

Intergraph's World of Earth Imaging

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ABSTRACT

The world of Earth Imaging including Photogrammetry and Remote Sensing solutions is turning faster and faster and is getting more tightly than ever integrated in the GIS world. Rapid production, global Geospatial Data sets, faster revision cycles and immediate data transport to end users (e.g. via web) represent today's industry demands. *Intergraph's response to this is a full highly productive digital workflow.* Since the first introduction of the world's most versatile large format digital camera DMC in 2003 we will today introduce the fastest post-processing technics ever. A new photogrammetric production environment enhances the ImageStation product line and will have a big impact on monitoring and managing production sites. New features like distributed processing will further increase productivity. The new stereo feature collection on top of GeoMedia fully integrates Photogrammetry into GIS.

1. INTRODUCTION

Today's Earth Imaging market is currently very much in change. There is an increasing dependency on the global GIS market. Almost all industries and governmental organisations have a high demand on imagery, especially Orthophotos, and huge volumes of DTMs. End-users are more and more used to working in open systems architectures with a high degree of data interoperability. Digital Aerial Cameras are becoming common place. The transition to fully digital workflows is on-going.

Being all-digital leads to new challenges:

- More productivity to be more competitive
- On-going demand for more automation tools
- Solutions to manage, store, view, archive and distribute data
- GIS-based stereo feature collection for capturing, editing and updating data
- Instant access to enterprise data through the intranet as well as the web

2. INTERGRAPH'S RESPONSE

The market changes are mainly driven by economic parameters. Geospatial data production on a local, state wide or cross country level is permanently affecting the business models. Depending on the project size companies are working stand-alone, through cooperations or in consortiums. This requires a high degree on flexibility in managing the workload through a flexible production environment.

Intergraph's goal is to provide full solutions across the whole range of Earth Imaging requirements based on the most productive tools in the market. These solutions include all components of the production workflow from planning a photo flight mission to the distribution of data into the web:

- Flight Mission Planning (ISMP)
- Digital Mapping Camera DMC and associated image post-processing (PPS)
- Airborne Sensor Management System (ASMS)

- Analog Camera RMK TOP
- Photogrammetric Scanner System PhotoScan
- Photogrammetric workstations and components (ImageStation, stereo bundle, Z/I mouse)
- ImageStation software solutions (Aerotriangulation, DTM, Orthophoto, stereo data capture)
- TerraShare product family (data management, data distribution, distributed processing)

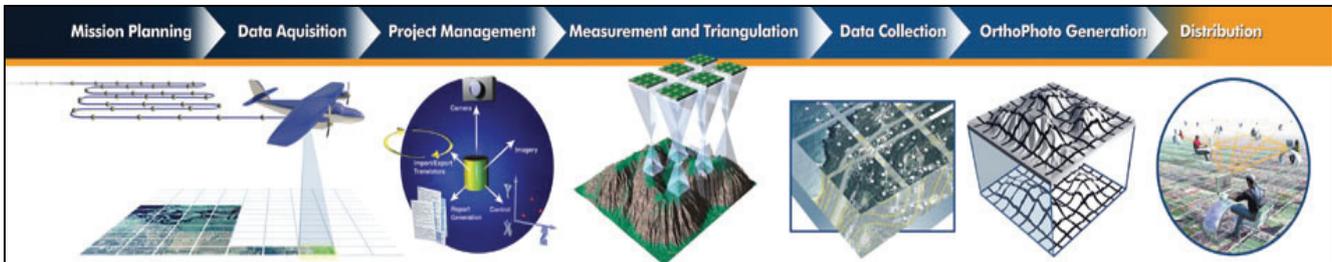


Figure 1: Intergraph supports complete solutions from data acquisition to exploitation to distribution

Following the market requirements and changes, today some major new features will be introduced:

- DMC post-processing including distributed processing (PPS DP)
- New features on ISMP
- New ASMS functionality (e.g. In-Flight-Control)
- A new ImageStation Photogrammetry Environment
- OrthoPro distributed processing (OrthoPro DP)
- GeoMedia-based Stereo Feature Collection (ISFC-G)

These features are very much focused on economical benefits to the flight companies and production shops, significantly reducing the workflow turnaround and helping them to be more cost effective and competitive.

