Geo-Intelligence Production System™
GeoMedia® Topographer: Data Capture & Image Processing Solution

A White Paper
1. Scope

Data capture and image processing are the start to any geospatial production activity. GeoMedia® Topographer is Intergraph’s most recent solution to its collection of feature data. This white paper details the basic architecture that GeoMedia Topographer employs to address the following tasks:

- Image ingest
- Image selection and processing
- Image management
- Feature collection

An essential component of the Geo-Intelligence Production System™ (GIPS), GeoMedia Topographer fits into an enterprisewide system that encompasses data collection, data management, and product generation. The GIPS is a set of Intergraph solutions using commercial software applications to provide a production system for the creation and maintenance of geospatial data and products. The GIPS is an end-to-end geospatial system that is flexible, scaleable, extensible, open, and interoperable, allowing for collaboration among agencies and their contractors and customers. Feature and elevation data capture is provided with interfaces to an image and raster management system. The multi-scale multiple representation feature database has mechanisms for validation, security, and revision. The product generation component includes tools for producing digital and hardcopy products, and the exploitation component allows for cataloging and dissemination of all forms of geospatial data.

2. Solution Relationship to GIPS

GeoMedia Topographer serves as the data capture and revision solution for feature and elevation data to the GIPS environment. GeoMedia Topographer is integrated with the GeoMedia Curator solution, which provides data integration and management capabilities. Data can be captured or edited in separate data warehouses or directly into a geospatial staging database managed by GeoMedia Curator. GeoMedia Topographer provides interfaces and tools to photogrammetrically ingest, enhance, and manage a variety of commercial.
image types and formats. Intergraph TerraShare® technology is utilized to manage imagery and other raster data products. GeoMedia Topographer includes a single-user image management component but can easily be integrated into an enterprisewide management system. GeoMedia Topographer presents a user-friendly feature, capture and editing environment, and offers definable rules for feature-specific validation to any feature extraction specification. GeoMedia Topographer supports both mono and stereo feature capture capabilities.

GeoMedia Topographer provides other geospatial solutions with accurate, validated, and geo-positioned digital data necessary to support today’s rapidly evolving geospatial production and exploitation systems. The technology underlying GeoMedia Topographer unites itself extremely well with the Geo-Intelligence Exploitation System (GIES), an Image Scout-based solution. Image Scout is an imagery analysis solution that allows image analysts to extract information from an extremely large number of images. GeoMedia Topographer provides a geographic reference source via cartographic products to support applications in Image Scout to intensify exploitation. The power of combining these two technologies creates a computer seat that is extremely well equipped to handle any data gathering and/or digital mapping task. Geospatial analysis and imagery analysis requirements can be fully satisfied by combining these solutions.

3. Target Market
The target market for GeoMedia Topographer includes government, both state and federal; mapping agencies; and their contractors. Out of the box, GeoMedia Topographer is configured to extract digital data to several mapping standards. Additionally, GeoMedia Topographer provides the tools necessary to collect digital feature data to any custom or standard specification.

4. Technical Challenge
Over the next few years, the imagery and mapping geospatial community can expect to analyze and exploit five to 10 times more sensor data collected by national and commercial imagery systems than is collected today. GeoMedia Topographer is designed to facilitate feature extraction from these sources by providing extraction tools that can quickly and efficiently exploit these sources. GeoMedia Topographer will provide users with the functionality necessary to keep pace with the increased feature extraction tasks driven by the abundance of new image data sources. GeoMedia Topographer also will support the demand for up-to-date feature data by providing several data revision scenarios.

5. Solution Description
GeoMedia Topographer empowers feature collection users with the tools to quickly and accurately extract digital feature data from a variety of digital image and raster map sources. Using the strength of the GeoMedia Professional platform, GeoMedia Topographer provides data collectors with a rich set of tools
to process, enhance, and manage source imagery, and extract feature data using interactive and automated feature extraction techniques.

