AERIAL TRIANGULATION REPORT

2006 DIGITAL ORTHOIMAGERY PROJECT

FAIRFIELD COUNTY, OHIO
WOOLPERT PROJECT #65340

August 2006

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Introduction

This report contains an outline of the photogrammetric aerial triangulation (AT) process that supported the Fairfield County, Ohio, 2006 Digital Orthoimagery Project.

Project Area

The project area encompasses approximately ±505 square miles of Fairfield County, Ohio

Purpose of Aerial Triangulation

Aerial triangulation is a method of ground control extension or densification performed mathematically and in conjunction with a limited number of ground control points, Airborne GPS data, and inertial measurement data to control aerial imagery such that it may be utilized to measure 3D information about features on or above the ground.

Dates of Image Acquisition

Aerial imagery was acquired using the Leica ADS40 digital sensor. A total of three (3) missions were completed for the entire project area as follows:

Julian Day	Imagery Flights	Date
078	01 through 23	March 19, 2006
086	7 and 8	March 27, 2006
089	24 through 33	March 30, 2006

Sensor Description

All data was acquired using the Leica ADS40 digital sensor, serial number 30027. Both the FCIR and RGB bands were acquired simultaneously. The maximum acquisition ground sampling distance was 0.06-foot with the final deliverable pixels being produced at 0.5-foot. The band configuration is outlined below:

BLUE NADIR	GREENF16	PANB14
GREEN NADIR	REDF14	PANF28
RED NADIR	NIRF18	

Calibration Date of Sensor: September 21, 2004

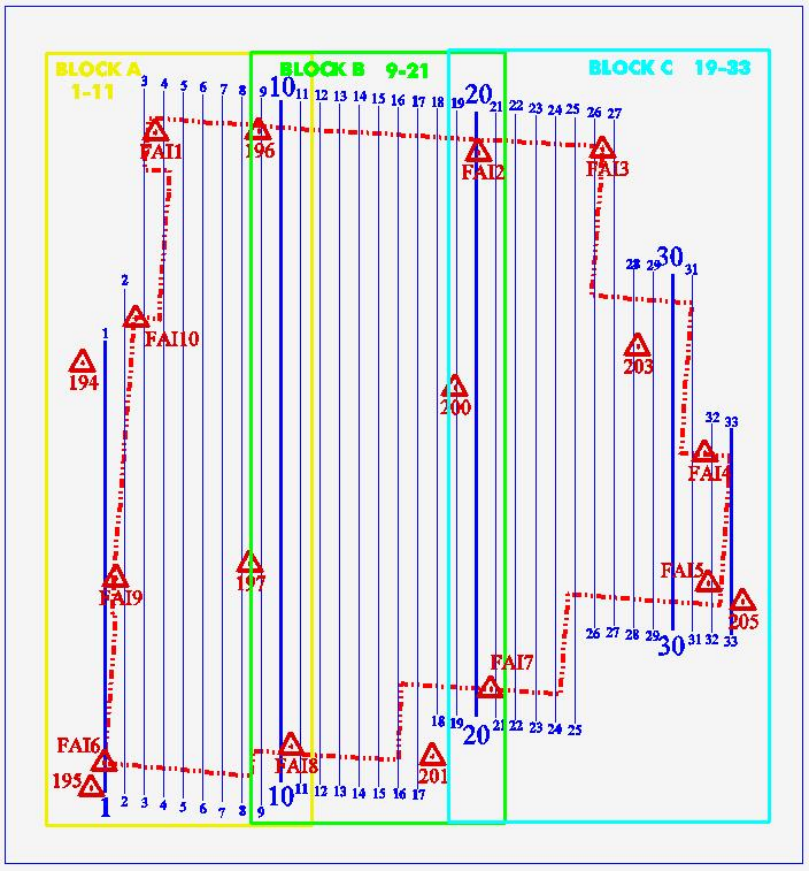
Processing Software

The software utilized for the digital image processing and aerial triangulation, developed by Leica GeoSystems, was: LPS 9.0, ORIMA 9.0a, CAP-A 7.12 and GPro 3.1.