3. DIGITAL MAPPING CAMERA DMC

Two years ago the DMC was first introduced into the market. Today it is the most versatile large format aerial camera in the world with more than 20 DMC systems in operation and more than 25 systems under contract. There is a high degree of market acceptance for this camera. Reasons for this are:

- very stable and precise image geometry
- high resolution (≥ 4 cm GSD)
- wide range of applications (large, medium, small scale, Remote Sensing)
- high image quality through electronic FMC (Time Delayed Integration -TDI)
- very high sensitivity due to 12 micron CCD pixel size
- 20% larger frame size compared to other sensors
- very reliable and robust technology
- certified against DO 160D and ISO 7137 as well as data quality specifications
- GPS/IMU system is not required
- fastest post-processing
- results may be used in any digital photogrammetric system

Beside these economical and technical benefits new features are going to be released with the next product version. The main focus is a more flexible and easy-to-use mission planning (ISMP) as well as many add-ons for In-Flight-Control within the Airborne Sensor Management System (ASMS). Features like the Airborne Online Project Viewer (AOPV) and the FDS Image Viewer will bring a high degree of quality control to the flight operation including image exposure and storage. This level of in-flight quality review is not practical with film-based camera systems.

One of the most productive new highlights is the introduction of TerraShare's distributed processing functionality to the DMC's post-processing system PPS. This environment makes post-processing of DMC raw data up to 6 times faster depending on the IT infrastructure. This allows customers to complete post-processing of a full set of FDS data (Flight Data Storage system) in less than one day.

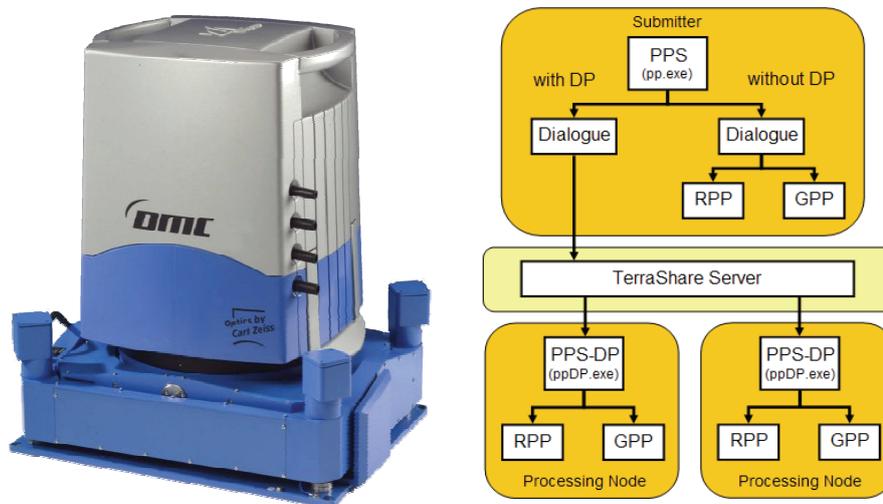


Figure 2: DMC and Distributed Post-Processing (PPS DP)

4. THE NEW IMAGESTATION PHOTOGRAMMETRY ENVIRONMENT

Since digital Photogrammetry was introduced into the market, more and more automation algorithms have been introduced to increase the productivity of the workflow, a big step for Photogrammetry. The goals for more automation have not changed, but correlation / matching technologies and bundle adjustments have reached a high level. Above all, fully automated object extraction tools are still some way off. The focus is on semi-automated solutions. All this leads to the question on how to improve today's workflows to be even more productive, more competitive and more cost-effective. Intergraph identifies the following areas in which automation may be applied to give increases in productivity:

- Distributed processing to reduce production cycles specifically for time consuming applications (PPS, Orthophoto, DTM)
- A new Photogrammetric user environment to optimize project management and monitoring
- Ongoing improvements on automation

The introduction of distributed processing technologies becomes more and more valuable to productivity since high performance IT-technology is available everywhere in the enterprise. Somehow customers don't even have to invest into new IT equipment, but just use what's available in the enterprise to significantly reduce production time. However, there are limits due to "Amdahl's law".