The power of performing data capture using GeoMedia Topographer manifests itself in the source integration capability and easy-to-use digitizing/editing interface built into this solution. GeoMedia Topographer puts a vast array of vector and raster ancillary data sources at the fingertips of the data collector. Raster map products and image products can be quickly ingested and displayed in GeoMedia Topographer to support data capture. Likewise, Vector Product Format map data, Dynamo Object Spaces, ArcInfo/ArcView, MapInfo, GML GIS data, CAD data, such as Microstation and AutoCAD, and even text files containing geospatial information can all be quickly exploited and integrated using GeoMedia data server technology. This integration can provide a powerful geospatial framework to assist data collection.

5.1 Image Ingest and Processing

_Absolute Image Ingest and Source Integration_

GeoMedia Topographer’s image ingest capability handles IKONOS, QuickBird, and OrbView commercial imagery as well as a variety of non-commercial imagery. Image ingest is photogrammetrically based so it supports photogrammetric processing operations, such as triangulation, image orthorectification, and stereo viewing/mensuration. Orthorectification and stereo viewing/mensuration capabilities are provided within the GeoMedia Topographer solution, and triangulation can be performed with a plug-in product to GeoMedia Topographer. Photogrammetric-based processing provides the most accurate source image geo-positioning possible. This gives the data collector tools to ensure that features extracted from these image sources are extracted to high geospatial accuracy standards. These tools include an accuracy assessment capability, which verifies the geo-positional accuracy of the image data used for feature extraction.

_Image Enhancement – “Making things clearer”_

GeoMedia Topographer’s data collection platform provides functionality to enhance image display to optimize automated and interactive feature collection techniques. GeoMedia Topographer presents a handy toolbar to the data collector to facilitate quick adjustments of displayed imagery. This toolbar provides quick access to brightness, contrast, gamma, sharpening, auto dynamic range adjustment (ADRA), and level-slicing operations that guarantee a continuous optimal image display for feature extraction. GeoMedia Topographer always presents the collector with the best possible display of the features to be extracted.

5.2 Feature Collection

_Absolute Image Viewing and Mensuration_
GeoMedia Topographer doesn’t limit the collector to 2D imagery displays. This solution provides a stereo viewing window that allows a collector to see features in 3D. The data collector can use this capability to roam through stereo image displays to exploit all the useful information contained in 3D displays that cannot be ascertained from 2D image presentations. The stereo window provides tools to manipulate the stereo view, and enhance the stereo image pairs being viewed. Stereo mensuration can be performed in the stereo view to provide very accurate measurement metrics for feature extraction. GeoMedia Topographer’s stereo viewer provides a mechanism to perform 3D photo interpretation where stereo image pairs are available.

**Enhanced Data Capture Capabilities**

Intergraph’s GeoMedia technology is used to support a large set of user-definable data models. Although only simple geometries are stored in the data warehouse, the GeoMedia topology engine can quickly and efficiently generate topology information to perform validation and analytical queries. GeoMedia supports typical area, line, and point geometries as well as compound, image, and text data types. Compound geometry types allow for different feature geometries to be maintained in the same feature table.

An extensive set of feature capture and editing tools are included that help the data collector capture accurate feature geometries and topologies. User-definable digitization tools, such as snapping, precision key-in, place hole, noncontiguous feature collection, copy/follow geometries, and place by face, make capturing feature data simple, quick, and accurate work.

GeoMedia Topographer gives data collectors a powerful set of feature attribution tools complementing point, line, and area feature extraction capabilities. Predefined database templates of some widely used data models are included with GeoMedia Topographer. These templates provide an “out-of-the-box” feature collection capability using some well-defined data capture specifications. Data remodeling tools allow the data collector to tailor the data model to any extraction specification. Attribute population and validation functions in the toolkit accelerate data capture efficiency.

