



PCI
GEOMATICS

Get More From Imagery

Case study - Historical Airphoto Processing finds new
uses for archival photographs

In Search of Lost Time

Case Study by PCI Geomatics



***Unlocking the valuable data
hidden in vast archives of
historical aerial imagery***

Semi-automated Historical Airphoto Processing

Nationwide Environmental Title Research (NETR) provides real estate research and information services nationwide. Headquartered in Tempe, Arizona, the company provides title services beyond that of conventional title insurance companies, without the costly addition of a title insurance policy or guarantee.

One of NETR's most common services is historical chain-of title-reports that satisfy one of the requirements for Phase I Environmental Site Assessments.

NETR, is tasked with providing online access to orthorectified historical aerial imagery. This imagery is used by

customers performing due diligence and investigation on properties for environmental and legal purposes. NETR deployed PCI Geomatics' Historical Airphoto Processing (HAP) system to increase geographic accuracy from their archives while improving the company's operating capacity.

The need for historical imagery

Potential environmental liability is a major legal concern in selling or purchasing real estate. Therefore, historical chain-of-title documents are crucial components in any real estate transaction, as they can identify previous owners, and how the land has been used in the past with respect to environmental concerns while identifying potentially responsible parties.

A visual record of the history of a title adds an extra layer to a traditional chain-of-title request. Historical airphotos date back as far almost as far as aviation itself, with many records dating as far back as the 1920s. While having a photographic record dating back decades is advantageous in and of itself, true value cannot be realized with these images until they are geographically corrected. It is only then that imagery can be ported into GIS applications for true year-over-year comparisons.

Until recently, the orthorectification and mosaicking of historical aerial imagery was a laborious, and manual, task. In 2012, PCI Geomatics developed a workflow - described in detail below - that automates these tasks, and has organizations unlocking the potential of their airphoto archives.

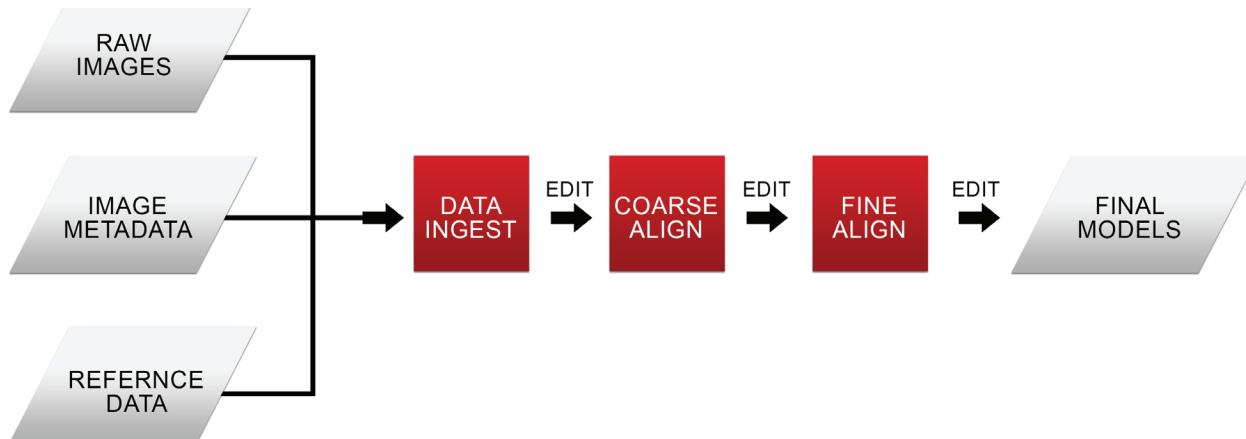
Challenges with historical imagery

PCI's Historical Airphoto Correction workflow was designed to consider the various problems that are often encountered with historical imagery. Several factors make historical airphotos more difficult to process than standard airphotos, which include: limited or incorrect metadata, large positional and orientation errors, poor fiducial marks, poor quality imagery as well as changes in land cover over time.

Historical airphoto processing workflow

The Historical Airphoto Processing (HAP) workflow was developed to improve project turnaround time while maintaining processing accuracy. To achieve this, automated processes were developed in areas that have been identified as significant time investments, such as Ground Control Point (GCP) and Tie Point (TP) collection.

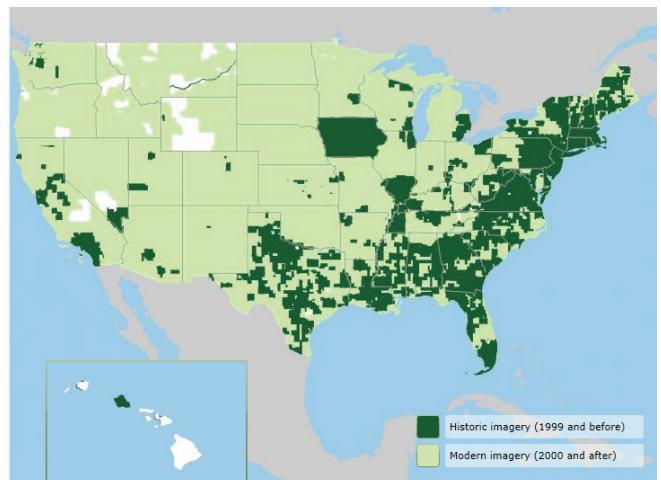
The workflow consists of three main processing steps (Data Ingest, Coarse Alignment and Fine Alignment) required to build the geometric models used to orthorectify the imagery. Each of the three steps is followed by a manual quality assurance step that is optional, but recommended and in some cases required.



A real-world example - The NETR case.