Looking into today's production workflow the bottlenecks in terms of performance are mostly image post-processing, Orthophoto rectification and DTM production. Intergraph introduced distributed processing (DP) by using TerraShare's Advanced Server (TS-AS). TS-AS allocates processes submitted to the queue to whatever processing units are available in the network. Figure 3 shows the principle design. The first Intergraph applications making use of this DP techniques are the DMC's post-processing (PPS DP) and the Orthophoto production using OrthoPro DP.

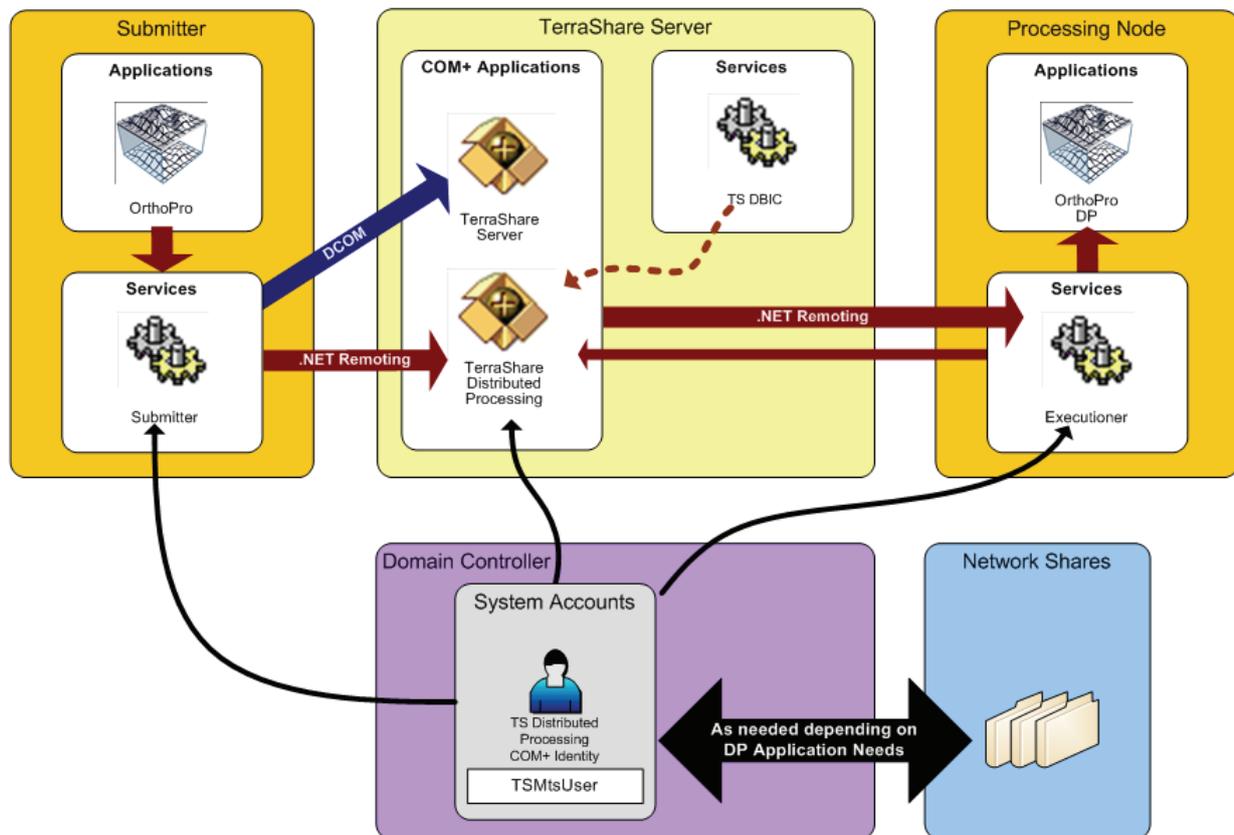


Figure 3: From Desktop Production to Distributed Production

Another step towards a more efficient production workflow will be the new photogrammetry environment for ImageStation. This represents a refresh of the graphical user interface as well as a simplified project display to create, view, manage and monitor a full photogrammetric workflow. The user will find all relevant project features linked between the map window and data views allowing users to select project features in either view.

