PROJECT REPORT

FOR

US GEOLOGICAL SURVEY
NGTOC III
ROLLA, MO

NRCS IL-KY LIDAR TASK ORDER

June 27, 2010

AERO-METRIC PROJECT NO. 1-100328

Airborne GPS Survey Report

For

US GEOLOGICAL SURVEY
NGTOC III

1400 Independence Road

Rolla, MO 65401

(573) 308-3756

Prepared by

AERO-METRIC, INC.

4020 Technology Parkway

Sheboygan, Wisconsin 53082-0449

920-457-3631

AERO-METRIC Project No. 1-100328

Table of Contents

USGS – NRCS – IL-KY LIDAR TASK ORDER

AERO-METRIC Project No. 1-090328

1 INTRODUCTION

This report contains a summary of the LiDAR data acquisition and processing for the **NRCS – IL-KY LIDAR TASK ORDER**.

1.1 Contact Info

Questions regarding the technical aspects of this report should be addressed to:

AERO-METRIC, Inc.
4020 Technology Parkway
Sheboygan, WI 53081

Attention: Robert Merry (Geomatics Manager)
Telephone: 920-457-3631
FAX: 920-457-0410
Email: rmerry@aerometric.com

1.2 Purpose

AERO-METRIC, INC. acquired highly accurate Light Detection and Ranging (LiDAR) data for an area that comprised approximately 241 square miles for the United State Geological Survey. Using AERO-METRIC's Optech Gemini LiDAR system, data was collected at multiple altitudes to support each project area's requirements.

1.3 Project Location

The first project area (Area 1) is approximately 115 square miles and is located near the city of Litchfield, Illinois. The second project area (Area 2) is approximately 126 square miles and is located near the city of Hopkinsville, KY. Each area was defined and supplied by USGS on March 9, 2010.

1.4 Time Period

LiDAR data acquisition, control and QC surveys were completed between April 9th, 2010 and April 13th, 2010. A total of 4 flight missions were required to cover the project areas. See paragraph 3.4 for a sketch of the acquisition missions and Section 6 of the report for each flight log. QC surveys were completed between April 6th and April 13th, 2010.

1.5 Project Scope

AERO-METRIC, INC. acquired highly accurate Light Detection and Ranging (LiDAR) data for an area that encompasses two project areas of approximately 241 square miles in Illinois and Kentucky. Using AERO-METRIC's Optech Gemini LiDAR system, data was collected at multiple altitudes to support each project area's requirements.

As documented in our proposal dated March 29, 2010 we were to achieve a TIN accuracy of 15cm for Area 1 and 9.25cm for Area 2. The accuracy as tested and published in this report in Section 8 has easily met both vertical accuracy requirements.

1.6 Conditions Affecting Progress

- None.

2 GEODETIC CONTROL

2.1 Network Scope

Base horizontal control for Area 1 consisted of two NGS stations: **GINN AZ MK** and **RENT**. Base horizontal control for Area 2 consisted of one NGS station: **B 22**, and three NGS CORS stations: **KYTB, KYTC**, and **TN48**.

Horizontal control is referenced to the Universal Transverse Mercator (UTM) Coordinate System – Zone 16, based on the North American Datum of 1983/2007 (NAD83/07). Final coordinates are published in meters.

Base vertical control for Area 1 consisted of four NGS stations: **GINN AZ MK**, **Q 218, RENT**, and **T 93**. Base vertical control for Area 2 consisted of three NGS stations: **B 22**, **M 133**, and **R 392**; and three NGS CORS stations using the published ellipsoid heights: **KYTB**, **KYTC**, and **TN48**. The NGS Geoid Model GEOID09 was applied to the derived ellipsoid heights that approximate the North American Vertical Datum of 1988.

Vertical control is based on the North American Vertical Datum of 1988 (NAVD88).

In order to support the project parameters for both project areas, an existing NGS station "**GINN AZ MK**" was used as base horizontal and vertical control for the Airborne GPS surveys. Additional stations were needed. One (1) additional control station "**101**" was established to support the acquisition for Area 1 while two (2) control stations "**101**" and "**102**" were established for Area 2.

NGS recovery sheets are located in Section 2 of the Control Survey Report.

2.2 Network Computations

GPS measurements were done in two stages. Initial computations were done with LEICA Geo Office (LGO), version 4.0. LGO permits the conversion of raw satellite data collected by the receivers to a meaningful coordinate difference between points (baseline solutions). Once the baseline solutions were determined, they were input into the GeoSurv-GeoLab2 series of programs (Geolab version 2.4d). Adjustments were performed for analysis and quality closure holding one position and one elevation for each of the two areas.

Area 1 (Illinois Area)
Holding the position and elevation of **RENT** fixed:

HORIZONTAL CLOSURES (in meters)

STATION	NORTHING	EASTING	LINEAR	DISTANCE	PROPORTION
GINN AZ MK	0.012	0.015	0.019	14540.7	1:765,000

VERTICAL CLOSURES (in meters)

STATION	ADJUSTED ELEVATION	PUBLISHED ELEVATION	DIFFERENCE	DISTANCE	ALLOWABLE 3rd ORDER CLOSURE
GINN AZ MK	207.637	207.631	0.006	14540.7	0.046
Q 218	193.983	193.970	0.013	55220.8	0.089

Area 2 (Kentucky Area)
Holding the position and elevation of **B 22** fixed:

HORIZONTAL CLOSURES (in meters)

STATION	NORTHING	EASTING	LINEAR	DISTANCE	PROPORTION
KYTB	0.061	0.043	0.075	60789.2	1:810,000
KYTC	0.075	0.030	0.081	119991.0	1:1,481,000
TN48	0.074	0.006	0.074	76784.1	1:1,037,000

VERTICAL CLOSURES (in meters)

STATION	ADJUSTED ELEVATION	PUBLISHED ELEVATION	DIFFERENCE	DISTANCE	ALLOWABLE 3rd ORDER CLOSURE
KYTB	135.347	135.243	0.125	60789.2	0.094*
KYTC	116.966	116.877	0.089	119991.0	0.132*
TN48	109.799	109.778	0.021	76784.1	0.105*
M 133	178.685	178.635	0.050	35830.4	0.072
R 392	182.921	182.871	0.050	49145.8	0.084

Note: * - The published heights are ellipsoid.

The NGS CORS station **KYTB** ellipsoid height was evaluated and NGS bench mark **T 93**, but not held in the final constrained adjustments. The rest of the above control were held in the fully constrained scaled least squares base network adjustments to derive the ground control checkpoint values

3 LiDAR ACQUISITION & PROCEDURES

3.1 Acquisition Time Period

LiDAR data acquisition and Airborne GPS control surveys were completed between April 9th, 2010 and April 13th, 2010. A total of 4 flight missions were required to cover the project areas.

3.2 LiDAR Planning

The LiDAR data for this project was collected with Aero-Metric's Optech Gemini Airborne LiDAR system (Serial Number 03SEN145). All flight planning and acquisition was completed using Optech's ALTM-Nav, version 2.1.25b (flight planning and LiDAR control software).

The following are the acquisition settings for Area 1 (Illinois Area)

- Flying Height (Above Ground): 1500 meters
- Laser Pulse Rate: 70 kHz
- Mirror Scan Frequency: 40 Hz
- Scan Angle (+/-): 16°
- Side Lap: 50 %
- Ground Speed: 160 kts
- Nominal Point Spacing: 0.688 meters

The following are the acquisition settings for Area 2 (Kentucky Area)

- Flying Height (Above Ground): 1000 meters
- Laser Pulse Rate: 125 kHz
- Mirror Scan Frequency: 58 Hz
- Scan Angle (+/-): 17°
- Side Lap: 55 %
- Ground Speed: 150 kts
- Nominal Point Spacing: 0.434 meters

3.3 LiDAR Acquisition

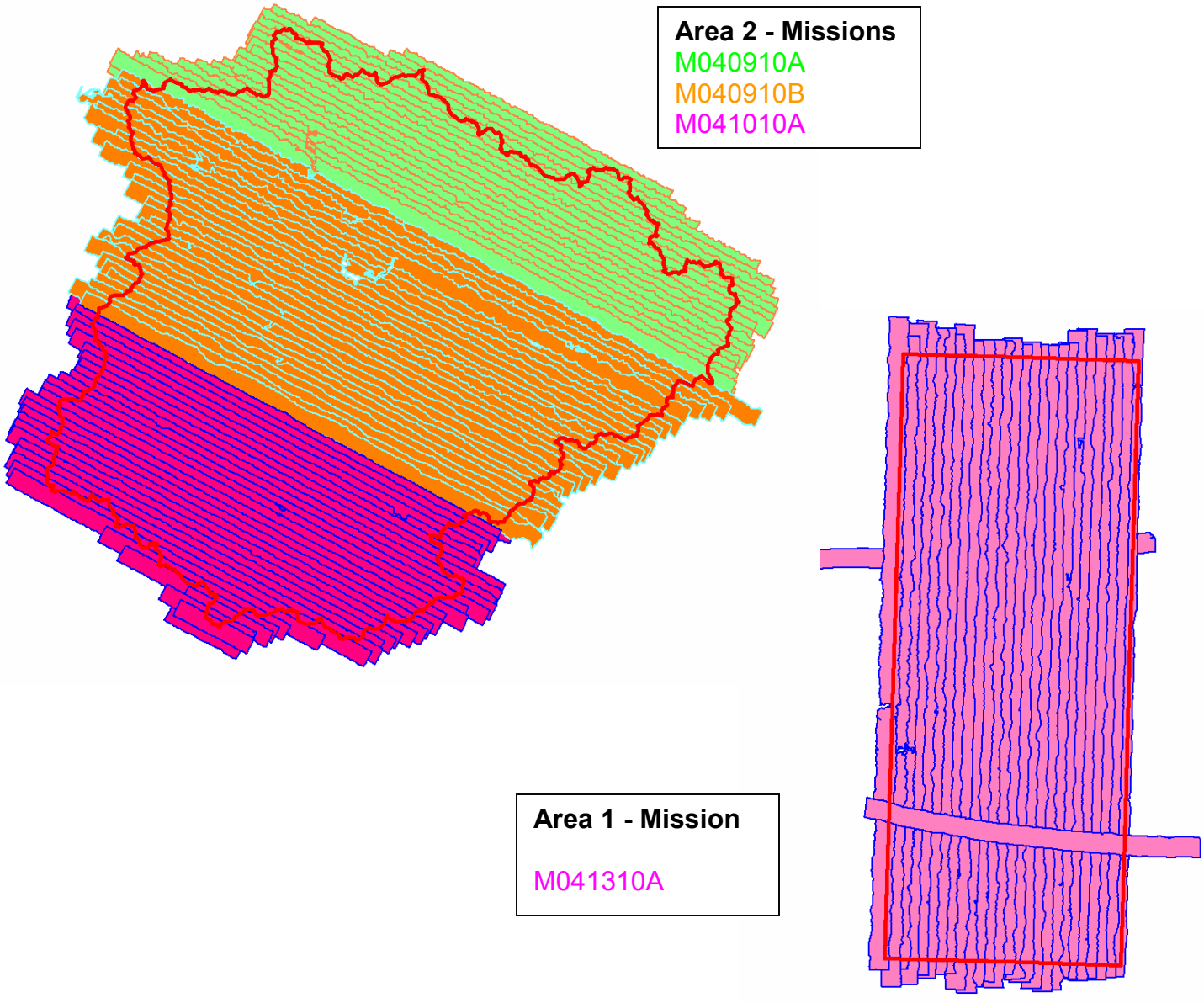
A total of 4 flight missions were required to cover the project area. The missions were flown using the above planned values. See below for a sketch of the acquisition missions and Section 6 of the report for each flight log.

Airborne GPS and IMU trajectories for the LiDAR sensor where also acquired during the time of flight.

Each mission was typically four to five hours long. Before take-off, the LiDAR system and the Airborne GPS and IMU system were initiated for a period of five minutes and then again after landing for another five minutes. The missions acquired data according to the planned flight lines and included a minimum of one (usually two) cross flights. The cross flights were flown perpendicular to the planned flight lines and their data used in the in-situ calibration of the sensor.

3.4 LiDAR Trajectory Processing

The airborne positioning was based on the following control stations: Area 1 – GINN and 101; and Area 2 – 101 and 102.



4 QC SURVEYS

The check point survey was performed between April 6th and April 13th, 2010 using Rapid Static GPS techniques. A total of 42 check points were surveyed across both project areas. These points were collected in open terrain to assess Fundamental Vertical Accuracy.

The control stations mentioned above to support the Airborne GPS acquisition were also used to complete the QC surveys.

See Section 5 of the control report for a complete listing.

5 FINAL LiDAR PROCESSING

5.1 ABGPS and IMU Processing

Airborne GPS

Applanix - POSGPS
Utilizing carrier phase ambiguity resolution on the fly (i.e., without initialization). The solution to sub-decimeter kinematic positioning without the operational constraint of static initialization as used in semi-kinematic or stop-and-go positioning was utilized for the airborne GPS post-processing.

The processing technique used by Applanix, Inc. for achieving the desired accuracy is Kinematic Ambiguity Resolution (KAR). KAR searches for ambiguities and uses a special method to evaluate the relative quality of each intersection (RMS). The quality indicator is used to evaluate the accuracy of the solution for each processing computation. In addition to the quality indicator, the software will compute separation plots between any two solutions, which will ultimately determine the acceptance of the airborne GPS post processing.

Inertial Data

The post-processing of inertial and aiding sensor data (i.e. airborne GPS post processed data) is to compute an optimally blended navigation solution. The Kalman filter-based aided inertial navigation algorithm generates an accurate (in the sense of least-square error) navigation solution that will retain the best characteristics of the processed input data. An example of inertial/GPS sensor blending is the following: inertial data is smooth in the short term. However, a free-inertial navigation solution has errors that grow without bound with time. A GPS navigation solution exhibits short-term noise but has errors that are bounded. This optimally blended navigation solution will retain the best features of both, i.e. the blended navigation solution has errors that are smooth and bounded.
The resultant processing generates the following data:

- Position: Latitude, Longitude, Altitude
- Velocity: North, East, and Down components
- 3-axis attitude: roll, pitch, true heading
- Acceleration: x, y, z components
- Angular rates: x, y, z components

The Applanix software, version 4.4, was used to determine both the ABGPS trajectory and the blending of inertial data.

The airborne GPS and blending of inertial and GPS post-processing were completed in multiple steps.

1. The collected data was transferred the field data collectors to the main computer. Data was saved under the project number and separated between LiDAR mission dates. Inside each mission date, a sub-directory was created with the aircraft's tail number and an A or B suffix was attached for the time of when the data was collected. Inside the tail number sub-directory, five sub-directories were also created EO, GPS, IMU, PROC, and RAW.

2. The aircraft raw data (IMU and GPS data combined) was run through a data extractor program. This separated the IMU and GPS data. In addition to the extracting of data, it provided the analyst the first statistics on the overall flight. The program was POSPac (POS post-processing PACkage).