Processing Methodology

The project area was divided up into three (3) aerial triangulation blocks (see Diagram "A" shown below). Each block was created using Leica's GPro software and is based on project specifications, control point locations and a suitable number of lines for our blocks. Each block had a good distribution of control points within its boundaries.

Diagram "A"



Every band for the required flight lines is added to the project applying the processed position and orientation data. This creates metadata files and an orientation data file for each band giving the imagery its raw position and orientation.

The aerial triangulation process uses only the Level 0 panchromatic imagery bands PANB14, PANF28, and GRNN00 which are created by GPro. The aerial triangulation process is similar to conventional operations, where the Level 0 panchromatic imagery is passed through Automatic Point Measurement, the resulting tie points and ground control is adjusted using CAP-A and ORIMA software. Blunders are removed and the block is analyzed for weak network areas, and if required, manual points are added. The final adjustment output consists of precise orientation data files for each band, calibration parameters and metadata. The imagery can now be rectified to a DEM which removes any relief displacement which may be present. During this processing stage, we can set the required ground sampling distance (GSD), 8 bit or 16 bit imagery, and apply a tonal curve. The ortho-rectified imagery is commonly referred to as Level 2 imagery.

Ground Control Used in Triangulation

The ground control used in the triangulation process is shown within the table below. The ground control was held at a weight of 0.1 meters or 0.33 feet.

UTM Zone 17			
Point Names	**X (Meters)**	**Y (Meters)**	**Z (Meters) Ellipsoidal**
FAI_1	573866.741	214648.444	227.202
FAI_2	594984.864	213318.318	244.133
FAI_3	603118.157	213529.569	238.651
FAI_4	609821.386	193623.582	266.620
FAI_5	610033.794	185157.046	212.475
FAI_6	570495.562	173392.394	221.610
FAI_7	595790.241	178241.149	198.963
FAI_8	582746.649	174486.083	314.945
FAI_9	571246.568	185474.526	263.448
FAI_10	572557.690	202458.503	200.713
196	580593.592	214719.151	275.380
197	580026.422	186422.164	269.352
200	593451.534	197925.237	279.348
203	605420.270	200612.795	252.032

Ground Control Withheld

No ground control points were withheld for this project.

AT Block Statistical Summaries

Block A

Control Point Residuals			
Point ID	**X ft**	**Y ft**	**Z ft**
FAI_1	0.139	-0.019	0.187
FAI_6	-0.135	0.469	-0.201
FAI_8	-0.044	0.355	-0.040
FAI_9	0.192	-0.175	-0.503
FAI_10	-0.360	-0.360	0.017
196	-0.022	-0.107	0.518
197	0.229	-0.282	0.022

Block B

Control Point Residuals			
Point ID	**X ft**	**Y ft**	**Z ft**
FAI_2	0.289	-0.050	0.508
FAI_7	0.467	-0.072	-0.130
FAI_8	-0.353	0.092	-0.532
196	-0.334	-0.034	0.233
197	-0.074	0.173	-0.397
200	-0.094	-0.109	0.316

Block C

Control Point Residuals			
Point ID	**X ft**	**Y ft**	**Z ft**
FAI_2	0.269	0.151	0.132
FAI_3	-0.220	-0.052	0.163
FAI_4	-0.220	-0.087	0.057
FAI_5	-0.141	-0.282	0.208
FAI_7	0.442	-0.045	-0.417
200	-0.042	0.240	-0.281
203	-0.088	0.075	0.139

Summary

The final RMSE (Root Mean Square Error) residuals on the ground control points are as follows:

	X	Y	Z
RMS	0.245	0.204	0.303
RMS P	0.319		

The RMSE P values fall well within the industry and National Map Accuracy Standards for DOI mapping at 1"=100' scale and DTM/contours at a 0.46-feet RMSE vertical accuracy.