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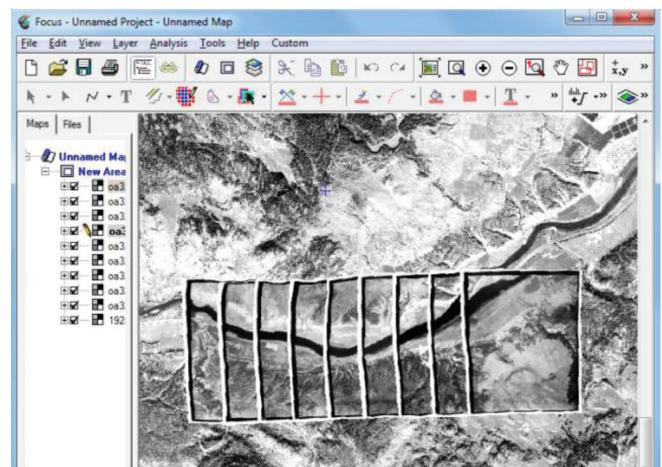
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Putting the Workflow to Work

Once the historical imagery has been scanned – over one million digital TIFF files exist in NETR's archives – it needs to be imported, along with reference data and a Digital Elevation Model (DEM), into the HAP system.

Reference data can come from a variety of sources - aerial or satellite imagery, even vector data - as long as it is properly georeferenced. A popular source of reference data is the National Agriculture Imagery Program (NAIP). The program is mandated to acquire aerial imagery during the agricultural growing seasons in the continental United States. This data is ideal for use as reference to historical imagery because the flight altitude and ground sample resolution are similar. NAIP provides orthorectified imagery at the county level for free download through the United States Department of Agriculture (USDA).



The data ingest phase of the operation provides approximate positioning to the historical images; providing accuracy sufficient for automated feature matching with the accurate geocoded reference data mentioned above. Python scripts are used to ingest all imagery - both historical and reference data – as well as associated metadata. The result of this is the calculation of an initial model that is used as a starting position for automated feature matching.

The second step of the production workflow, improves the positional accuracy of the historical airphotos even further, reaching an approximate accuracy of 200-300 pixels to the chosen reference data. During this step, users can setup a custom strategy file that defines parameters such as GCP search radius, number of GCPs, and GCP/TP refinement. After running a coarse-alignment script, an operator reviews results and performs the necessary cleanup (Number of GCPs and TPs, Distribution, RMS and residual Error, Manually identified feature matching errors, if required, manually remove or add GCPs/TPs). The coarse alignment results in the calculation of a new model that is used as a starting position for the fine alignment stage of feature matching.

The final step of the HAP workflow further refines positioning to achieve proper spatial accuracy. With the alignment of the historical images complete, the refined models can be used to perform further processing of the imagery – such as orthorectification and mosaicking to gain full utility of the data. Standard image editing tools can be used to generate the products.

Automation Saves Time and Money

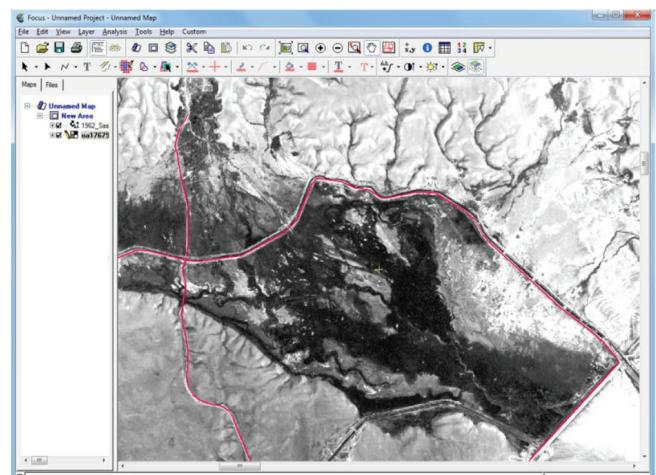
Organizations like NETR have found the processing time, on average, to be approximately two times faster than the conventional, manual intensive approach they were using before implementing the HAP system. One reason for this is that most of the operation can be run without operator intervention. Once data has been ingested in step one described above, the rest of the processing can be completely automated.

While NETR has found the ideal size for a batch project to be between 300 and 600 images, the group has seen no significant slowdowns or bottlenecks with larger datasets. Jeff Teasley, Director of HistoricAerials.com explains: "It doesn't matter if we are working with 10 or 10,000 images, our workflow remains consistent and the results are excellent."

The flexibility of the HAP system allows for operational efficiencies to be realized depending on the resources available. For example staggering the processing - by connecting a dedicated processing computer and a separate quality assurance computer, through a network - would allow a single operator to perform manual quality assurance without interrupting the processing.

PCI Geomatics developed the HAP workflow as a way to provide a new method to preserve valuable historical air photos and return them to operational use. NETR, and its subsidiary, [HistoricalAerials.com](http://HistoricAerials.com) have provided the early evidence of success that is starting to pay dividends for itself, and its clients. For Teasley, the benefits are clear: "Using the HAP system has allowed us to grow our online repository of historical imagery to stay ahead of demand and better serve our clients."

For more information about PCI Geomatics and the Historical Airphoto Processing workflow, visit www.pcigeomatics.com/HAP. To learn how to obtain historical imagery from NETR, visit www.HistoricAerials.com.



About PCI Geomatics

PCI Geomatics is a world-leading developer of software and systems for remote sensing, imagery processing, and photogrammetry. With more than 30 years of experience in the geospatial industry, PCI is recognized globally for its excellence in providing software for accurately and rapidly processing satellite and aerial imagery. There are more than 30,000 PCI licenses, in over 150 countries worldwide. Find out more about PCI Geomatics at www.pcigeomatics.com.



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