3. Executing POSGPS program to derive accurate GPS positions for all flights:
   Applanix POSGPS
   The software utilized for the data collected was PosGPS, a kinematic on-the-fly (OTF) processing software package. Post processing of the data is computed from each base station (Note: only base stations within the flying area were used) in both a forward and backward direction. This provides the analyst the ability to Quality Check (QC) the post processing, since different ambiguities are determined from different base stations and also with the same data from different directions.

   The trajectory separation program is designed to display the time of week that the airborne or roving antenna traveled, and compute the differences found between processing runs. Processed data can be compared between a forward/reverse solution from one base station, a reverse solution from one base station and a forward solution from the second base station, etc. For the Applanix POSGPS processing, this is considered the final QC check for the given mission. If wrong ambiguities were found with one or both runs, the analyst would see disagreements from the trajectory plot, and re-processing would continue until an agreement was determined.

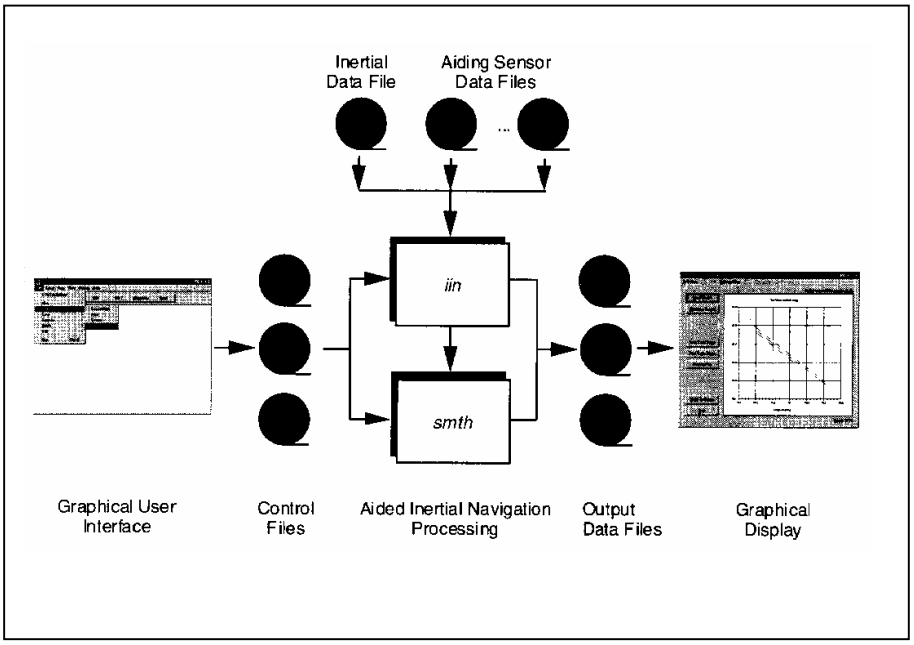
   Once the analyst accepts a forward and reverse processing solution, the trajectory plot is analyzed and the combined solution is stored in a file format acceptable for the IMU post processor.

   Please see Section 7 of the control report for the final accepted trajectory plots.

4. When the processed trajectory (either through POSGPS) data was accepted after quality control analysis, the combined solution is stored in a file format acceptable for the IMU post processor (i.e. POSProc).

5. Execute POSProc.
   POSProc comprises a set of individual processing interface tools that execute and provide the following functions:

   Diagram 3 shows the organization of these tools, and is a function of the



   POSProc processing components.

   - Integrated Inertial Navigation (*iin*) Module.
     The name *iin* is a contraction of Integrated Inertial Navigation. *iin* reads inertial data and aiding data from data files specified in a processing environment file and computes the aided inertial navigation solution. The inertial data comes from a strapdown IMU. *iin* outputs the navigation data between start and end times at a data rate as specified in the environment file. *iin* also outputs Kalman filter data for analysis of estimation error statistics and smoother data that the smoothing program *smth* uses to improve the navigation solution accuracy.[3]
     iin implements a full strapdown inertial navigator that solves Newton's equation of motion on the earth using inertial data from a strapdown IMU. The inertial navigator implements coning and sculling compensation to handle potential problems caused by vibration of the IMU. [3]

- Smoother Module (*smth*).
  smth is a companion processing module to *iin*. *smth* is comprised of two individual functions that run in sequence. *smth* first runs the *smoother function* and then runs the *navigation correction function*. [3]

  The *smth* smoother function performs backwards-in-time processing of the forwards-in-time blended navigation solution and Kalman filter data generated by *iin* to compute smoothed error estimates. *smth* implements a modified Bryson-Frazier smoothing algorithm specifically designed for use with the *iin* Kalman filter. The resulting smoothed strapdown navigator error estimates at a given time point are the optimal estimates based on all input data before and after the given time point. In this sense, *smth* makes use of all available information in the input data. *smth* writes the smoothed error estimates and their RMS estimation errors to output data files. [3]

  The *smth* navigation correction function implements a feedforward error correction mechanism similar to that in the *iin* strapdown navigation solution using the smoothed strapdown navigation errors. s*mth* reads in the smoothed error estimates and with these, corrects the strapdown navigation data. The resulting navigation solution is called a Best Estimate of Trajectory (BET), and is the best obtainable estimate of vehicle trajectory with the available inertial and aiding sensor data. [3]

The above mentioned modules provide the analyst the following statistics to ensure that the most optimal solution was achieved: a log of the *iin* processing, the Kalman filter Measurement Residuals, Smoothed RMS Estimation Errors, and Smoothed Sensor Errors and RMS.

5.2 LiDAR "Point Cloud" Processing

The ABGPS/IMU post processed data along with the LiDAR raw measurements were processed using Optech Incorporated's ASDA software. This software was used to match the raw LiDAR measurements with the computed ABGPS/IMU positions and attitudes of the LiDAR sensor. The result was a "point cloud" of LiDAR measured points referenced to the ground control system.

5.3 LIDAR CALIBRATION

Introduction

The purpose of the LiDAR system calibration is to refine the system parameters in order for the post-processing software to produce a "point cloud" that best fits the actual ground.

The following report outlines the calibration techniques employed for this project.

Calibration Procedures

AERO-METRIC routinely performs two types of calibrations on its Optech Gemini LiDAR system. The first calibration, system calibration, is performed whenever the LiDAR system is installed in the aircraft. This calibration is performed to define the system parameters affected by the physical misalignment of the system versus aircraft. The second calibration, in-situ calibration, is performed for each mission using that missions data. This calibration is performed to refine the system parameters that are affected by the on site conditions as needed.

System Calibration and Correction Software

Optech has developed proprietary calibration software in December of 2009 that performs system calibration. The results from this new software achieved excellent results and an accuracy that meets the project requirements.

This new calibration tool incorporates Optech's proprietary optical sensor models to compute laser point positions and provide laser point calibration improvements on a per flightline basis for the entire project area. It furthermore calculates planar surfaces at different angles from each flight line and then uses a robust least squares solution to compute the orientation parameters at the optical level instead of the traditional methods relating to the ground points. Determining and correcting at the optical level is critical when correcting the data especially when working in terrain and aggressive design parameters as found in this project. Each flight line was computed individually and output in LAS 1.2 format.

In-situ Calibration

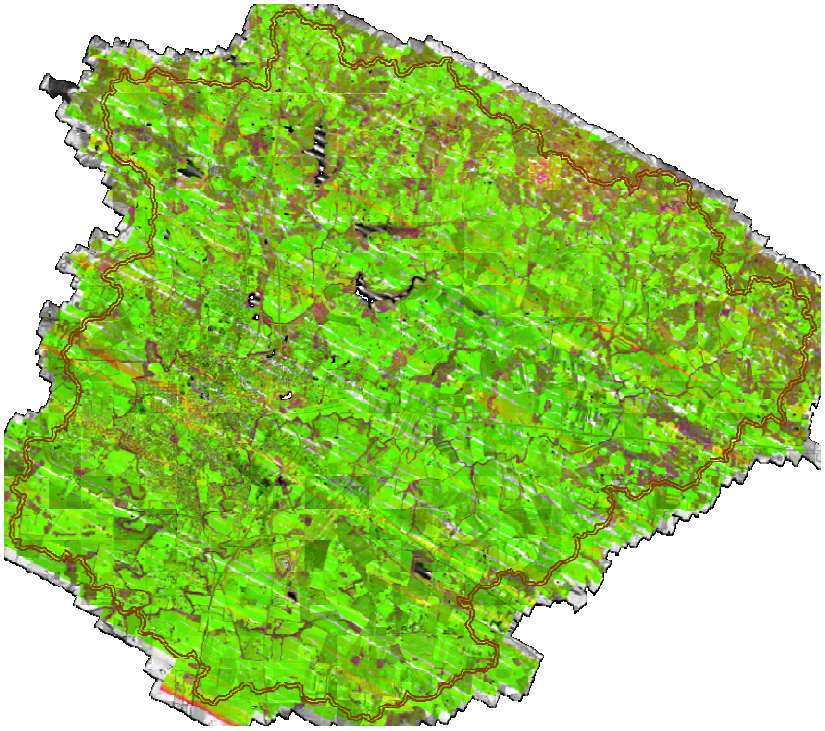
The in-situ calibration is performed as needed using the mission's data. This calibration is performed to refine the system parameters that are affected by the on site conditions.

For each mission, LiDAR data for at least one cross flight is acquired over the mission's acquisition site. The processed data of the cross flight is compared to the perpendicular flight lines using either the Optech proprietary software or TerraSolid's TerraMatch software to determine if any systematic errors are present. In this calibration, the data of individual flight lines are compared against each other and their systematic errors are corrected in the final processed data.

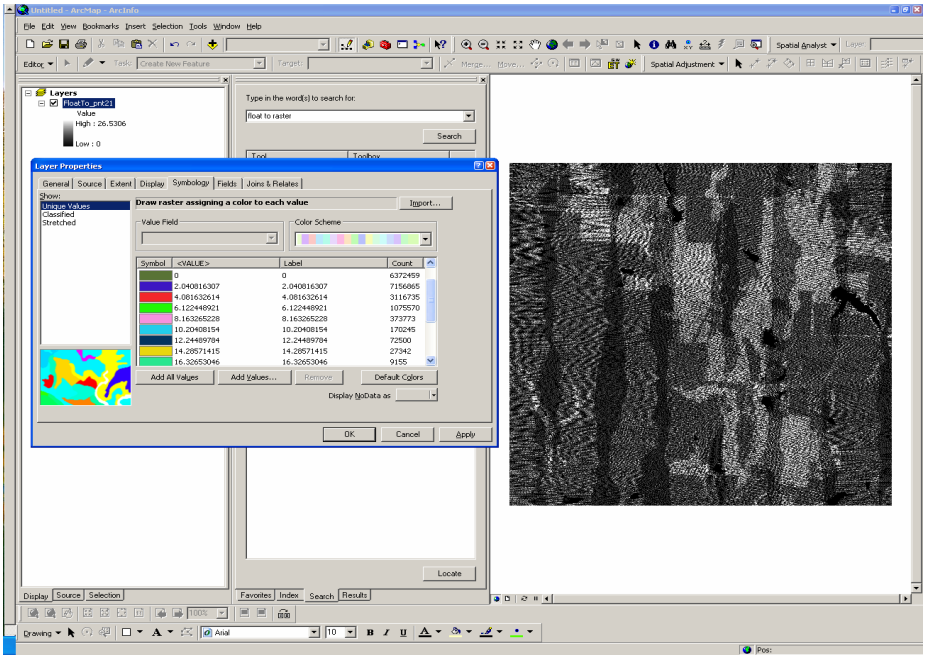
5.4 LiDAR Processing

The LAS files were then imported, verified, and parsed into manageable, tiled grids using GeoCue version 6.1.21.0. GeoCue allows for ease of data management and process tracking.

The first step after the data has been processed and calibrated is to perform a relative accuracy assessment on the flightline to flightline comparisons and also a data density test prior any further processing. To determine a proper accuracy assessment between flightlines, Aero-Metric uses GeoCue to create Orthos by elevation differences. The generated orthos have assigned elevation ranges that allow the technician to evaluate if the data passes the accuracy assessment and also determine if additional calibration efforts are needed based on the bias trends. Below are screen captures of the elevation orthos with green indicates a flightline comparison of less than 0.05 meters; yellow is 0.056 – 0.100 meters; red 0.101 – 0.150 meters; and magenta 0.151 – 0.200 meters.



In addition to the relative accuracy assessment, Aero-Metric also reviews a few tiles to ensure that the desire density has been met. Aero-Metric utilizes LP360 software to complete this task. Initially a grid was placed according the version 12 specification that is based on the nominal post spacing. The results indicated that the density of the sampled tiles achieved only 65% of the points meeting the specified data density criteria. However, using the latest USGS specification, version 13, which modifies the requirements to allow up to 2 times the nominal post spacing our data tests now easily meets the desired density requirements. Below are the statistics and also screen captures of the results of the inspected tiles.



Sampled tiles: Area 1 (6_264043215, 6_264043230, 6_265543215, and 6_265543230)

Area 1 (Version 12 – 0.7m)
Total number of cells: 18378369
Total number of cells with one point: 12005910
Percentage of tiles with 1 point or more: 65%

Area 1 (Version 13 – 1.4m)
Total number of cells: 4596736
Total number of cells with one point: 4505282
Percentage of tiles with 1 point or more: 98%

Once both the accuracy between swaths and data density is accepted an automated classification algorithm is performed using TerraSolid's TerraScan, version 10.011. This will produce the majority of the bare-earth datasets.

The remainder of the data was classified using manual classification techniques. The majority of the manual edit removed point misclassified as ground (class 2) to unclassified (class 1). Erroneous low points, high points, including clouds are classified to class 7.

5.5 Check Point Validation

The data was then verified using the ground control data collected by Aero-Metric. TerraScan then computes the vertical differences between the surveyed elevation and the LiDAR derived elevation for each point.

A report listing the differences and common statistics was created and can be found in Section 8 of this report.

5.6 LiDAR Data Delivery

Raw point cloud data supplied is in the following format:

- LAS, version 1.2
- GPS times adjusted to GPS Absolute
- Full swaths and delivered as 1 file per swath which did not exceed 2gb.

Classified point cloud data is also being supplied using the following criteria.

- LAS, version 1.2
- GPS times adjusted to GPS Absolute
- Classification schemed:
  - Code 1 – Processed, but unclassified
  - Code 2 – Ground
  - Code 7 – Noise
  - Code 9 - Water
  - Code 10 – Ignored Ground (Breakline proximity)

The 1 meter bare-earth DEMs were created in the following manner. First, ArcGrids in ASCII format were created using TerraModeler version 10.003 (TerraSolid Ltd.). The ASCII grids were then imported into ARC and translated to raster format and placed in a geodatabase DEM feature dataset.

