An integrated approach to production utilising the Intergraph® DMC™ and TerraShare™

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ABSTRACT

After extensive research into large format digital airborne cameras, Ordnance Survey (Britain's national mapping agency) purchased an Intergraph DMC (digital mapping camera) in early 2005. With the DMC potentially capturing, processing and archiving terabytes of data in one season, a new approach was required for managing the digital data. It was decided that the existing IT infrastructure within Photogrammetric Services would not manage the extra data. Therefore a new corporate SAN (storage area network) storage system was implemented, which would enable all photogrammetric projects to be integrated from flight planning to the end of aerial triangulation using Intergraph software. Whilst this has resulted in the first fully digital photogrammetric workflow at Ordnance Survey, it would not share data beyond these processes. By introducing TerraShare, Ordnance Survey has been able to create a fully integrated enterprise-wide digital photogrammetric flowline where all data and project information is accessible through the one portal. This allows users and viewers to get a logical view of all projects and allows enterprise wide access to these data. This paper sets out to describe how this has been achieved.

1. INTRODUCTION

Ordnance Survey is the national mapping agency of Great Britain. It is responsible for creating and updating the definitive map of England, Scotland, and Wales. More than 5 000 changes are made to this database each day – the base map consisting of 1:1250, 1:2500 and 1:10 000 scales of mapping. Photogrammetric Services is part of Data Collection & Management, which is responsible for gathering information from across Great Britain to maintain and update our digital mapping database.
In line with trends within the photogrammetric industry, Ordnance Survey has taken the last step to creating a total digital photogrammetric production workflow with the implementation of the Intergraph DMC.
Photogrammetric Services have responsibility for the revision of the basic scales of mapping, creation of the Land-Form PROFILE® Plus DTM product and OS MasterMap® Imagery Layer orthoimagery. This requires the capture and processing of approximately 30 000 km² of imagery per year. This imagery is captured by the Ordnance Survey Flying Unit, which is based in north west England. The unit operates two aircraft.
There are many benefits of the DMC system over existing film cameras, including the speed with which imagery can be produced, the radiometric depth of the captured images, multiformat capture capability and the ease of use for the camera operator.

2. BACKGROUND

Prior to the introduction of the digital camera, the photogrammetric production flowline at Photogrammetric Services consisted of a typical aerial photographic flowline. Colour aerial photography was processed as an analogue process up to film scanning; thereafter all processes were on digital photogrammetric workstations (DPWs), where Intergraph and SOCET SET™ software are employed.
The data created at scanning stage was managed by a local storage system, which was maintained within the department. The project files and imagery data for all work were held on this storage system and was distributed by copying data to the relevant DPW, where processes took place.