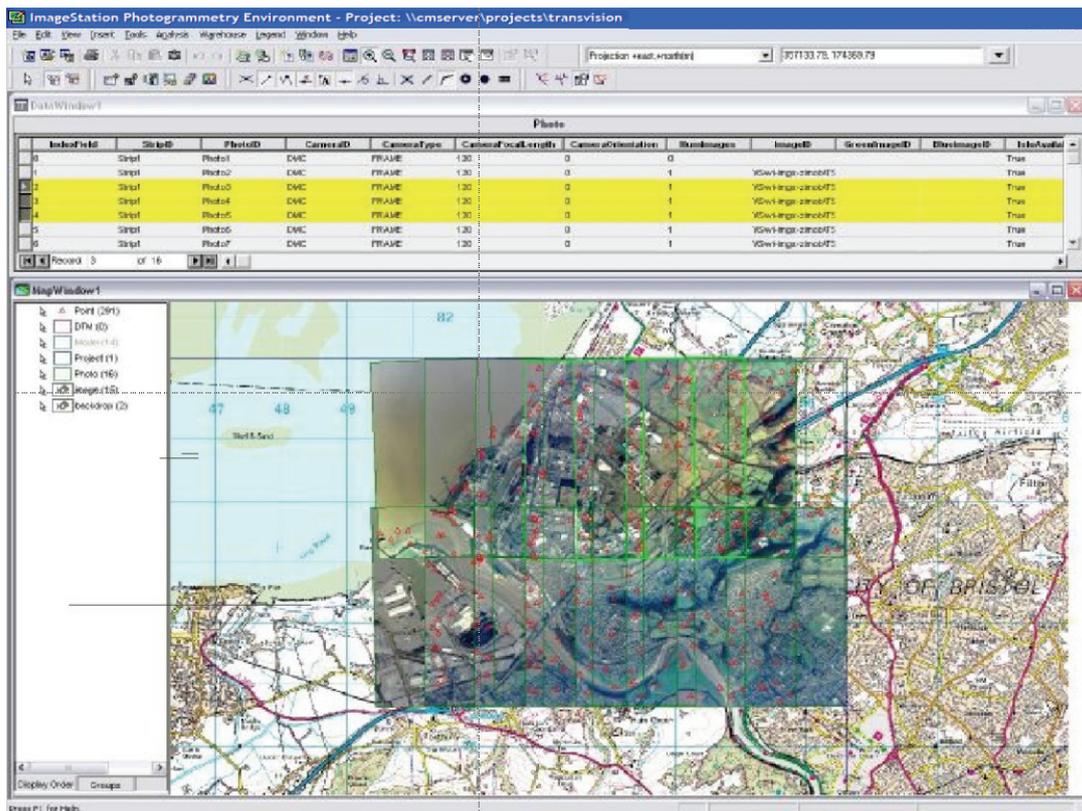


Figure 4: The New ImageStation Photogrammetry Environment

5. GIS INTEGRATION AND DATA DISTRIBUTION INTO THE WEB

Traditionally Photogrammetric operators work in a CAD-based 3-D data capturing mode. Most production shops deliver design files (e.g. DGN, DWG) to complete or update customer's maps or geospatial database. Data and map revision mostly runs through different import/export interfaces or translators. But today's market increasingly demands object oriented data capture and revision to directly support the existing database formats and schemas of the end users, ideally without requiring the data to be translated from one format to the other. Intergraph is addressing these needs by introducing a new stereo feature collection tool on top of GeoMedia (ISFC-G) in co-existence with the existing platform.