The first return 1 meter intensity images were created using GeoCue. These images are in GeoTiff format.

Collected breaklines are first collected in a Microstation environment using the base specifications. Upon acceptance the breaklines, either polygons or lines, are translated into ARC and imported to the final geodatabase as separate features.

6 CONCLUSION

Because of the rigorous procedures and use of new technology, this project will serve the USDA-NRCS and all users requiring the provided LiDAR derivative products for both project areas in Illinois and Kentucky well into the future. Although this project tested the limits of both the equipment and personnel, the results are extremely accurate and reliable.

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
DATABASE =  , PROGRAM = datasheet, VERSION = 7.85
1        National Geodetic Survey,   Retrieval Date = MAY 16, 2010
 KB0890 ***********************************************************************
 KB0890  CBN         -  This is a Cooperative Base Network Control Station.
 KB0890  DESIGNATION -  GINN AZ MK
 KB0890  PID         -  KB0890
 KB0890  STATE/COUNTY-  IL/MONTGOMERY
 KB0890  USGS QUAD   -  LITCHFIELD (1974)
 KB0890
 KB0890                        *CURRENT SURVEY CONTROL
 KB0890
 KB0890* NAD 83(2007)-  39 08 47.73610(N)     089 40 09.00079(W)      ADJUSTED
 KB0890* NAVD 88     -       207.631  (meters)      681.20   (feet)   ADJUSTED
 KB0890
 KB0890  EPOCH DATE  -         2002.00
 KB0890  X           -        28,600.283 (meters)                      COMP
 KB0890  Y           -    -4,953,123.608 (meters)                      COMP
 KB0890  Z           -     4,005,062.787 (meters)                      COMP
 KB0890  LAPLACE CORR-             0.85  (seconds)                    DEFLEC09
 KB0890  ELLIP HEIGHT-           176.371 (meters)          (02/10/07) ADJUSTED
 KB0890  GEOID HEIGHT-           -31.26  (meters)                     GEOID09
 KB0890  DYNAMIC HT  -           207.510 (meters)      680.81  (feet) COMP
 KB0890
 KB0890  -------- Accuracy Estimates (at 95% Confidence Level in cm) --------
 KB0890  Type    PID    Designation                        North   East  Ellip
 KB0890  ----------------------------------------------------------------------
 KB0890  NETWORK KB0890 GINN AZ MK                          0.29   0.24   0.63
 KB0890  ----------------------------------------------------------------------
 KB0890  MODELED GRAV-      980,042.0   (mgal)                        NAVD 88
 KB0890
 KB0890  VERT ORDER  -  SECOND    CLASS 0
 KB0890
 KB0890.The horizontal coordinates were established by GPS observations
 KB0890.and adjusted by the National Geodetic Survey in February 2007.
 KB0890
 KB0890.The datum tag of NAD 83(2007) is equivalent to NAD 83(NSRS2007).
 KB0890.See National Readjustment for more information.
 KB0890.The horizontal coordinates are valid at the epoch date displayed above.
 KB0890.The epoch date for horizontal control is a decimal equivalence
 KB0890.of Year/Month/Day.
 KB0890
 KB0890.The orthometric height was determined by differential leveling and
 KB0890.adjusted in June 1991.
 KB0890
 KB0890.Photographs are available for this station.
 KB0890
 KB0890.The X, Y, and Z were computed from the position and the ellipsoidal ht.
 KB0890
 KB0890.The Laplace correction was computed from DEFLEC09 derived deflections.
 KB0890
 KB0890.The ellipsoidal height was determined by GPS observations
 KB0890.and is referenced to NAD 83.
 KB0890
 KB0890.The geoid height was determined by GEOID09.
 KB0890
 KB0890.The dynamic height is computed by dividing the NAVD 88
 KB0890.geopotential number by the normal gravity value computed on the
 KB0890.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 KB0890.degrees latitude (g = 980.6199 gals.).
 KB0890
```

```
KB0890.The modeled gravity was interpolated from observed gravity values.
KB0890
KB0890;                      North         East      Units Scale Factor Converg.
KB0890;SPC IL W      -   275,360.534   743,005.128   MT  0.99996394   +0 18 50.7
KB0890;SPC IL W      -   903,412.02  2,437,675.99   sFT  0.99996394   +0 18 50.7
KB0890;UTM  16       - 4,336,437.724   269,332.733   MT  1.00025519   -1 41 08.9
KB0890
KB0890!              -  Elev Factor  x  Scale Factor =   Combined Factor
KB0890!SPC IL W      -   0.99997233  x   0.99996394  =   0.99993627
KB0890!UTM  16       -   0.99997233  x   1.00025519  =   1.00022751
KB0890
KB0890                          SUPERSEDED SURVEY CONTROL
KB0890
KB0890  ELLIP H (10/15/04)  176.354  (m)                          GP(      ) 4 2
KB0890  NAD 83(1997)-  39 08 47.73598(N)    089 40 09.00126(W) AD(      ) B
KB0890  ELLIP H (07/17/98)  176.385  (m)                          GP(      ) 4 1
KB0890  NAD 83(1986)-  39 08 47.74905(N)    089 40 08.97902(W) AD(      ) 1
KB0890  NAVD 88 (07/17/98)  207.63   (m)          681.2    (f) LEVELING    3
KB0890  NGVD 29 (??/??/92)  207.758  (m)          681.62   (f) ADJ UNCH    2 0
KB0890
KB0890.Superseded values are not recommended for survey control.
KB0890.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
KB0890.See file dsdata.txt to determine how the superseded data were derived.
KB0890
KB0890_U.S. NATIONAL GRID SPATIAL ADDRESS: 16SBJ6933236437(NAD 83)
KB0890_MARKER: DZ = AZIMUTH MARK DISK
KB0890_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
KB0890_SP_SET: CONCRETE POST
KB0890_STAMPING: GINN 1960
KB0890_MARK LOGO: CGS
KB0890_PROJECTION: FLUSH
KB0890_MAGNETIC: N = NO MAGNETIC MATERIAL
KB0890_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
KB0890+STABILITY: SURFACE MOTION
KB0890_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
KB0890+SATELLITE: SATELLITE OBSERVATIONS - April 11, 2010
KB0890
KB0890  HISTORY      - Date     Condition        Report By
KB0890  HISTORY      - 1960     MONUMENTED       CGS
KB0890  HISTORY      - 19901016 GOOD             NGS
KB0890  HISTORY      - 19970422 GOOD             NGS
KB0890  HISTORY      - 19980714 GOOD             NGS
KB0890  HISTORY      - 20030613 GOOD             WOOLPT
KB0890  HISTORY      - 20040119 GOOD             WOOLPT
KB0890  HISTORY      - 20100411 GOOD             AEROME
KB0890
KB0890                          STATION DESCRIPTION
KB0890
KB0890'DESCRIBED BY COAST AND GEODETIC SURVEY 1960
KB0890'2.1 MI S FROM LITCHFIELD.
KB0890'ABOUT 2.1 MILES SOUTH ALONG U.S. HIGHWAY 66 (FOUR LANE DUAL
KB0890'HIGHWAY) FROM THE JUNCTION OF STATE HIGHWAY 16, AT THE JUNCTION
KB0890'OF U.S. HIGHWAY 66 (FOUR LANE DUAL HIGHWAY) AND OLD U.S. HIGHWAY
KB0890'66 AND OILED ROAD WEST, 106 FEET WEST OF SOUTH BOUND LANE OF U.S.
KB0890'HIGHWAY 66 (FOUR LANE DUAL HIGHWAY), 20 FEET SOUTH OF THE CENTER
KB0890'LINE OF OIL ROAD WEST, 109 FEET WEST-SOUTHWEST OF THE JUNCTION
KB0890'OF AN OIL ROAD WEST AND THE CENTER LINE OF THE SOUTH BOUND LANE
KB0890'OF U.S. HIGHWAY 66 (FOUR LANE DUAL HIGHWAY), 2 FEET WEST OF
KB0890'TELEPHONE POLE, 2 FEET EAST OF A METAL WITNESS POST, ABOUT LEVEL
KB0890'WITH THE ROAD, AND SET IN THE TOP OF A CONCRETE POST PROJECTING
KB0890'4 INCHES.
KB0890
KB0890                          STATION RECOVERY (1990)
KB0890
KB0890'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1990
KB0890'THIS STATION IS A BENCH MARK.  IT IS LOCATED ABOUT 3.5 KM (2.2 MI)
KB0890'SOUTH-SOUTHWEST OF LITCHFIELD, 2.6 KM (1.6 MI) EAST OF THE
KB0890'MONTGOMERY-MACOUPIN COUNTY LINE, IN THE SOUTHWEST ANGLE OF A ROAD
```

KB0890'JUNCTION, AT A FIELD EDGE, IN THE NORTHEAST 1/4 OF SECTION 17, T 8 N,
KB0890'R 5 W. OWNERSHIP--COUNTY ROAD DEPARTMENT.
KB0890'TO REACH FROM THE JUNCTION OF INTERSTATE HIGHWAY 55 AND STATE HIGHWAY
KB0890'16 (EXIT 52) ON THE WEST SIDE OF LITCHFIELD, GO EAST ON HIGHWAY 16
KB0890'FOR 1.4 KM (0.9 MI) TO A PAVED CROSSROAD. TURN RIGHT, SOUTH, ON THE
KB0890'FOUR LANE HIGHWAY FOR 3.45 KM (2.14 MI) TO A PAVED CROSSROAD (ROAD
KB0890'1000 N)AND THE STATION ON THE RIGHT.
KB0890'STATION MARK IS A STANDARD AZIMUTH MARK DISK SET IN THE TOP OF A 30-CM
KB0890'SQUARE CONCRETE POST PROJECTING 4 CM. IT IS 30.9 M (101.4 FT) WEST
KB0890'OF THE CENTER OF THE SOUTHBOUND LANES OF ROAD 150 E, 5.9 M (19.4 FT)
KB0890'SOUTH OF THE CENTER OF ROAD 1000 N, LEVEL WITH 1000 N, 0.4 M (1.3 FT)
KB0890'EAST OF A FIBERGLASS WITNESS POST, AND 0.8 M (2.6 FT) WEST OF
KB0890'TELEPHONE PEDESTAL F7 P1 F71.
KB0890
KB0890 STATION RECOVERY (1997)
KB0890
KB0890'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1997 (CSM)
KB0890'THE STATION IS LOCATED ABOUT 3.5 KM (2.15 MI) SOUTH-SOUTHWEST OF
KB0890'LITCHFIELD, IL, ABOUT 2.6 KM (1.60 MI) EAST OF THE MONTGOMERY/MACOUPIN
KB0890'COUNTY LINE, IN THE SOUTHWEST QUADRANT OF THE JUNCTION OF OLD U.S.
KB0890'HIGHWAY 66 AND (N 10TH AV) , BETWEEN 2 UNDERGROUND CABLE WARNING
KB0890'SIGNS. OWNERSHIP--STATE OF ILLINOIS. NOTE--THIS STATION IS A FBN/CBN
KB0890'STATION AND B.M. TIE. TO REACH THE STATION FROM THE JUNCTION OF
KB0890'INTERSTATE HIGHWAY 55 AND STATE HIGHWAY 16 (EXIT 52) NEAR THE WEST
KB0890'SIDE OF LITCHFIELD, GO EAST, 1.4 KM (0.85 MI) ALONG HIGHWAY 16 TO THE
KB0890'INTERSECTION OF OLD U.S. HIGHWAY 66. TURN RIGHT, SOUTH, 3.45 KM (2.15
KB0890'MI) ALONG OLD HIGHWAY 66 TO NORTH 10TH AVENUE AND THE STATION ON THE
KB0890'RIGHT, BETWEEN THE 2 WARNING SIGNS. STATION IS 30.9 M (101.4 FT) WEST
KB0890'OF THE OLD HIGHWAY 66 CENTER, 8.8 M (28.9 FT) WEST OF A 16-INCH
KB0890'CONCRETE CULVERTS SOUTH END CENTER RUNNING UNDER 10TH AVENUE, 6.5 M
KB0890'(21.3 FT) EAST OF A METAL UNDERGROUND CABLE WARNING SIGN, 5.8 M (19.0
KB0890'FT) SOUTH OF THE 10TH AVENUE CENTER, 0.8 M (2.6 FT) WEST-SOUTHWEST OF
KB0890'A GREEN UNDERGROUND CABLE JUNCTION BOX AND WARNING SIGN, 0.3 M (1.0
KB0890'FT) EAST OF A WITNESS POST, AND THE MONUMENT IS ABOUT 0.3 M (1.0 FT)
KB0890'BELOW THE 10TH AVENUE LEVEL AND PROJECTING ABOUT 4-CM ABOVE THE GROUND
KB0890'SURFACE. BY R.G. HAYES
KB0890
KB0890 STATION RECOVERY (1998)
KB0890
KB0890'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1998 (GW)
KB0890'RECOVERED AS DESCRIBED
KB0890'
KB0890
KB0890 STATION RECOVERY (2003)
KB0890
KB0890'RECOVERY NOTE BY WOOLPERT CONSULTANTS 2003 (BJM)
KB0890'THIS STATION WAS RECOVERED AS DESCRIBED AND FOUND IN GOOD CONDITION.
KB0890'
KB0890
KB0890 STATION RECOVERY (2004)
KB0890
KB0890'RECOVERY NOTE BY WOOLPERT CONSULTANTS 2004 (BJM)
KB0890'THIS STATION WAS RECOVERED AS DESCRIBED AND FOUND IN GOODCONDITION.
KB0890
KB0890 STATION RECOVERY (2010)
KB0890
KB0890'RECOVERY NOTE BY AERO METRIC INC 2010
KB0890'RECOVERED IN GOOD CONDITION.

*** retrieval complete.
Elapsed Time = 00:00:00

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
DATABASE =  ,PROGRAM = datasheet, VERSION = 7.85
1        National Geodetic Survey,   Retrieval Date = MAY 16, 2010
 KB1018 ***********************************************************************
 KB1018  DESIGNATION -  Q 218
 KB1018  PID         -  KB1018
 KB1018  STATE/COUNTY-  IL/MONTGOMERY
 KB1018  USGS QUAD   -  DIVERNON (1976)
 KB1018
 KB1018                         *CURRENT SURVEY CONTROL
 KB1018
 KB1018* NAD 83(1986)-  39 31 23.      (N)     089 40 59.      (W)      SCALED
 KB1018* NAVD 88     -       193.970   (meters)      636.38    (feet)   ADJUSTED
 KB1018
 KB1018  GEOID HEIGHT-          -31.92  (meters)                         GEOID09
 KB1018  DYNAMIC HT  -          193.862 (meters)      636.03    (feet)   COMP
 KB1018  MODELED GRAV-      980,064.6   (mgal)                           NAVD 88
 KB1018
 KB1018  VERT ORDER  -  SECOND    CLASS 0
 KB1018
 KB1018.The horizontal coordinates were scaled from a topographic map and have
 KB1018.an estimated accuracy of +/- 6 seconds.
 KB1018
 KB1018.The orthometric height was determined by differential leveling and
 KB1018.adjusted in June 1991.
 KB1018
 KB1018.The geoid height was determined by GEOID09.
 KB1018
 KB1018.The dynamic height is computed by dividing the NAVD 88
 KB1018.geopotential number by the normal gravity value computed on the
 KB1018.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 KB1018.degrees latitude (g = 980.6199 gals.).
 KB1018
 KB1018.The modeled gravity was interpolated from observed gravity values.
 KB1018
 KB1018;                     North         East      Units  Estimated Accuracy
 KB1018;SPC IL W      -   317,150.      741,580.        MT  (+/- 180 meters Scaled)
 KB1018
 KB1018                          SUPERSEDED SURVEY CONTROL
 KB1018
 KB1018  NGVD 29 (??/??/92)  194.086  (m)           636.76    (f) ADJ UNCH    2 0
 KB1018
 KB1018.Superseded values are not recommended for survey control.
 KB1018.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 KB1018.See file dsdata.txt to determine how the superseded data were derived.
 KB1018
 KB1018_U.S. NATIONAL GRID SPATIAL ADDRESS: 16SBJ693782(NAD 83)
 KB1018_MARKER: DB = BENCH MARK DISK
 KB1018_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
 KB1018_SP_SET: SET IN TOP OF CONCRETE MONUMENT
 KB1018_STAMPING: Q 218 1960
 KB1018_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
 KB1018+STABILITY: SURFACE MOTION
 KB1018_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 KB1018+SATELLITE: SATELLITE OBSERVATIONS - April 10, 2001
 KB1018
 KB1018  HISTORY     - Date     Condition        Report By
 KB1018  HISTORY     - 1960     MONUMENTED       CGS
 KB1018  HISTORY     - 1989     GOOD             USPSQD
 KB1018  HISTORY     - 20010410 GOOD             INDIV
 KB1018
```

```
KB1018                          STATION DESCRIPTION
KB1018
KB1018'DESCRIBED BY COAST AND GEODETIC SURVEY 1960
KB1018'5.6 MI NE FROM VIRDEN.
KB1018'1.6 MILES NORTH ALONG THE GULF, MOBILE AND OHIO RAIL ROAD FROM
KB1018'THE STATION IN VIRDEN, THENCE 4.05 MILE EAST ALONG AN OIL ROAD
KB1018'AT THE JUNCTION OF AN OILED ROAD SOUTH AND A FIELD ROAD NORTH,
KB1018'21 FEET SOUTH OF THE CENTER LINE OF THE ROAD, 36 FEET WEST OF
KB1018'THE CENTER LINE OF AN OILED ROAD SOUTH, 43 FEET SOUTHWEST OF
KB1018'THE CENTER OF THE JUNCTION, 1 FOOT NORTH OF THE FENCE, 18 FEET
KB1018'WEST OF A FENCE CORNER, 15.5 FEET WEST OF A POWER POLE, 1.7
KB1018'FEET WEST OF A METAL WITNESS POST, 0.5 FEET ABOVE THE LEVEL OF
KB1018'THE ROAD, AND SET IN THE TOP OF A CONCRETE POST PROJECTING 4
KB1018'INCHES.
KB1018
KB1018                          STATION RECOVERY (1989)
KB1018
KB1018'RECOVERY NOTE BY US POWER SQUADRON 1989 (GMC)
KB1018'RECOVERED IN GOOD CONDITION.
KB1018
KB1018                          STATION RECOVERY (2001)
KB1018
KB1018'RECOVERY NOTE BY INDIVIDUAL CONTRIBUTORS 2001 (BCA)
KB1018'STATION IS NEAR THE NW CORNER SEC 5 T12N R5W 3PM, AT T-ROAD TO SOUTH,
KB1018'20.4 FEET SOUTH OF THE CENTERLINE OF MONTGOMERY ROAD (OIL/CHIP), 37.0
KB1018'FEET WEST OF THE CENTERLINE OF EAST FIRST ROAD (GRAVEL), 14.8 FEET
KB1018'NORTHWEST OF A UTILITY POLE, LEVEL WITH THE GROUND.  FENCE AND METAL
KB1018'WITNESS POST HAVE BEEN REMOVED.

*** retrieval complete.
Elapsed Time = 00:00:01
```