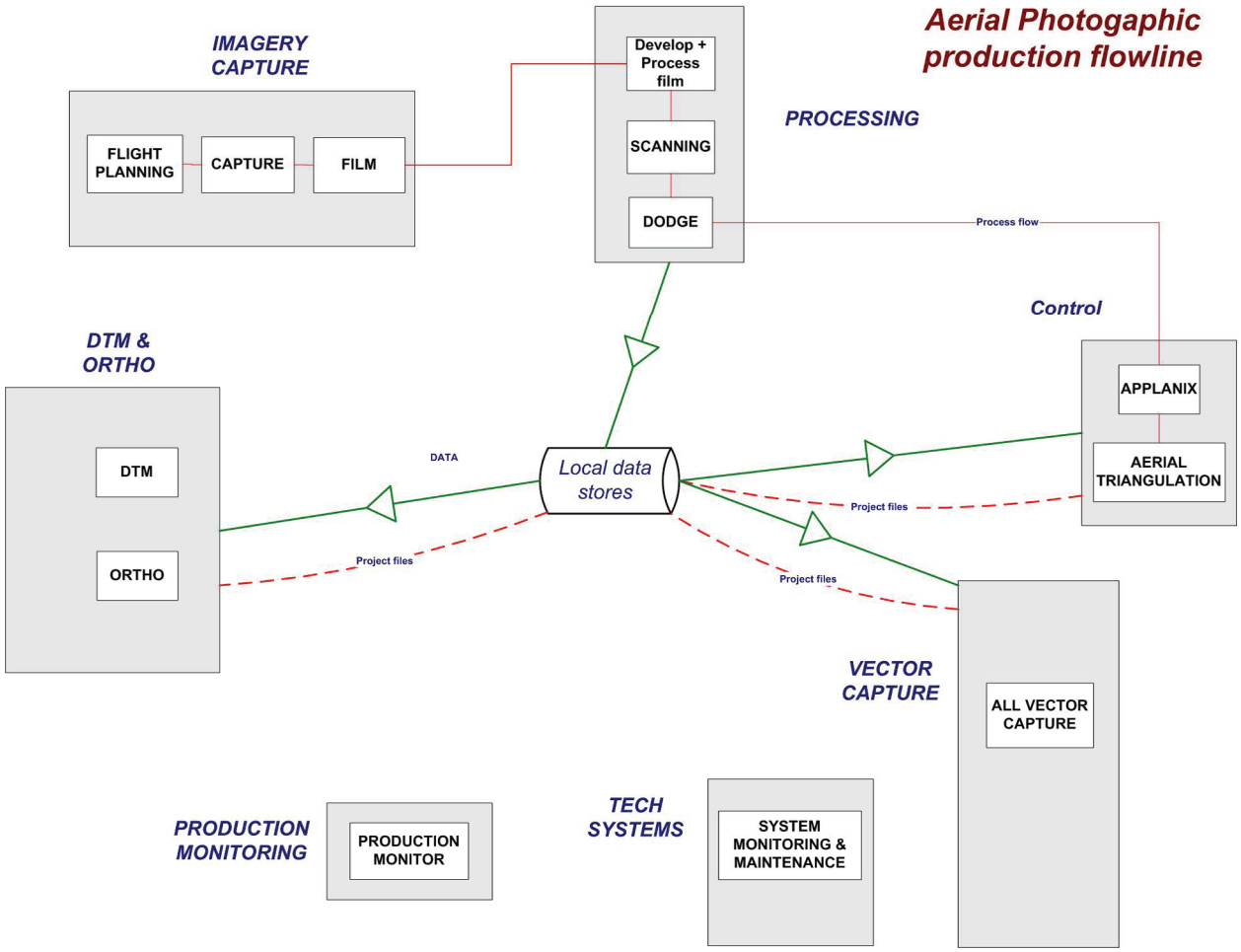


Diagram 1. Aerial photographic film production flowline infrastructure.

The introduction of the DMC has enabled the whole flowline to become totally digital. The introduction of a new corporate IT infrastructure (SAN) now means that the digital camera data is held centrally and supported corporately. With the introduction of a new 1 gigabit network throughout the department, all project and imagery data can be accessed and processed over the network without having to copy data to DPWs. The introduction of TerraShare has enabled all the project and imagery data to be accessed from one central enterprise-wide information management system, removing the need to browse for any digital data within the production flowline.

3. BUSINESS RATIONALE

Ordnance Survey had been looking at the development of digital airborne cameras for some years. In 2003 it was decided to run trials on digital cameras with a view to investigating the technologies and to assist in producing a business case for the purchase of a digital camera. In February 2005, following a procurement process, the Intergraph DMC was chosen as the most suitable camera for Photogrammetric Services' requirements.

The main business rationale for the purchase of this camera included integration with current software (Intergraph aerial triangulation-ISAT), capture of multiformat imagery, bypassing film processing and scanning, quick turnaround of the imagery and the improved radiometry of the imagery, thus increasing flying opportunities.