This object-based feature collection is tightly integrated into GeoMedia. This allows users to have a full access to the most popular database structures by using GeoMedia's wide range of data servers. This product gives new benefits to the Geospatial desktop operators to work for multiple clients with different data formats. Also the photogrammetric operator is now able to support different projects with different feature-based data structures through one single environment. Figure 5 shows the stereo display inside GeoMedia.

Beside the close integration of Photogrammetry and GIS there is a basic need for Earth Imaging data across the entire enterprise and beyond. Planners and engineers would like to share data via the intranet, external customers or partners would like to browse data via the web. Intergraph's TerraShare product family consequently completes the Earth Imaging solutions offering comprehensive tools for data management and distribution. It brings your imagery and DTM's to the most popular GIS desktops including GeoMedia and GeoMedia WebMap.

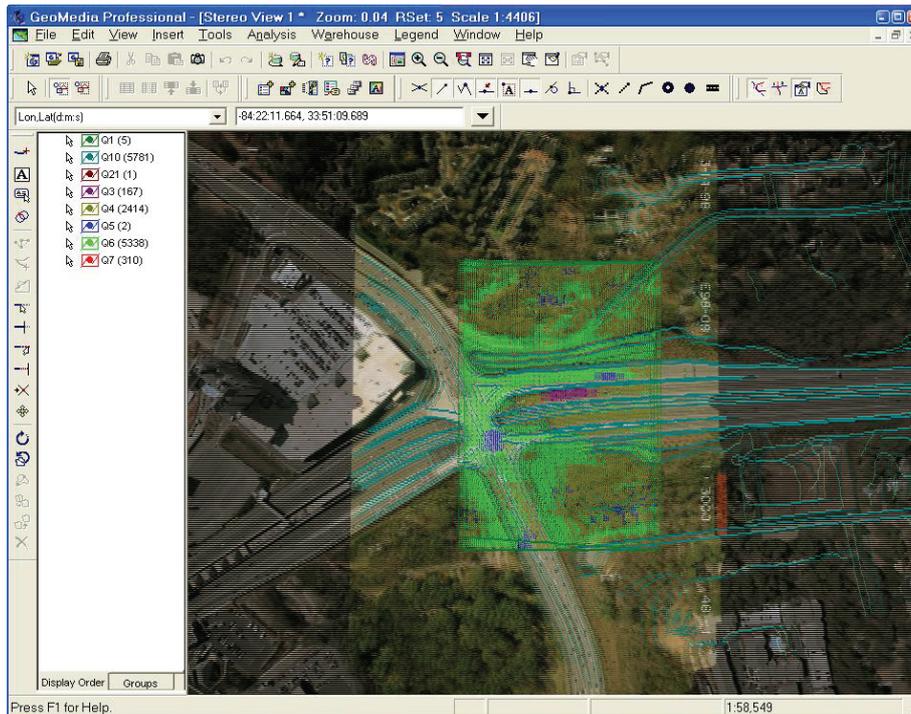


Figure 5: Geomedia's Stereo Feature Collection (ISFC-G)

6. CONCLUSION AND OUTLOOK

Intergraph's Z/I product line represents the complete range of Earth Imaging applications from digital and analog camera sensors through data exploitation to Intranet- and Web-based distribution. The Digital Mapping Camera DMC is well accepted in the market. New features like distributed processing for PPS and Orthophoto production increase productivity significantly. GeoMedia-based stereo feature collection and TerraShare for enterprise data management and data distribution to the GIS desktop add value for more productivity and cost-effectiveness. The transition of data from on-the-flight storage to delivery to the end-user is faster than ever. The future is open interoperability for any sensor within any process along any workflow. Then any geospatial data can be made available to anyone, anywhere. These are the challenges for Photogrammetry and Remote Sensing in today's world.

7. REFERENCES

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