The NGS Data Sheet

See file _dsdata.txt for more information about the datasheet.

```
DATABASE =  ,PROGRAM = datasheet, VERSION = 7.85
1        National Geodetic Survey,   Retrieval Date = MAY 16, 2010
 KB0920 ***********************************************************************
 KB0920  CBN          -  This is a Cooperative Base Network Control Station.
 KB0920  DESIGNATION  -  RENT
 KB0920  PID          -  KB0920
 KB0920  STATE/COUNTY-  IL/MACOUPIN
 KB0920  USGS QUAD    -  MOUNT OLIVE (1974)
 KB0920
 KB0920                        *CURRENT SURVEY CONTROL
 KB0920
 KB0920* NAD 83(2007)-  39 01 41.29820(N)     089 44 27.12080(W)      ADJUSTED
 KB0920* NAVD 88      -       195.787  (meters)      642.34   (feet)  ADJUSTED
 KB0920
 KB0920  EPOCH DATE   -         2002.00
 KB0920  X            -      22,439.377 (meters)                      COMP
 KB0920  Y            -  -4,961,437.979 (meters)                      COMP
 KB0920  Z            -   3,994,847.829 (meters)                      COMP
 KB0920  LAPLACE CORR-            0.25  (seconds)                     DEFLEC09
 KB0920  ELLIP HEIGHT-          164.582 (meters)          (02/10/07)  ADJUSTED
 KB0920  GEOID HEIGHT-          -31.20  (meters)                      GEOID09
 KB0920  DYNAMIC HT   -         195.671 (meters)      641.96  (feet)  COMP
 KB0920
 KB0920  ------- Accuracy Estimates (at 95% Confidence Level in cm) --------
 KB0920  Type    PID    Designation                        North   East  Ellip
 KB0920  ----------------------------------------------------------------------
 KB0920  NETWORK KB0920 RENT                                0.39   0.27   0.71
 KB0920  ----------------------------------------------------------------------
 KB0920  MODELED GRAV-     980,028.9   (mgal)                          NAVD 88
 KB0920
 KB0920  VERT ORDER   -  SECOND    CLASS 0
 KB0920
 KB0920.The horizontal coordinates were established by GPS observations
 KB0920.and adjusted by the National Geodetic Survey in February 2007.
 KB0920
 KB0920.The datum tag of NAD 83(2007) is equivalent to NAD 83(NSRS2007).
 KB0920.See National Readjustment for more information.
 KB0920.The horizontal coordinates are valid at the epoch date displayed above.
 KB0920.The epoch date for horizontal control is a decimal equivalence
 KB0920.of Year/Month/Day.
 KB0920
 KB0920.The orthometric height was determined by differential leveling and
 KB0920.adjusted in June 1991.
 KB0920
 KB0920.The X, Y, and Z were computed from the position and the ellipsoidal ht.
 KB0920
 KB0920.The Laplace correction was computed from DEFLEC09 derived deflections.
 KB0920
 KB0920.The ellipsoidal height was determined by GPS observations
 KB0920.and is referenced to NAD 83.
 KB0920
 KB0920.The geoid height was determined by GEOID09.
 KB0920
 KB0920.The dynamic height is computed by dividing the NAVD 88
 KB0920.geopotential number by the normal gravity value computed on the
 KB0920.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 KB0920.degrees latitude (g = 980.6199 gals.).
 KB0920
 KB0920.The modeled gravity was interpolated from observed gravity values.
 KB0920
```

```
KB0920;                      North         East      Units Scale Factor Converg.
KB0920;SPC IL W      -   262,179.172   736,868.792   MT  0.99995791   +0 16 05.3
KB0920;SPC IL W      -   860,166.17  2,417,543.70   sFT  0.99995791   +0 16 05.3
KB0920;UTM  16       - 4,323,474.184   262,738.640   MT  1.00029321   -1 43 36.2
KB0920
KB0920!              -  Elev Factor  x  Scale Factor =  Combined Factor
KB0920!SPC IL W      -   0.99997418  x   0.99995791  =   0.99993209
KB0920!UTM  16       -   0.99997418  x   1.00029321  =   1.00026738
KB0920
KB0920:                  Primary Azimuth Mark                     Grid Az
KB0920:SPC IL W      -  RENT AZ MK                               086 40 56.7
KB0920:UTM  16       -  RENT AZ MK                               088 40 38.2
KB0920
KB0920|-----------------------------------------------------------------------|
KB0920| PID    Reference Object                      Distance      Geod. Az  |
KB0920|                                                            dddmmss.s |
KB0920| KB0919 RENT RM 1                           10.752 METERS 00458     |
KB0920| KB0917 RENT AZ MK                                        0865702.0 |
KB0920| KB0918 RENT RM 2                           11.133 METERS 08821     |
KB0920| KB1438 MT OLIVE ILL PWR LT MICRO MAST     APPROX. 1.9 KM 3360825.8 |
KB0920|-----------------------------------------------------------------------|
KB0920
KB0920                          SUPERSEDED SURVEY CONTROL
KB0920
KB0920  NAD 83(1997)-  39 01 41.29834(N)    089 44 27.12098(W) AD(       ) A
KB0920  ELLIP H (09/15/03)  164.577  (m)                       GP(       ) 4 1
KB0920  NAD 83(1997)-  39 01 41.29880(N)    089 44 27.12293(W) AD(       ) 2
KB0920  NAD 83(1986)-  39 01 41.30868(N)    089 44 27.11591(W) AD(       ) 2
KB0920  NAD 27       -  39 01 41.14220(N)    089 44 26.78300(W) AD(       ) 2
KB0920  NAVD 88 (09/15/03)  195.79   (m)          642.4     (f) LEVELING    3
KB0920  NGVD 29 (??/??/92)  195.905  (m)          642.73    (f) ADJ UNCH    2 0
KB0920
KB0920.Superseded values are not recommended for survey control.
KB0920.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
KB0920.See file dsdata.txt to determine how the superseded data were derived.
KB0920
KB0920_U.S. NATIONAL GRID SPATIAL ADDRESS: 16SBJ6273823474(NAD 83)
KB0920_MARKER: DE = TRAVERSE STATION DISK
KB0920_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
KB0920_SP_SET: SET IN TOP OF CONCRETE MONUMENT
KB0920_STAMPING: RENT 1960
KB0920_MARK LOGO: CGS
KB0920_PROJECTION: RECESSED 1 CENTIMETERS
KB0920_MAGNETIC: N = NO MAGNETIC MATERIAL
KB0920_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
KB0920+STABILITY: SURFACE MOTION
KB0920_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
KB0920+SATELLITE: SATELLITE OBSERVATIONS - April 11, 2010
KB0920
KB0920  HISTORY      - Date     Condition        Report By
KB0920  HISTORY      - 1960     MONUMENTED       CGS
KB0920  HISTORY      - 1960     GOOD             CGS
KB0920  HISTORY      - 1990     GOOD             USPSQD
KB0920  HISTORY      - 20020819 GOOD             NGS
KB0920  HISTORY      - 20040119 GOOD             WOOLPT
KB0920  HISTORY      - 20100411 GOOD             AEROME
KB0920
KB0920                          STATION DESCRIPTION
KB0920
KB0920'DESCRIBED BY COAST AND GEODETIC SURVEY 1960 (CAA)
KB0920'THE STATION IS LOCATED ABOUT 3 MILES SOUTH-SOUTHWEST OF MT. OLIVE,
KB0920'ABOUT 2-1/2 MILES NORTHEAST OF STAUNTON, ABOUT 2-1/2 MILES
KB0920'WEST OF THE MACOUPIN-MONTGOMERY COUNTY LINE AND 0.5 MILE EAST OF U.S.
KB0920'HIGHWAY 66.
KB0920'
KB0920'TO REACH THE STATION FROM THE JUNCTION OF U.S. HIGHWAY 66 AND STATE
KB0920'HIGHWAY 138 ABOUT 1 MILE WEST OF MT. OLIVE, GO SOUTH ON U.S.
KB0920'HIGHWAY 66 FOR 2.2 MILES TO RAILROAD OVERPASS, CONTINUE SOUTH 0.8
```

```
KB0920'MILE TO CROSSROAD, TURN LEFT, GO EAST ON OILED ROAD FOR 0.5 MILE
KB0920'TO A SMALL CONCRETE BRIDGE AND THE STATION ON THE RIGHT AS DESCRIBED.
KB0920'
KB0920'THE STATION MARK, A STANDARD TRAVERSE DISK SET IN TOP OF A 12 INCH
KB0920'SQUARE CONCRETE POST WHICH IS SET FLUSH WITH THE SURFACE OF
KB0920'GROUND AND IS STAMPED RENT 1960. THE MARK IS 21 FEET SOUTH OF CENTER
KB0920'OF ROAD, 18 FEET WEST OF FENCE CORNER, 15 FEET WEST OF
KB0920'TELEPHONE POLE, 12 FEET SOUTH-SOUTHWEST OF THE WEST END OF SMALL
KB0920'CONCRETE BRIDGE AND 5.9 FEET WEST OF WITNESS POST.
KB0920'
KB0920'REFERENCE MARK 2, A STANDARD REFERENCE DISK SET IN TOP OF A 12 INCH
KB0920'SQUARE CONCRETE POST WHICH IS SET FLUSH WITH THE SURFACE OF
KB0920'GROUND AND IS STAMPED RENT NO 2 1960. THE MARK IS 25.5 FEET SOUTHEAST
KB0920'OF THE EAST END OF SMALL BRIDGE, 21.5 FEET EAST OF TELEPHONE
KB0920'POLE, 21 FEET SOUTH OF CENTER OF RD.,18.5 FT. EAST OF FENCE CORNER
KB0920'AND 1 FOOT NORTH OF FENCE.
KB0920'
KB0920'REFERENCE MARK 1, A STANDARD REFERENCE DISK SET IN A DRILL HOLE AT
KB0920'THE WEST END OF A SMALL CONCRETE BRIDGE AND IS STAMPED RENT NO
KB0920'1 1960. THE MARK IS 20.5 FEET WEST OF CENTER OF PRIVATE ROAD, 13 FEET
KB0920'NORTH OF CENTER OF ROAD AND 8.5 FEET SOUTH OF POWER LINE POLE.
KB0920'
KB0920'AZIMUTH MARK IS A STANDARD AZIMUTH DISK SET IN TOP OF 12 INCH SQUARE
KB0920'CONCRETE POST WHICH PROJECTS ABOUT 3 INCHES AND IS STAMPED RENT
KB0920'1960. THE MARK IS 24 FEET NORTH OF CENTER OF ROAD, 10 FEET
KB0920'SOUTH-SOUTHWEST OF POWER LINE POLE AND 1.8 FEET WEST-NORTHWEST
KB0920'OF WITNESS POST.
KB0920'
KB0920'TO REACH THE AZIMUTH MARK FROM THE STATION, GO EAST ON OILED ROAD FOR
KB0920'0.2 MILE TO THE MARK ON LEFT AS DESCRIBED.
KB0920'
KB0920'THE DISTANCE BETWEEN REFERENCE MARK 1 AND REFERENCE MARK 2 IS 47.78
KB0920'FEET.
KB0920
KB0920                          STATION RECOVERY (1960)
KB0920
KB0920'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1960
KB0920'3.8 MI SW FROM MOUNT OLIVE.
KB0920'ABOUT 2.1 MILES SOUTH ALONG POPLAR STREET AND A BLACK TOP ROAD
KB0920'FROM ITS JUNCTION WITH MAIN STREET IN MOUNT OLIVE, THENCE 0.5
KB0920'MILE WEST ON AN OIL ROAD, THENCE 1.0 MILE SOUTH ON AN OIL ROAD,
KB0920'THENCE 0.25 MILE WEST ON AN OIL ROAD, AT THE JUNCTION OF A DRIVE
KB0920'NORTH TO A FARM HOUSE, 22 FEET SOUTH OF THE CENTER LINE OF THE
KB0920'ROAD, 26 FEET WEST OF THE EXTENDED CENTER LINE OF THE DRIVE, 18
KB0920'FEET WEST OF A FENCE CORNER, 12 FEET SOUTH OF THE WEST END OF THE
KB0920'SOUTH HEADWALL OF A 4 FOOT CONCRETE BOX CULVERT, 44 FEET SOUTH
KB0920'AND ACROSS THE ROAD FROM POWER POLE 4, 5.9 FEET WEST OF A METAL
KB0920'WITNESS POST, 1 FOOT BELOW THE LEVEL OF THE ROAD, AND SET IN THE
KB0920'TOP OF A CONCRETE POST PROJECTING 1 INCH.
KB0920
KB0920                          STATION RECOVERY (1990)
KB0920
KB0920'RECOVERY NOTE BY US POWER SQUADRON 1990 (GG)
KB0920'RECOVERED IN GOOD CONDITION.
KB0920
KB0920                          STATION RECOVERY (2002)
KB0920
KB0920'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 2002 (BD)
KB0920'RECOVERED AS DESCRIBED
KB0920'
KB0920
KB0920                          STATION RECOVERY (2004)
KB0920
KB0920'RECOVERY NOTE BY WOOLPERT CONSULTANTS 2004 (BJM)
KB0920'THIS STATION WAS RECOVERED AS DESCRIBED AND FOUND IN GOODCONDITION.
KB0920'
KB0920'
KB0920
```

```
KB0920                          STATION RECOVERY (2010)
KB0920
KB0920'RECOVERY NOTE BY AERO METRIC INC 2010
KB0920'RECOVERED IN GOOD CONDITION.

*** retrieval complete.
Elapsed Time = 00:00:00
```