4. IMPLEMENTATION PROJECT

The implementation of the DMC has required the introduction of the following major pieces of technology and processes:

- New data storage system at flying unit
- Data transfer facility between flying unit and Southampton
- New data storage system at Southampton (SAN FABRIC)
- Post processing capability within photogrammetric work area
- 1 gigabit network within Photogrammetric Services
- DMC system
- TerraShare

It was soon recognised that the IT infrastructure would have to be in place before the camera arrived. This was designed and built by Ordnance Survey between January 2005 and March 2005 and consisted of the first four items in the list above.
During March the digital camera arrived and full training and implementation began. It took one to two weeks to be fully operational at the flying unit. This required rigorous training and expert advice from Intergraph (UK), and Ordnance Survey Information Systems department.
Despite the tight timescales, the implementation was a success and this is demonstrated by the fact that 8 000 km² of imagery has been captured between March 2005 and early July 2005. It was also noted that the quality of the imagery taken in March was exceptional and exceeded what could have been achieved using film.

5. DMC

The actual DMC camera system is now running reliably on production work.

The imagery captured has met Ordnance Survey requirements and the 12-bit radiometric depth of the imagery has proved to show all the depth of image information expected. This is demonstrated

in the DMC images above. With image enhancement information in the shadow areas can be revealed as shown in the right image.
The production flowline now has two new processes: mission reporting and post-processing. Both of these have required new operating instructions and new disciplines in how and when to carry out these procedures. The end to end production flowline using the DMC system is governed and supported by ISPM (image station photogrammetric manager) project files, so long as Intergraph software is used during the flowline. At Ordnance Survey this has been utilised to good effect from flight planning to the end of aerial triangulation. Beyond aerial triangulation all processes utilise alternative software. Therefore the ISPM files are created and updated at the following stages:

1. Flight planning created
2. Imagery capture Microsoft® database file created for up-date of ISPM
3. Mission reporting updated
4. Post-processing updated
5. Aerial triangulation updated

Once the project and imagery files are ready for aerial triangulation, the project files and imagery are instantly loaded without project set-up. These files are accessed by browsing directly from the new storage system over the network.