**Data Capture Automation & Productivity**

A specialized toolkit is built into GeoMedia Topographer, supplying a variety of productivity boosters for data capture. GeoMedia Topographer contains a rule-based interface to promote productivity, validity, and usability during the collection process. Customized dialogs provide more descriptive labels for feature class and attribute names as well as the ability to display only the attributes to be collected. Definable rules ensure that the collector captures features correctly and validates attribute values dynamically during collection. Attribute validation can also be executed as a post-collection process to identify, report, and display errors. All attribute properties can be controlled from domain range values to mandatory attribute population. Users can even define their own default values during the collection process through the interface.
GeoMedia Topographer’s automated tools enhance productivity. Derived attributes, whose values are based on the values of other attributes, can be dynamically populated. A custom distance-measuring tool creates a zoomed window and automatically populates a dimensional attribute without having to enter and exit numerous individual commands. User-definable templates help the user to quickly assess whether a feature needs to be captured. Additionally, a raster line following tool is included that semi-automates the collection of binary raster data. Feature Analyst, a plug-in product to GeoMedia Topographer, provides a fully automated feature collection solution based on cutting-edge technology developed by the Visual Learning Systems company.

5.3 Image Management

*TerraShare Style*

Image data management can be time consuming and difficult when working with large numbers of images. A single data collector can be faced with the labor-intensive task of organizing hundreds of images over a collection area. To alleviate this task and allow the analyst to best use his time collecting data – not managing it – an image management system has been built into GeoMedia Topographer. The personal image management system gives the data collector the ability to quickly store image location and metadata into a database. The feature extraction environment uses a TerraShare data server to retrieve and display imagery based upon the imagery metadata. This capability is based on Intergraph’s very successful TerraShare technology. TerraShare’s enterprise products provide a powerful file-based management system for imagery, elevation, and other geospatial data. TerraShare can greatly increase the efficiency of data capture operations on an enterprise level.

GeoMedia Topographer incorporates a personal edition of TerraShare for single seat data management. Using GeoMedia Topographer, imagery and elevation data can be intelligently archived into the management system for extremely efficient retrieval. The data is intelligently stored with the metadata automatically extracted and archived within the TerraShare image management system. The data collector never has to remember where or what data is available for data capture. GeoMedia Topographer remembers.

6. Solution Architecture

GeoMedia Topographer is built on the GeoMedia Professional platform and brings together commercial-off-the-shelf (COTS) and specialized data capture and image processing solution components that provide a synergistic feature capture environment. All components of this solution are fully integrated into the GeoMedia Professional product so the collector can execute a seamless workflow from one unified platform. GeoMedia Topographer is complemented by a focused set of optional plug-in products that address specific functionality to broaden feature data capture workflows. These plug-in products support
automated feature collection, stereo feature collection, image triangulation, high-volume orthophoto production, enterprise image management, and image product generation. Combined with GeoMedia Topographer, these add-on products provide a comprehensive yet flexible solution to address the many aspects of diverse data capture workflows.

7. Conclusions

GeoMedia Topographer is a high-powered data collection platform. Historically, digital data capture involved merging techniques from the disciplines of photogrammetry, CAD, and GIS. Data capture involved running separate workflows on multiple software and hardware platforms. The data pass-off frequency under this architecture creates data throughput inefficiencies and may even compromise the integrity of the data passing through the system. The GIPS solutions confront these issues by providing a unified software platform that can be supported by a single desktop/workstation hardware configuration. GeoMedia Topographer gives each individual data collector the ability to photogrammetrically ingest a wide range of imagery types and formats, perform orthorectification, enhance the imagery display for optimum feature identification, view and mensurate from both mono and stereo imagery, use automated and interactive feature extraction techniques for digital feature compilation, and manage all the imagery involved in a data capture workflow. The plug-in extensions to GeoMedia Topographer further elevate the solution to handle all aspects of any feature data capture workflow.

GeoMedia Topographer acts as the data generator and provider for GeoMedia Curator and GeoMedia Cartographer, which are based on the same powerful platform. In the GIPS architecture, one platform provides the mechanism to generate many digital map products. Data flows from one workflow step to the next and from one solution to the next in a seamless and efficient manner.
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