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
DATABASE =  ,PROGRAM = datasheet, VERSION = 7.85
1        National Geodetic Survey,   Retrieval Date = MAY 16, 2010
 KB0740 ***********************************************************************
 KB0740  DESIGNATION -  T 93
 KB0740  PID         -  KB0740
 KB0740  STATE/COUNTY-  IL/MONTGOMERY
 KB0740  USGS QUAD   -  HILLSBORO (1974)
 KB0740
 KB0740                          *CURRENT SURVEY CONTROL
 KB0740
 KB0740* NAD 83(1986)-  39 09 31.      (N)     089 29 38.      (W)      SCALED
 KB0740* NAVD 88     -       191.892   (meters)      629.57    (feet)   ADJUSTED
 KB0740
 KB0740  GEOID HEIGHT-          -31.30  (meters)                         GEOID09
 KB0740  DYNAMIC HT  -          191.783 (meters)      629.21    (feet)   COMP
 KB0740  MODELED GRAV-      980,058.8   (mgal)                           NAVD 88
 KB0740
 KB0740  VERT ORDER  -  SECOND    CLASS 0
 KB0740
 KB0740.The horizontal coordinates were scaled from a topographic map and have
 KB0740.an estimated accuracy of +/- 6 seconds.
 KB0740
 KB0740.The orthometric height was determined by differential leveling and
 KB0740.adjusted in June 1991.
 KB0740
 KB0740.The geoid height was determined by GEOID09.
 KB0740
 KB0740.The dynamic height is computed by dividing the NAVD 88
 KB0740.geopotential number by the normal gravity value computed on the
 KB0740.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 KB0740.degrees latitude (g = 980.6199 gals.).
 KB0740
 KB0740.The modeled gravity was interpolated from observed gravity values.
 KB0740
 KB0740;                      North         East      Units  Estimated Accuracy
 KB0740;SPC IL W      -    276,790.      758,150.       MT  (+/- 180 meters Scaled)
 KB0740
 KB0740                           SUPERSEDED SURVEY CONTROL
 KB0740
 KB0740  NGVD 29 (??/??/92)  192.020  (m)           629.99    (f) ADJ UNCH    2 0
 KB0740
 KB0740.Superseded values are not recommended for survey control.
 KB0740.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 KB0740.See file dsdata.txt to determine how the superseded data were derived.
 KB0740
 KB0740_U.S. NATIONAL GRID SPATIAL ADDRESS: 16SBJ845373(NAD 83)
 KB0740_MARKER: DB = BENCH MARK DISK
 KB0740_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
 KB0740_SP_SET: SET IN TOP OF CONCRETE MONUMENT
 KB0740_STAMPING: T 93 1935
 KB0740_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
 KB0740+STABILITY: SURFACE MOTION
 KB0740_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 KB0740+SATELLITE: SATELLITE OBSERVATIONS - April 11, 2010
 KB0740
 KB0740  HISTORY      - Date     Condition        Report By
 KB0740  HISTORY      - 1935     MONUMENTED       CGS
 KB0740  HISTORY      - 1974     GOOD             ILDT
 KB0740  HISTORY      - 20100411 GOOD             AEROME
 KB0740
```

```
KB0740                          STATION DESCRIPTION
KB0740
KB0740'DESCRIBED BY COAST AND GEODETIC SURVEY 1935
KB0740'AT HILLSBORO.
KB0740'AT HILLSBORO, MONTGOMERY COUNTY, AT THE POST OFFICE, AT THE
KB0740'NORTHEAST CORNER OF THE GROUNDS, 24 FEET SOUTH OF THE CENTERLINE
KB0740'OF EAST WOOD STREET, 20 FEET EAST OF THE CENTERLINE OF A DRIVEWAY
KB0740'TO THE REAR OF THE POST OFFICE, AND 8 INCHES SOUTH OF THE CURB.  A
KB0740'STANDARD DISK, STAMPED T 93 1935 AND SET IN THE TOP OF A CONCRETE
KB0740'POST.
KB0740
KB0740                          STATION RECOVERY (1974)
KB0740
KB0740'RECOVERY NOTE BY ILLINOIS DEPARTMENT OF TRANSPORTATION 1974
KB0740'RECOVERED IN GOOD CONDITION.
KB0740
KB0740                          STATION RECOVERY (2010)
KB0740
KB0740'RECOVERY NOTE BY AERO METRIC INC 2010
KB0740'RECOVERED IN GOOD CONDITION.

*** retrieval complete.
Elapsed Time = 00:00:00
```

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
DATABASE =  ,PROGRAM = datasheet, VERSION = 7.85
1        National Geodetic Survey,   Retrieval Date = MAY 16, 2010
 GC1765 ***********************************************************************
 GC1765  DESIGNATION -  B 22
 GC1765  PID         -  GC1765
 GC1765  STATE/COUNTY-  KY/TRIGG
 GC1765  USGS QUAD   -  CADIZ (1982)
 GC1765
 GC1765                         *CURRENT SURVEY CONTROL
 GC1765
 GC1765* NAD 83(1993)-  36 52 02.75962(N)     087 48 45.77626(W)      ADJUSTED
 GC1765* NAVD 88     -       152.770  (meters)      501.21   (feet)  ADJUSTED
 GC1765
 GC1765  LAPLACE CORR-          -1.86  (seconds)                      DEFLEC09
 GC1765  GEOID HEIGHT-         -29.19  (meters)                       GEOID09
 GC1765  DYNAMIC HT  -         152.651 (meters)      500.82   (feet)  COMP
 GC1765  MODELED GRAV-     979,851.4   (mgal)                         NAVD 88
 GC1765
 GC1765  HORZ ORDER  -  SECOND
 GC1765  VERT ORDER  -  FIRST     CLASS II
 GC1765
 GC1765.The horizontal coordinates were established by classical geodetic methods
 GC1765.and adjusted by the National Geodetic Survey in December 1995.
 GC1765
 GC1765.The orthometric height was determined by differential leveling and
 GC1765.adjusted in June 1991.
 GC1765
 GC1765.The Laplace correction was computed from DEFLEC09 derived deflections.
 GC1765
 GC1765.The geoid height was determined by GEOID09.
 GC1765
 GC1765.The dynamic height is computed by dividing the NAVD 88
 GC1765.geopotential number by the normal gravity value computed on the
 GC1765.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 GC1765.degrees latitude (g = 980.6199 gals.).
 GC1765
 GC1765.The modeled gravity was interpolated from observed gravity values.
 GC1765
 GC1765;                    North         East      Units Scale Factor Converg.
 GC1765;SPC KY1Z     - 1,061,310.988 1,316,080.166   MT  1.00005865   -1 15 59.1
 GC1765;SPC KY1Z     - 3,481,984.47  4,317,839.68    sFT 1.00005865   -1 15 59.1
 GC1765;SPC KY S     -   561,278.672   316,094.568   MT  0.99997837   -1 15 03.5
 GC1765;SPC KY S     - 1,841,461.78  1,037,053.60    sFT 0.99997837   -1 15 03.5
 GC1765;UTM  16      - 4,080,474.718   427,561.729   MT  0.99966464   -0 29 15.4
 GC1765
 GC1765!             -  Elev Factor  x  Scale Factor =   Combined Factor
 GC1765!SPC KY1Z     -   0.99998061  x   1.00005865  =   1.00003926
 GC1765!SPC KY S     -   0.99998061  x   0.99997837  =   0.99995898
 GC1765!UTM  16      -   0.99998061  x   0.99966464  =   0.99964525
 GC1765
 GC1765                         SUPERSEDED SURVEY CONTROL
 GC1765
 GC1765  NAD 83(1986)-  36 52 02.76860(N)     087 48 45.77915(W) AD(       ) 2
 GC1765  NAD 27      -  36 52 02.58300(N)     087 48 45.72400(W) AD(       ) 2
 GC1765  NGVD 29 (??/??/92)  152.841  (m)           501.45   (f) ADJ UNCH    1 2
 GC1765
 GC1765.Superseded values are not recommended for survey control.
 GC1765.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 GC1765.See file dsdata.txt to determine how the superseded data were derived.
 GC1765
```

GC1765 U.S. NATIONAL GRID SPATIAL ADDRESS: 16SDF2756180474(NAD 83)
GC1765 MARKER: DB = BENCH MARK DISK
GC1765 SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
GC1765 SP_SET: SET IN TOP OF CONCRETE MONUMENT
GC1765 STAMPING: B 22 1934
GC1765 STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
GC1765+STABILITY: SURFACE MOTION
GC1765 SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
GC1765+SATELLITE: SATELLITE OBSERVATIONS - April 04, 2006
GC1765

GC1765 HISTORY	- Date	Condition	Report By
GC1765 HISTORY	- 1953	MONUMENTED	USGS
GC1765 HISTORY	- 1948	GOOD	NGS
GC1765 HISTORY	- 1982	GOOD	NGS
GC1765 HISTORY	- 20060404	GOOD	PENRIL

GC1765
GC1765 STATION DESCRIPTION
GC1765
GC1765'DESCRIBED BY US GEOLOGICAL SURVEY 1953
GC1765'SEE STATION CADIZ
GC1765
GC1765 STATION RECOVERY (1948)
GC1765
GC1765'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1948
GC1765'1.5 MI E FROM CADIZ.
GC1765'ABOUT 1.5 MILES EAST ALONG U.S. HIGHWAY 68 FROM THE COURT HOUSE
GC1765'IN CADIZ, 258 FEET EAST OF THE EAST SIDE OF A WHITE STUCCO HOUSE
GC1765'THAT IS LOCATED BETWEEN THE HIGHWAY AND THE CADIZ RAILROAD
GC1765'TRACKS, 35 FEET SOUTH OF THE SOUTH RAIL, 39 FEET NORTH OF THE
GC1765'CENTER LINE OF THE HIGHWAY, 22 FEET NORTHEAST OF A 16-INCH
GC1765'SYCAMORE, 89 FEET WEST OF POWER POLE NUMBER 4063, ABOUT IN LINE
GC1765'WITH THE ROW OF POLES, 1 1/2 FEET WEST OF A WHITE WOODEN WITNESS
GC1765'POST, ABOUT LEVEL WITH THE CENTER OF THE HIGHWAY AND IN THE TOP
GC1765'OF A CONCRETE POST PROJECTING ABOUT 4 INCHES.
GC1765
GC1765 STATION RECOVERY (1982)
GC1765
GC1765'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1982
GC1765'2.4 KM (1.5 MI) EAST ALONG U.S. HIGHWAY 68 FROM THE COURTHOUSE AT
GC1765'CADIZ, 3.4 M (11 FT) SOUTHWEST OF A FIRE PLUG, 4.3 M (14 FT) WEST OF
GC1765'THE SOUTHWEST OF THE SOUTHWEST CORNER OF AN OLD CONCRETE LOADING DOCK
GC1765'AND 8.8 M (29 FT) NORTH OF THE CENTERLINE OF THE HIGHWAY.
GC1765
GC1765 STATION RECOVERY (2006)
GC1765
GC1765'RECOVERY NOTE BY PENNYRILE AREA DEVELOPEMENT DISTRICT 2006 (JMC)
GC1765'RECOVERED, NOW IN RIGHT-OF-WAY IMMEDIATELY ACROSS US-68B ROADWAY (MAIN
GC1765'ST, CADIZ, KY) FROM CADIZ HARDWARE.