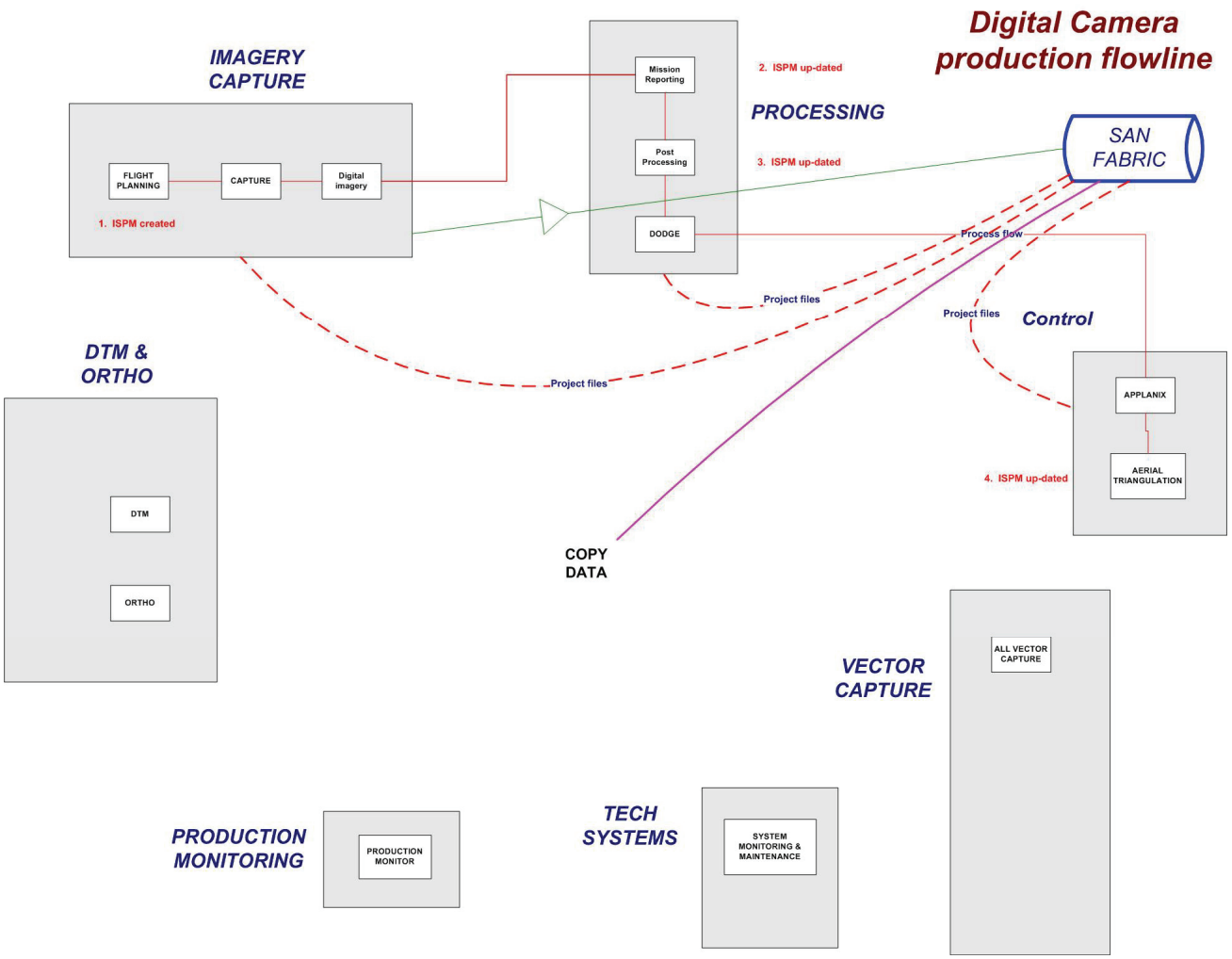


Diagram 2. Digital camera production flowline infrastructure (before TerraShare).

6. TERRASHARE

In the process described in figure 2, projects and imagery are accessed through a multitude of physical files from the new SAN FABRIC storage system. With the introduction of TerraShare the imagery and project data have a logical view where imagery and project data have a logical meaning for the user. TerraShare now shares all these files on an enterprise wide basis. Users of TerraShare are no longer aware or need to know where the data are stored.
TerraShare is an enterprise-wide data management and sharing system. It allows users to be driven directly to any digital data that has been declared to TerraShare. For example, if an Microsoft® Word document is accessed through TerraShare, TerraShare opens the document for the user. Once the document is open, the user is working out of TerraShare and directly on the document. TerraShare simply connects the user to the data. In addition, it can also start specified software programs held on the local PC or workstation.

How is this achieved?

Information for all relevant data is stored on an Oracle® database. TerraShare is the front end to this database. If a Word document is declared to TerraShare, it has to be declared as a data type (in this case, generic). Once this occurs, the existence and location of the document will be known by the Oracle database. When this data is accessed through TerraShare, the Oracle database is interrogated to establish where the data is located and then TerraShare points the user directly to the data and opens the document. Additionally, the Oracle database stores TerraShare derived metadata and also user-defined metadata as specified by the user. This metadata can be queried and user reports produced.

