trials, software development will involve incorporating environmental data analysis and management functionality. More recently, DOE has initiated a program to transfer INSIST-like capabilities to the UNSC in New York to support its role in Iraqi inspections. Delivery of this workstation is scheduled for June 1994.

**Acknowledgements**

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