*** retrieval complete.
Elapsed Time = 00:00:00

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
DATABASE =  ,PROGRAM = datasheet, VERSION = 7.85
1        National Geodetic Survey,   Retrieval Date = MAY 16, 2010
 GC1100 ***********************************************************************
 GC1100  DESIGNATION -  M 133
 GC1100  PID         -  GC1100
 GC1100  STATE/COUNTY-  KY/CHRISTIAN
 GC1100  USGS QUAD   -  OAK GROVE (1982)
 GC1100
 GC1100                          *CURRENT SURVEY CONTROL
 GC1100
 GC1100* NAD 83(1986)-  36 43 14.      (N)     087 27 18.      (W)      SCALED
 GC1100* NAVD 88     -       178.635   (meters)      586.07    (feet)   ADJUSTED
 GC1100
 GC1100  GEOID HEIGHT-          -29.57  (meters)                         GEOID09
 GC1100  DYNAMIC HT  -          178.491 (meters)      585.60    (feet)   COMP
 GC1100  MODELED GRAV-      979,820.8   (mgal)                           NAVD 88
 GC1100
 GC1100  VERT ORDER  -  FIRST     CLASS II
 GC1100
 GC1100.The horizontal coordinates were scaled from a topographic map and have
 GC1100.an estimated accuracy of +/- 6 seconds.
 GC1100
 GC1100.The orthometric height was determined by differential leveling and
 GC1100.adjusted in June 1991.
 GC1100
 GC1100.The geoid height was determined by GEOID09.
 GC1100
 GC1100.The dynamic height is computed by dividing the NAVD 88
 GC1100.geopotential number by the normal gravity value computed on the
 GC1100.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 GC1100.degrees latitude (g = 980.6199 gals.).
 GC1100
 GC1100.The modeled gravity was interpolated from observed gravity values.
 GC1100
 GC1100;                      North         East      Units  Estimated Accuracy
 GC1100;SPC KY1Z      - 1,044,370.    1,347,670.       MT  (+/- 180 meters Scaled)
 GC1100
 GC1100                          SUPERSEDED SURVEY CONTROL
 GC1100
 GC1100  NGVD 29 (??/??/92)  178.666  (m)           586.17    (f) ADJ UNCH    1 2
 GC1100
 GC1100.Superseded values are not recommended for survey control.
 GC1100.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 GC1100.See file dsdata.txt to determine how the superseded data were derived.
 GC1100
 GC1100 U.S. NATIONAL GRID SPATIAL ADDRESS: 16SDF593639(NAD 83)
 GC1100 MARKER: DB = BENCH MARK DISK
 GC1100 SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
 GC1100 SP_SET: SET IN TOP OF CONCRETE MONUMENT
 GC1100 STAMPING: M 133 1949
 GC1100 STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
 GC1100+STABILITY: SURFACE MOTION
 GC1100 SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 GC1100+SATELLITE: SATELLITE OBSERVATIONS - April 07, 2010
 GC1100
 GC1100  HISTORY     - Date     Condition        Report By
 GC1100  HISTORY     - 1949     MONUMENTED       CGS
 GC1100  HISTORY     - 1968     GOOD             NGS
 GC1100  HISTORY     - 20020702 GOOD             KYDT
 GC1100  HISTORY     - 20100407 GOOD             AEROME
```

```
GC1100
GC1100                          STATION DESCRIPTION
GC1100
GC1100'DESCRIBED BY COAST AND GEODETIC SURVEY 1949
GC1100'10.8 MI S FROM HOPKINSVILLE.
GC1100'10.75 MILES SOUTH ALONG THE TENNESSEE CENTRAL RAILWAY FROM
GC1100'THE JUNCTION OF THE ILLINOIS CENTRAL RAILROAD AT HOPKINSVILLE,
GC1100'ABOUT 0.9 MILE SOUTH OF A ROAD CROSSING AND FIDELIO AND JOHN G.
GC1100'MOSS GROCERY STORE, AT A PUBLIC EAST-WEST GRAVEL ROAD CROSSING,
GC1100'44.8 FEET EAST OF THE EAST RAIL, 38 FEET SOUTH OF THE CENTER
GC1100'LINE OF THE GRAVEL ROAD, 78 FEET SOUTHEAST OF THE CENTER OF THE
GC1100'CROSSING, 21.5 FEET SOUTH OF A FENCE CORNER, 29 FEET SOUTH OF A
GC1100'TELEPHONE POLE, 1 FOOT WEST OF A FENCE LINE, 2 FEET NORTH OF A
GC1100'WHITE WOODEN WITNESS POST, 1 1/2 FEET BELOW THE TRACK AND SET
GC1100'IN THE TOP OF A CONCRETE POST PROJECTING 4 INCHES.
GC1100
GC1100                          STATION RECOVERY (1968)
GC1100
GC1100'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1968
GC1100'RECOVERED IN GOOD CONDITION.
GC1100
GC1100                          STATION RECOVERY (2002)
GC1100
GC1100'RECOVERY NOTE BY KENTUCKY DEPARTMENT OF TRANSPORTATION 2002 (RDH)
GC1100'MARK IS AT THE CROSSING OF KY 1453, 41.8 FEET SOUTH OF CENTERLINE OF
GC1100'ROAD, 81.5 FEET SOUTHEAST OF CENTER OF CROSSING, 18 FEET SOUTH OF A
GC1100'FENCE CORNER, 30.2 FEET SOUTH OF A TELEPHONE POLE, 4 FEET WEST OF
GC1100'FENCE, 1.5 FEET WEST OF A US ARMY CORPS OF ENGINEERS FIBERGLASS
GC1100'WITNESS POST AND FLUSH WITH GROUND.
GC1100
GC1100                          STATION RECOVERY (2010)
GC1100
GC1100'RECOVERY NOTE BY AERO METRIC INC 2010
GC1100'RECOVERED IN GOOD CONDITION.

*** retrieval complete.
Elapsed Time = 00:00:00
```

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
DATABASE =  ,PROGRAM = datasheet, VERSION = 7.85
1        National Geodetic Survey,   Retrieval Date = MAY 16, 2010
 GC1208 ***********************************************************************
 GC1208  DESIGNATION -  R 392
 GC1208  PID         -  GC1208
 GC1208  STATE/COUNTY-  KY/TODD
 GC1208  USGS QUAD   -  PEMBROKE (1981)
 GC1208
 GC1208                          *CURRENT SURVEY CONTROL
 GC1208
 GC1208  ______________________________________________________________________
 GC1208* NAD 83(1986)-  36 50 33.      (N)     087 15 46.      (W)      SCALED
 GC1208* NAVD 88      -       182.871  (meters)      599.97    (feet)   ADJUSTED
 GC1208  ______________________________________________________________________
 GC1208  GEOID HEIGHT-          -29.63  (meters)                         GEOID09
 GC1208  DYNAMIC HT  -         182.727  (meters)      599.50    (feet)   COMP
 GC1208  MODELED GRAV-     979,836.8    (mgal)                           NAVD 88
 GC1208
 GC1208  VERT ORDER  -  FIRST     CLASS I
 GC1208
 GC1208.The horizontal coordinates were scaled from a topographic map and have
 GC1208.an estimated accuracy of +/- 6 seconds.
 GC1208
 GC1208.The orthometric height was determined by differential leveling and
 GC1208.adjusted in June 1991.
 GC1208
 GC1208.The geoid height was determined by GEOID09.
 GC1208
 GC1208.The dynamic height is computed by dividing the NAVD 88
 GC1208.geopotential number by the normal gravity value computed on the
 GC1208.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 GC1208.degrees latitude (g = 980.6199 gals.).
 GC1208
 GC1208.The modeled gravity was interpolated from observed gravity values.
 GC1208
 GC1208;                     North         East     Units  Estimated Accuracy
 GC1208;SPC KY1Z      - 1,057,610.    1,365,070.      MT  (+/- 180 meters Scaled)
 GC1208
 GC1208                          SUPERSEDED SURVEY CONTROL
 GC1208
 GC1208  NGVD 29 (??/??/92)  182.947  (m)           600.22    (f) ADJ UNCH    1 1
 GC1208
 GC1208.Superseded values are not recommended for survey control.
 GC1208.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 GC1208.See file dsdata.txt to determine how the superseded data were derived.
 GC1208
 GC1208_U.S. NATIONAL GRID SPATIAL ADDRESS: 16SDF765774(NAD 83)
 GC1208_MARKER: DB = BENCH MARK DISK
 GC1208_SETTING: 30 = SET IN A LIGHT STRUCTURE
 GC1208_SP_SET: CULVERT
 GC1208_STAMPING: R 392 1968
 GC1208_STABILITY: D = MARK OF QUESTIONABLE OR UNKNOWN STABILITY
 GC1208_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 GC1208+SATELLITE: SATELLITE OBSERVATIONS - April 06, 2010
 GC1208
 GC1208  HISTORY     - Date     Condition        Report By
 GC1208  HISTORY     - 1968     MONUMENTED       CGS
 GC1208  HISTORY     - 20100406 GOOD             AEROME
 GC1208
 GC1208                          STATION DESCRIPTION
 GC1208
```

GC1208'DESCRIBED BY COAST AND GEODETIC SURVEY 1968
GC1208'2.1 MI E FROM FAIRVIEW.
GC1208'ABOUT 2.1 MILES EAST ALONG U.S. HIGHWAY 68 AND STATE HIGHWAY 80
GC1208'FROM THE JEFFERSON DAVIS MONUMENT AT FAIRVIEW, 100 YARDS EAST OF
GC1208'THE EAST END OF A CURVE IN THE HIGHWAY, 19 1/2 FEET NORTH OF
GC1208'THE CENTERLINE OF THE HIGHWAY, SET IN THE TOP OF THE WEST END OF
GC1208'THE NORTH HEADWALL OF THE MORE WESTERLY OF TWO CONCRETE CULVERTS
GC1208'UNDER THE HIGHWAY, AND ABOUT LEVEL WITH THE HIGHWAY.
GC1208
GC1208 STATION RECOVERY (2010)
GC1208
GC1208'RECOVERY NOTE BY AERO METRIC INC 2010
GC1208'RECOVERED IN GOOD CONDITION.

*** retrieval complete.
Elapsed Time = 00:00:00

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
DATABASE =  ,PROGRAM = datasheet, VERSION = 7.85
1        National Geodetic Survey,   Retrieval Date = MAY 16, 2010
 DK3316 ***********************************************************************
 DK3316  CORS         -  This is a GPS Continuously Operating Reference Station.
 DK3316  DESIGNATION  -  KY HWY DIST 2 CORS ARP
 DK3316  CORS_ID      -  KYTB
 DK3316  PID          -  DK3316
 DK3316  STATE/COUNTY-  KY/HOPKINS
 DK3316  USGS QUAD    -  MADISONVILLE EAST (1978)
 DK3316
 DK3316                          *CURRENT SURVEY CONTROL
 DK3316
 DK3316* NAD 83(CORS)-  37 21 11.58294(N)     087 29 48.30971(W)      ADJUSTED
 DK3316* NAVD 88      -       165.4    (meters)      543.      (feet)  GPS OBS
 DK3316
 DK3316  EPOCH DATE   -         2002.00
 DK3316  X            -     221,717.457 (meters)                      COMP
 DK3316  Y            -  -5,071,568.696 (meters)                      COMP
 DK3316  Z            -   3,848,709.141 (meters)                      COMP
 DK3316  ELLIP HEIGHT-         135.243 (meters)          (04/??/08)  ADJUSTED
 DK3316  GEOID HEIGHT-         -30.09  (meters)                      GEOID09
 DK3316  HORZ ORDER   -  SPECIAL (CORS)
 DK3316  ELLP ORDER   -  SPECIAL (CORS)
 DK3316
 DK3316.ITRF positions are available for this station.
 DK3316.The coordinates were established by GPS observations
 DK3316.and adjusted by the National Geodetic Survey in April 2008.
 DK3316.The coordinates are valid at the epoch date displayed above.
 DK3316.The epoch date for horizontal control is a decimal equivalence
 DK3316.of Year/Month/Day.
 DK3316
 DK3316.The orthometric height was determined by GPS observations and a
 DK3316.high-resolution geoid model.
 DK3316
 DK3316.The PID for the CORS L1 Phase Center is DK3317.
 DK3316
 DK3316.The XYZ, and position/ellipsoidal ht. are equivalent.
 DK3316
 DK3316.The ellipsoidal height was determined by GPS observations
 DK3316.and is referenced to NAD 83.
 DK3316
 DK3316.The geoid height was determined by GEOID09.
 DK3316
 DK3316;                    North         East      Units Scale Factor Converg.
 DK3316;SPC KY1Z     - 1,114,638.539 1,345,258.118   MT  0.99994636   -1 04 20.8
 DK3316;SPC KY1Z     - 3,656,943.27  4,413,567.68    sFT  0.99994636   -1 04 20.8
 DK3316;SPC KY S     -   614,611.329   345,258.039   MT  0.99994546   -1 03 33.6
 DK3316;SPC KY S     - 2,016,437.34  1,132,734.08    sFT  0.99994546   -1 03 33.6
 DK3316
 DK3316!             -  Elev Factor  x  Scale Factor =   Combined Factor
 DK3316!SPC KY1Z     -   0.99997878  x   0.99994636  =   0.99992514
 DK3316!SPC KY S     -   0.99997878  x   0.99994546  =   0.99992424
 DK3316
 DK3316                          SUPERSEDED SURVEY CONTROL
 DK3316
 DK3316.No superseded survey control is available for this station.
 DK3316
 DK3316 U.S. NATIONAL GRID SPATIAL ADDRESS: 16SDG5600634172(NAD 83)
 DK3316 MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
 DK3316
```

```
DK3316                          STATION DESCRIPTION
DK3316
DK3316'DESCRIBED BY NATIONAL GEODETIC SURVEY 2008
DK3316'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
DK3316'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
DK3316'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
DK3316'    FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
DK3316'    HTTP://WWW.NGS.NOAA.GOV/CORS.