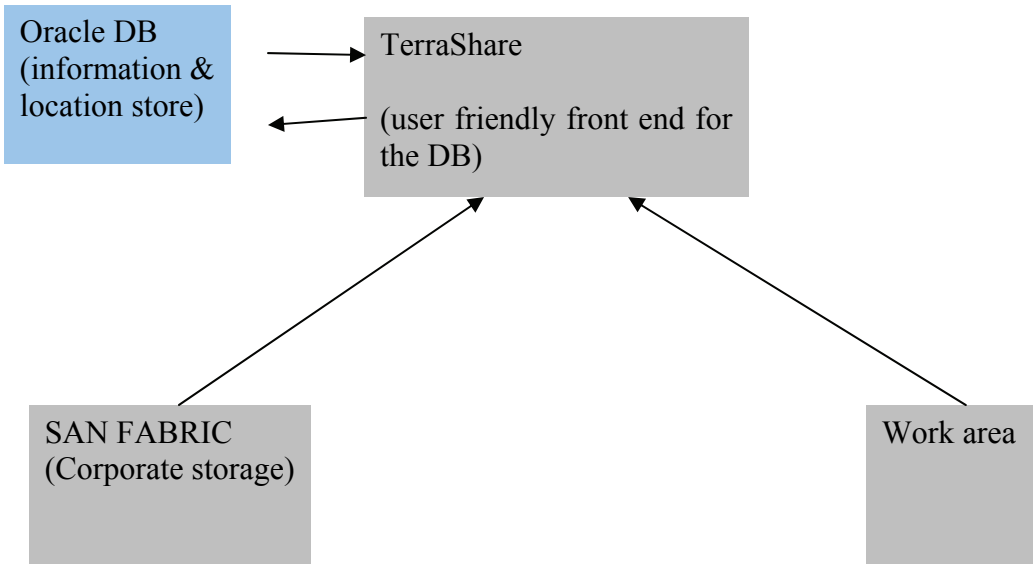


Diagram 3. Overview of TerraShare structure.

How does this advantage photogrammetry?

The Intergraph project files (ISPM files) can be declared to TerraShare as 'ISPM project' data types in the same way as the Word document described above. Once the projects are declared to TerraShare they are supported by a TSPM (TerraShare production manager) licence. TSPM licences allow the user to:

- access the whole project through TerraShare; and
- commence Intergraph processes directly through TerraShare.

At Ordnance Survey TerraShare has been set up to store information on all flying projects indefinitely. In addition, the following data are being held indefinitely:

- Background mapping
- CAA air charts
- Ground control database
- Production monitors
- Operating procedures

The indefinite storing of the project information will allow the creation of queries from these data to produce reports for years to come. It also allows all DPW operators to access all project files and imagery without having to copy data.
This has integrated the flowline by making all these data available to all users who have a TerraShare Client licence installed. Such an example is the flying unit at Blackpool, which can now access all post-processed projects on their desktop immediately after processing.

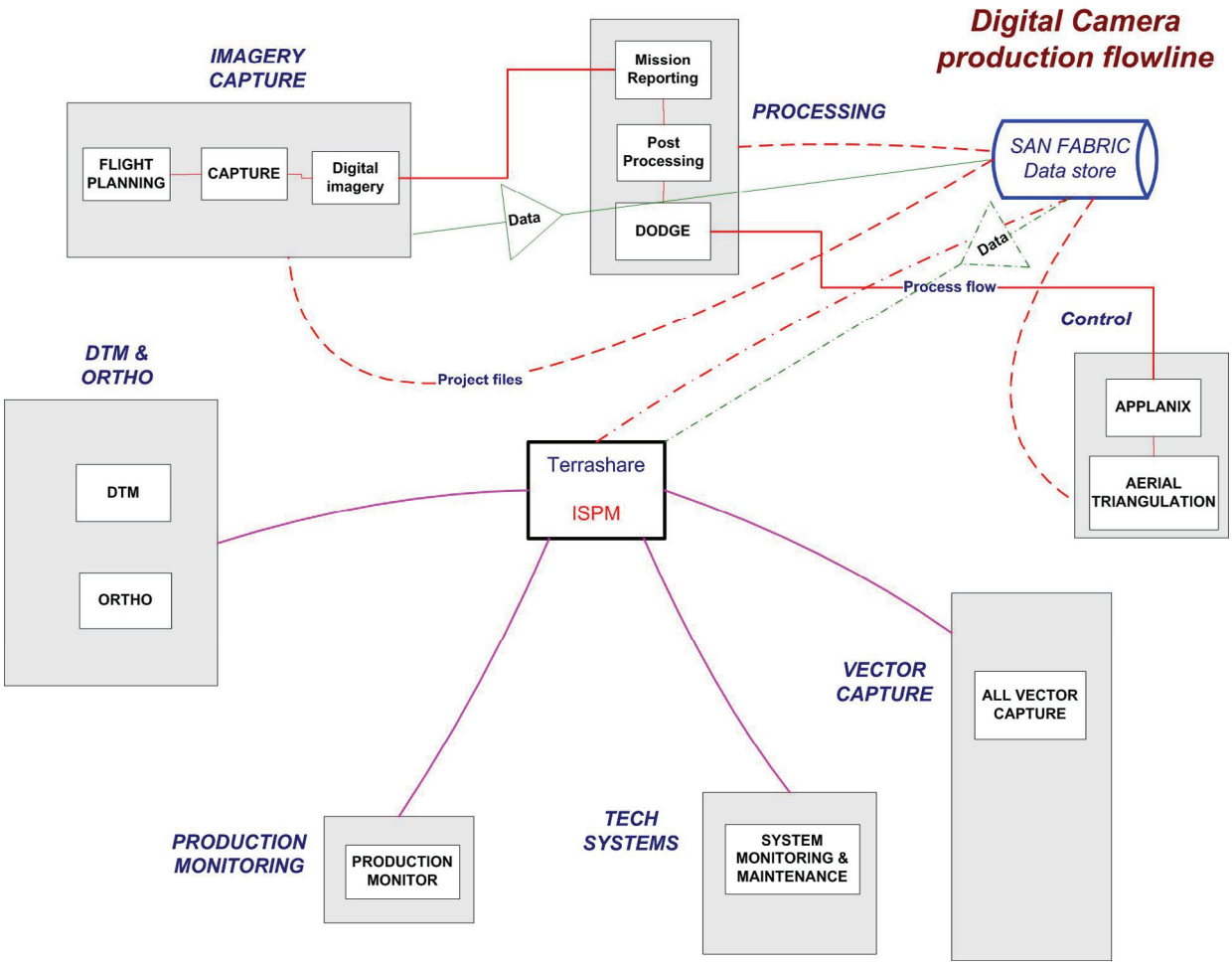
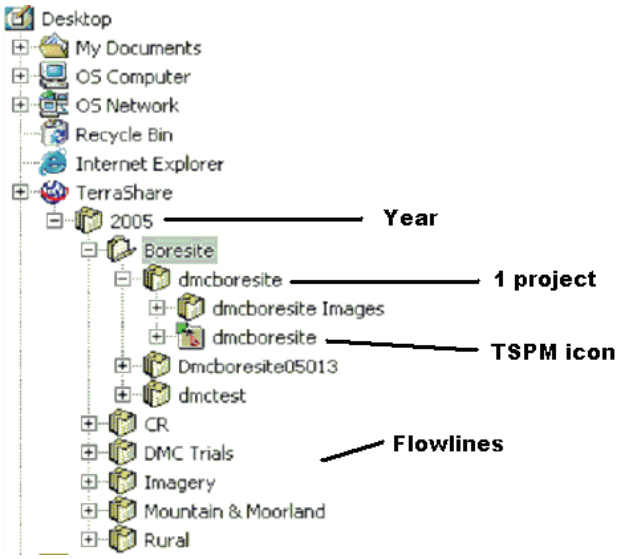
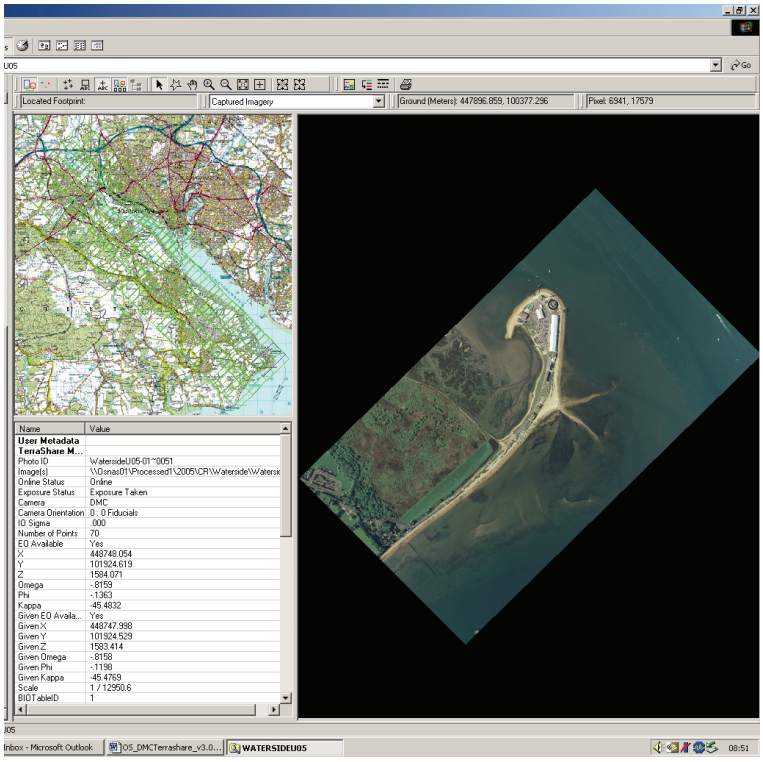