*** retrieval complete.
Elapsed Time = 00:00:00
```

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
DATABASE =  ,PROGRAM = datasheet, VERSION = 7.85
1        National Geodetic Survey,   Retrieval Date = MAY 16, 2010
 DK3318 ***********************************************************************
 DK3318  CORS         -  This is a GPS Continuously Operating Reference Station.
 DK3318  DESIGNATION -  KY HWY DIST 3 CORS ARP
 DK3318  CORS_ID      -  KYTC
 DK3318  PID          -  DK3318
 DK3318  STATE/COUNTY-  KY/WARREN
 DK3318  USGS QUAD    -  BOWLING GREEN SOUTH (1993)
 DK3318
 DK3318                          *CURRENT SURVEY CONTROL
 DK3318
 DK3318* NAD 83(CORS)-  36 59 20.97709(N)     086 28 28.19418(W)      ADJUSTED
 DK3318* NAVD 88      -              **(meters)             **(feet)
 DK3318
 DK3318  EPOCH DATE   -         2002.00
 DK3318  X            -     313,663.062 (meters)                      COMP
 DK3318  Y            -  -5,091,157.201 (meters)                      COMP
 DK3318  Z            -   3,816,502.684 (meters)                      COMP
 DK3318  ELLIP HEIGHT-         116.877 (meters)          (04/??/08) ADJUSTED
 DK3318  GEOID HEIGHT-         -30.42  (meters)                      GEOID09
 DK3318  HORZ ORDER   -  SPECIAL (CORS)
 DK3318  ELLP ORDER   -  SPECIAL (CORS)
 DK3318
 DK3318.ITRF positions are available for this station.
 DK3318.The coordinates were established by GPS observations
 DK3318.and adjusted by the National Geodetic Survey in April 2008.
 DK3318.The coordinates are valid at the epoch date displayed above.
 DK3318.The epoch date for horizontal control is a decimal equivalence
 DK3318.of Year/Month/Day.
 DK3318
 DK3318
 DK3318.The PID for the CORS L1 Phase Center is DK3319.
 DK3318
 DK3318.The XYZ, and position/ellipsoidal ht. are equivalent.
 DK3318
 DK3318.The ellipsoidal height was determined by GPS observations
 DK3318.and is referenced to NAD 83.
 DK3318
 DK3318.The geoid height was determined by GEOID09.
 DK3318
 DK3318;                    North         East      Units Scale Factor Converg.
 DK3318;SPC KY1Z     - 1,073,038.028 1,435,501.143   MT  1.00002387   -0 26 41.3
 DK3318;SPC KY1Z     - 3,520,458.93  4,709,640.00   sFT  1.00002387   -0 26 41.3
 DK3318;SPC KY S     -   573,026.674   435,505.026   MT  0.99996342   -0 26 21.8
 DK3318;SPC KY S     - 1,880,005.01  1,428,819.41   sFT  0.99996342   -0 26 21.8
 DK3318
 DK3318!             -  Elev Factor  x  Scale Factor =   Combined Factor
 DK3318!SPC KY1Z     -   0.99998166  x   1.00002387  =   1.00000553
 DK3318!SPC KY S     -   0.99998166  x   0.99996342  =   0.99994508
 DK3318
 DK3318                          SUPERSEDED SURVEY CONTROL
 DK3318
 DK3318.No superseded survey control is available for this station.
 DK3318
 DK3318 U.S. NATIONAL GRID SPATIAL ADDRESS: 16SEF4676393798(NAD 83)
 DK3318 MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
 DK3318
 DK3318                          STATION DESCRIPTION
 DK3318
```

```
DK3318'DESCRIBED BY NATIONAL GEODETIC SURVEY 2008
DK3318'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
DK3318'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
DK3318'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
DK3318'    FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
DK3318'    HTTP://WWW.NGS.NOAA.GOV/CORS.

*** retrieval complete.
Elapsed Time = 00:00:00
```

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
DATABASE =  ,PROGRAM = datasheet, VERSION = 7.85
1        National Geodetic Survey,   Retrieval Date = MAY 16, 2010
 DL6197 ***********************************************************************
 DL6197  CORS         -  This is a GPS Continuously Operating Reference Station.
 DL6197  DESIGNATION  -  TDOT DISTRICT 48 CORS ARP
 DL6197  CORS_ID      -  TN48
 DL6197  PID          -  DL6197
 DL6197  STATE/COUNTY-  TN/HENRY
 DL6197  USGS QUAD    -  PARIS (1986)
 DL6197
 DL6197                          *CURRENT SURVEY CONTROL
 DL6197
 DL6197* NAD 83(CORS)-  36 17 45.75598(N)     088 17 47.68131(W)      ADJUSTED
 DL6197* NAVD 88      -              **(meters)            **(feet)
 DL6197
 DL6197  EPOCH DATE   -        2002.00
 DL6197  X            -     152,990.802 (meters)                      COMP
 DL6197  Y            - -5,144,435.840 (meters)                      COMP
 DL6197  Z            -  3,754,782.450 (meters)                      COMP
 DL6197  ELLIP HEIGHT-        109.778 (meters)          (01/??/10) ADJUSTED
 DL6197  GEOID HEIGHT-        -28.44  (meters)                      GEOID09
 DL6197  HORZ ORDER   -  SPECIAL (CORS)
 DL6197  ELLP ORDER   -  SPECIAL (CORS)
 DL6197
 DL6197.ITRF positions are available for this station.
 DL6197.The coordinates were established by GPS observations
 DL6197.and adjusted by the National Geodetic Survey in January 2010.
 DL6197.The coordinates are valid at the epoch date displayed above.
 DL6197.The epoch date for horizontal control is a decimal equivalence
 DL6197.of Year/Month/Day.
 DL6197
 DL6197
 DL6197.The PID for the CORS L1 Phase Center is DL6198.
 DL6197
 DL6197.The XYZ, and position/ellipsoidal ht. are equivalent.
 DL6197
 DL6197.The ellipsoidal height was determined by GPS observations
 DL6197.and is referenced to NAD 83.
 DL6197
 DL6197.The geoid height was determined by GEOID09.
 DL6197
 DL6197;                    North         East      Units Scale Factor Converg.
 DL6197;SPC TN        -   220,184.029   393,731.618   MT  0.99998083   -1 20 40.2
 DL6197;SPC TN        -   722,387.10  1,291,767.82   sFT  0.99998083   -1 20 40.2
 DL6197
 DL6197!              -  Elev Factor  x  Scale Factor =   Combined Factor
 DL6197!SPC TN        -   0.99998277  x   0.99998083  =   0.99996360
 DL6197
 DL6197                          SUPERSEDED SURVEY CONTROL
 DL6197
 DL6197.No superseded survey control is available for this station.
 DL6197
 DL6197 U.S. NATIONAL GRID SPATIAL ADDRESS: 16SCF8357717564(NAD 83)
 DL6197 MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
 DL6197
 DL6197                          STATION DESCRIPTION
 DL6197
 DL6197'DESCRIBED BY NATIONAL GEODETIC SURVEY 2010
 DL6197'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
 DL6197'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
```

```
DL6197'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
DL6197'    FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
DL6197'    HTTP://WWW.NGS.NOAA.GOV/CORS.