Diagram 4. Digital camera production infrastructure integrated with TerraShare.

All projects are stored under each flying year and production flowline, for example:



Operators can now view all footprints of each project, associated metadata and the actual image, as shown below:



The DMC and TerraShare were deliberately implemented as a staged project, the first stage being successfully implemented in record time, the aims of which were to get the camera operational as soon as possible.

To make the whole process work does require the ISPM and TSPM project files to be created meticulously in the first place. A good understanding of the new concept is required by operators to enable troubleshooting when required.

The next stage of the project will solve issues such as:

7. FUTURE DIRECTION WITH TERRASHARE

- **Interface with SOCET SET** This will allow all photogrammetric processes to be carried out online through TerraShare, thus enabling all jobs to be DPW independent.
- **Interface with scanned aerial imagery projects** This will allow all photogrammetric projects to be stored and accessed online from the new SAN FABRIC through TerraShare.
- **Interface with DTM and ortho-creation data** This will enable all output products (DTM and ortho) to be accessible for onward delivery and quality assurance to be accessed through TerraShare.
- **Establish users outside of Photogrammetric Services** To fully utilise TerraShare, Ordnance Survey is seeking to extend the accessibility of all photogrammetric projects outside of Photogrammetric Services.

8. CONCLUSION

The overall concept for the digital production flowline was to have a workflow where the discipline of data management was of paramount importance. The main requirements for this have been met using the DMC and TerraShare, these being:

- accessibility and visibility of data;
- quick transfer of data;
- quick processing of data;
- storing dual copies of captured data once downloaded from aircraft;
- storing of raw and post-processed data;
- quality acceptance of imagery as quickly as possible; and
- online processing and accessing data.

Through the acquisition of the DMC and the implementation of TerraShare, Ordnance Survey has established a fully digital photogrammetric production flowline. Not only have the above requirements been met, but TerraShare has opened up the possibility of accessibility to digital data by multiple users outside of the immediate work area

There is no doubt that successful implementation of this project could not have been achieved in such a short timescale without the close cooperation from employees of Intergraph (UK), as well as the dedication of Ordnance Survey staff from Photogrammetric Services and Information Services.

Photogrammetric Services now has improved capability to deliver precise, high-quality, geo corrected imagery, which forms the core of its remotely sensed data cycle strategy.

REFERENCES

Greening, T. (2001): Experience with the TerraShare Product in a production environment. Proceeedings of Photogrammetric Week ‘01’

Rosengarten (2001): TerraShare™ - Distributed Image Data Management. Proceeedings of Photogrammetric Week ‘01’