*** retrieval complete.
Elapsed Time = 00:00:00
```

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base Control

PROJECT 1-100328 111.
OPERATOR MS
DATE 4.11.10

SITE NUMBER 1
SITE NAME GINN AZ MK

TRACKING TIMES (LOCAL) MEASURE ✓
START 7:16 a.
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 732
BATTERY NO. CG
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.248

STATION DESCRIPTIONS USC+GS cap/
conc. mon. "GINN 1960"

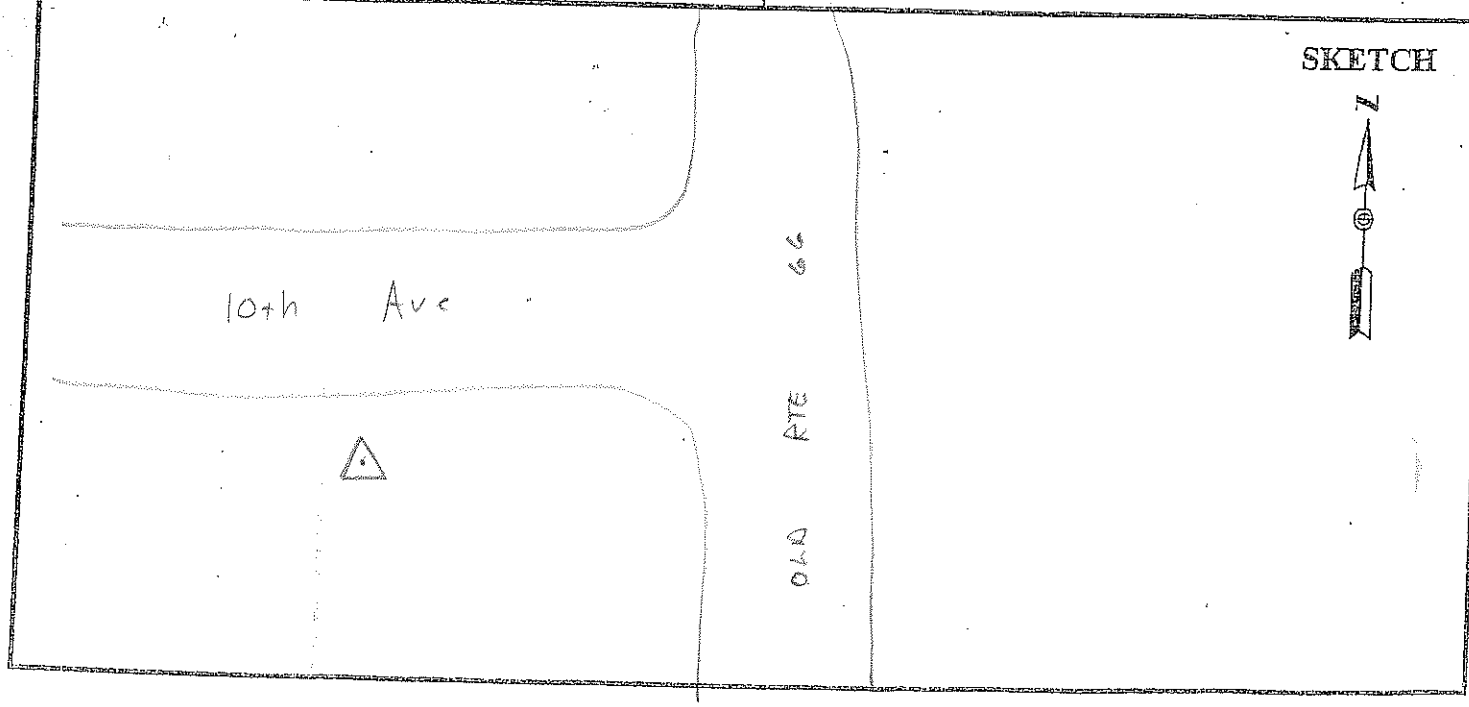
AT502 1608

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
716	2.4	7/8

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base

PROJECT 1-100328 111
OPERATOR MB
DATE 4-11-10

SITE NUMBER 1
SITE NAME 101

TRACKING TIMES (LOCAL) MEASURE _____
START 7:37a
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 704
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: Sign E

HEIGHT READINGS MTS FT
1.290
AT 502 1.650

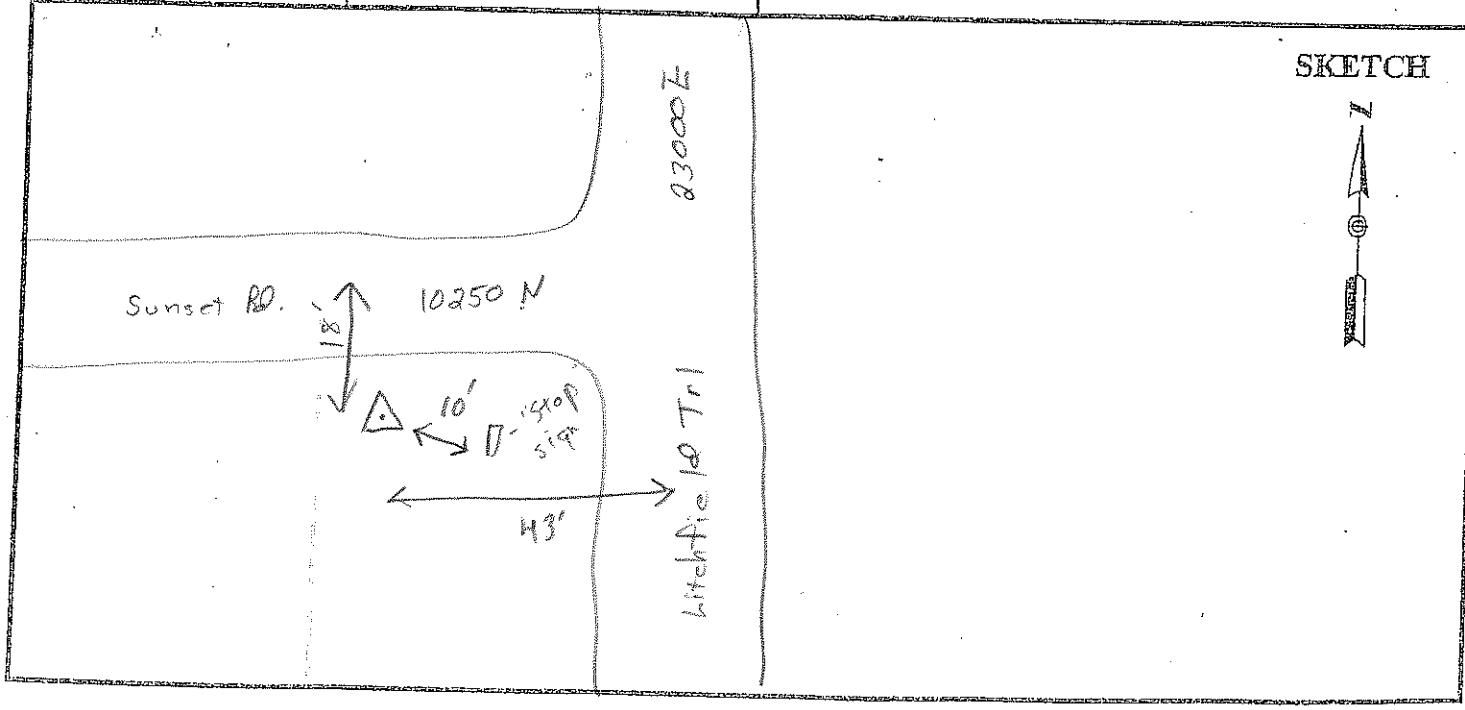
STATION DESCRIPTIONS set rebar + cap

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
737	4.6	7/7

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS
89 08 59.2
89 43 06.8

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 CONTROL

PROJECT 1-100328 III.
OPERATOR MB
DATE 4.11.10

SITE NUMBER 1
SITE NAME Q218

TRACKING TIMES (LOCAL) MEASURE ✓
START 8:41a.
STOP 9:36a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO. C18
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: RP east

HEIGHT READINGS MTS FT
1.231

STATION DESCRIPTIONS Fnd USC+GS
cap/conc mon. "Q 218
1960"

AT502 1.591

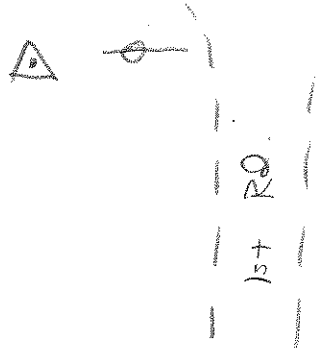
SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
841	2.3	7/7
936		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH

Montgomery Rd.



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 CONTROL

PROJECT 1-100328 111
OPERATOR NB
DATE 4.11.10

SITE NUMBER 2
SITE NAME T 93

TRACKING TIMES (LOCAL) MEASURE √
START 10:32a
STOP 11:05a

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: tree SW
pole E bldg NE

HEIGHT READINGS MTS FT
1.259

STATION DESCRIPTIONS fnd cap/conc. mon "T 93 1935"

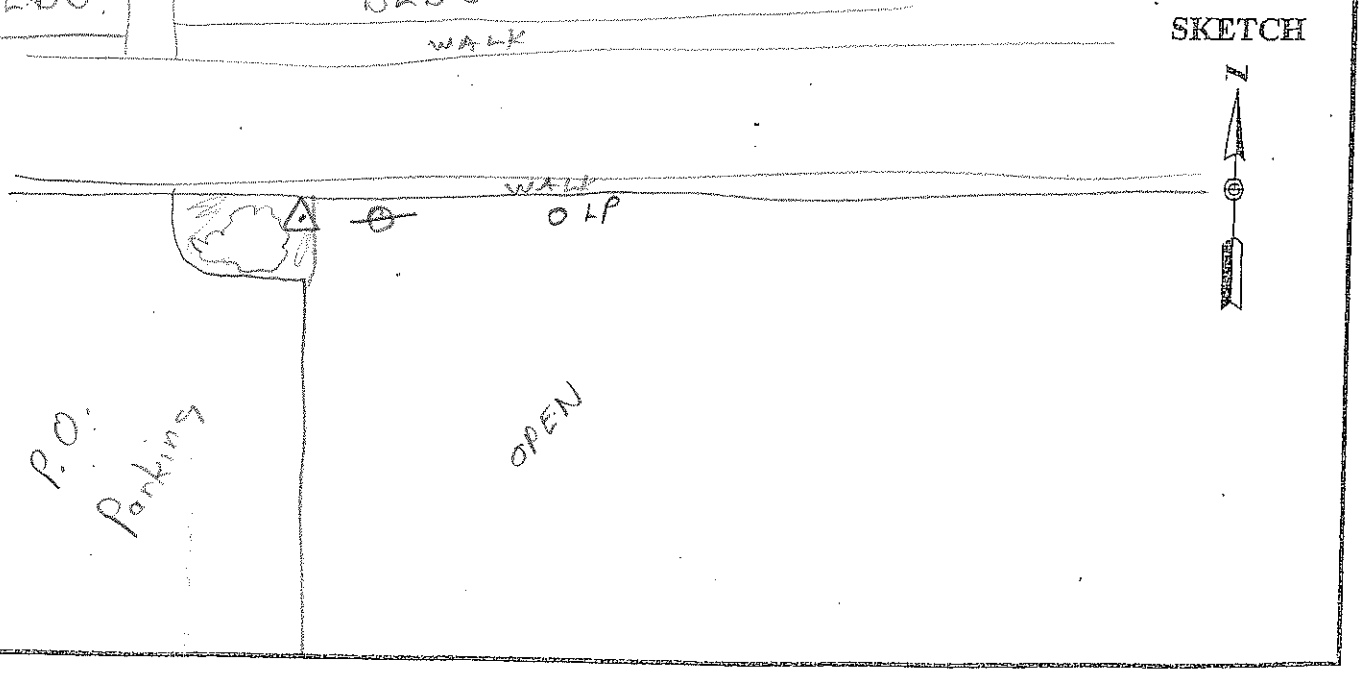
AT502 1619

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1032	2.0	9/9
1105		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

CONTROL

PROJECT 1-100328 111.
OPERATOR MB
DATE 4.11.10

SITE NUMBER 3
SITE NAME RENT

TRACKING TIMES (LOCAL) MEASURE V
START 11:48a
STOP 12:12p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: tree SE

HEIGHT READINGS MTS FT
1.328
1.688

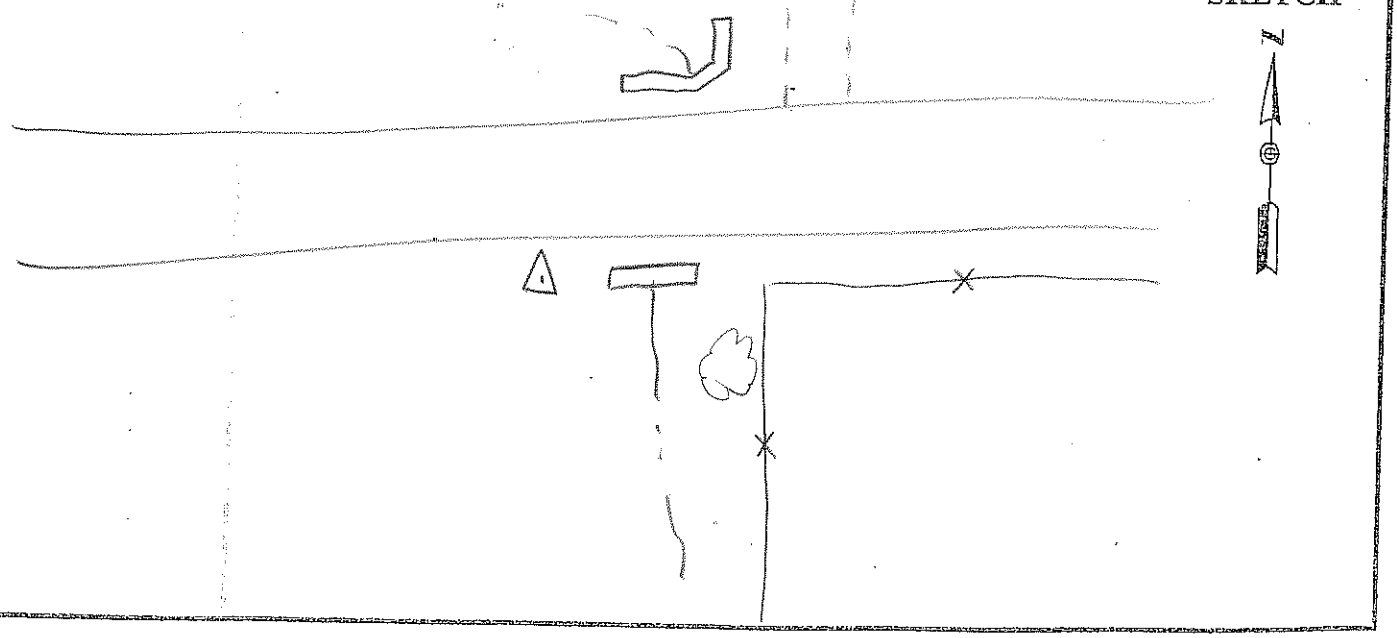
STATION DESCRIPTIONS fnd USC+GS
cap/con. cmon. "RENT 1960"

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1148	2.1	10/10
1212		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS
CAN BE USED AS A √PT.

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

VPT

lidar

PROJECT 1-100328 111
OPERATOR MB
DATE 4.11.10

SITE NUMBER 4
SITE NAME 1

TRACKING TIMES (LOCAL) MEASURE ✓
START 12:28 p
STOP 12:52 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO. CR
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
~~500~~ 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.360

STATION DESCRIPTIONS E bound lane

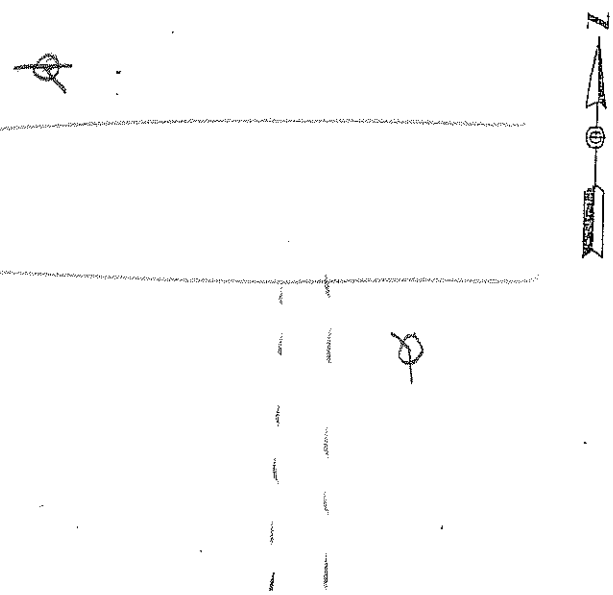
AT502 1.720

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1228	2.9	9/9
1252		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

lidar

PROJECT 1-100328 III
OPERATOR MB
DATE 4.11.10

SITE NUMBER 5
SITE NAME 2

TRACKING TIMES (LOCAL) MEASURE ✓
START 1:05 p
STOP 1:30 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.388

AT502 1.748

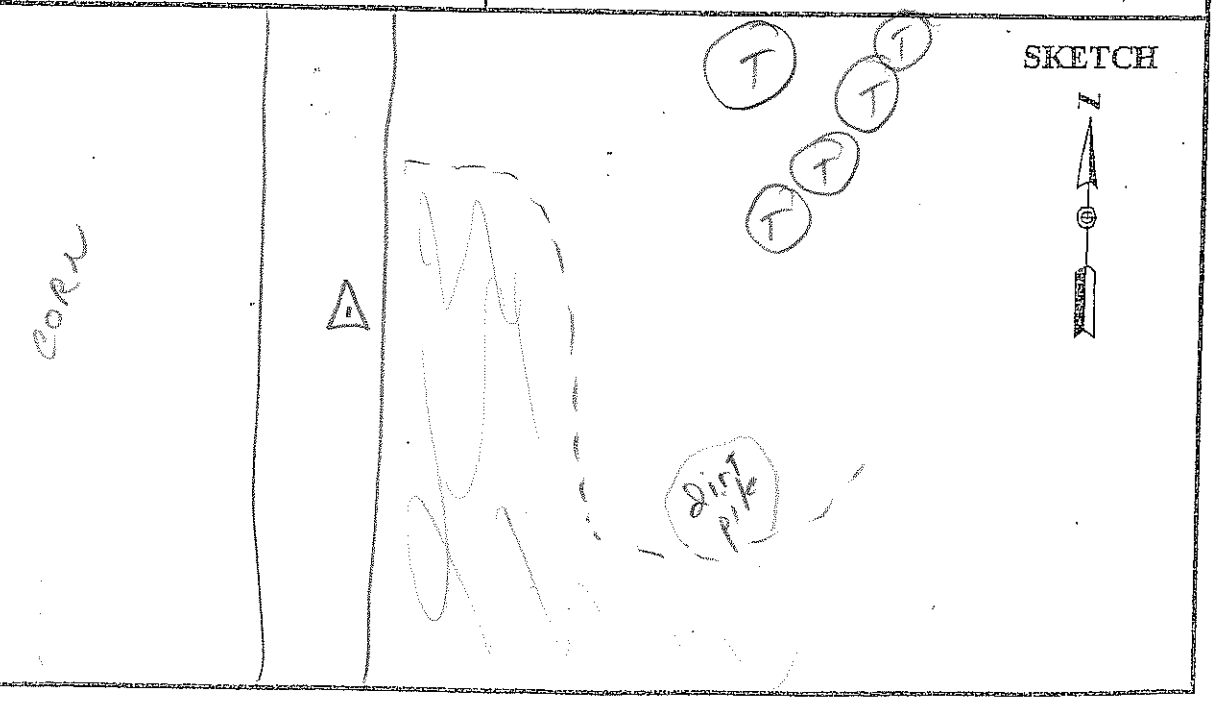
STATION DESCRIPTIONS N. bound lane

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1305	2.2	8/8
1330		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

✓ PT

1:2ar

PROJECT 1-100328 111
OPERATOR MB
DATE 4·11·10

SITE NUMBER 6
SITE NAME 3

TRACKING TIMES (LOCAL) MEASURE ✓
START 2:21 p
STOP 2:44 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/~~9500~~ ~~0.389~~
500 0.360

OBSTRUCTIONS: trees NW + E

HEIGHT READINGS MTS FT
1.388

STATION DESCRIPTIONS N. bound lane on bridge Deck

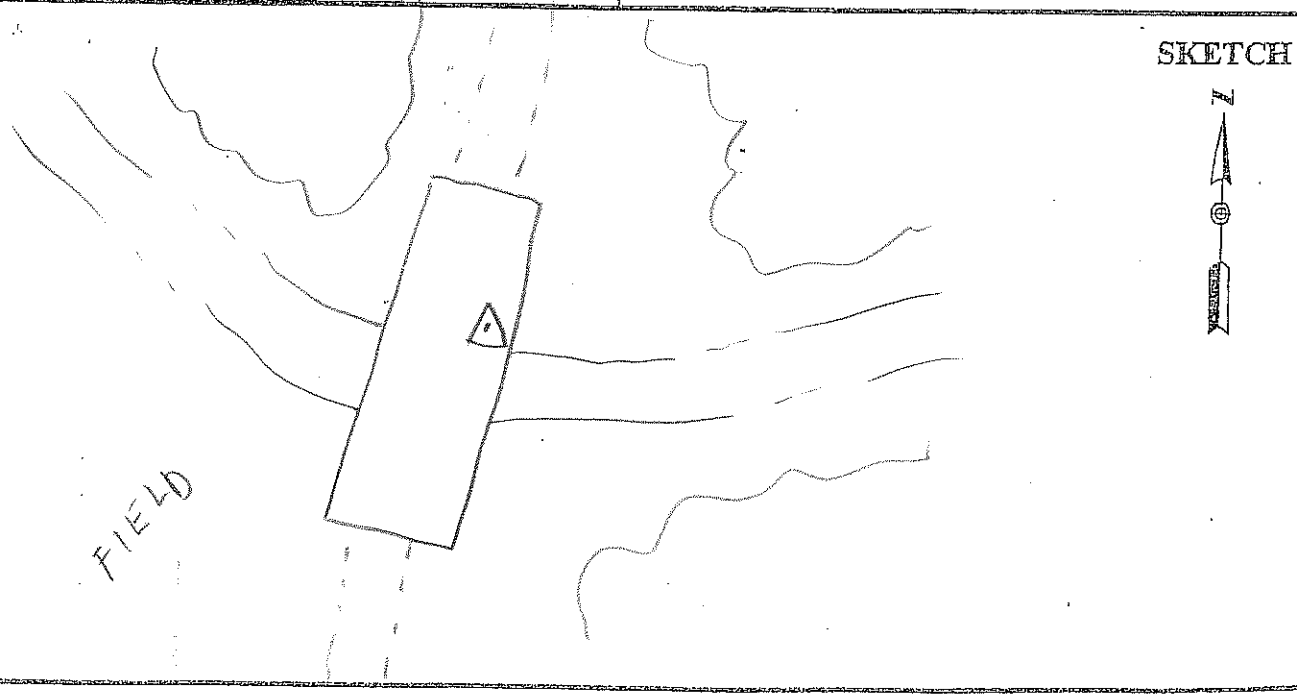
AT502 1.748

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1421	4.1	4/5
1444		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 ✓ PT lidar

PROJECT 1-100328 111
OPERATOR NB
DATE 4-11-10

SITE NUMBER 7
SITE NAME 4

TRACKING TIMES (LOCAL) MEASURE ✓
START 2:57 p
STOP 3:21 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.370

AT502 1.730

STATION DESCRIPTIONS in gravel field lane

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1457	2.1	8/8
1521		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base Control

PROJECT 1-100328 111.
OPERATOR MB
DATE 4.12.10

SITE NUMBER 1
SITE NAME GINN AZ MK

TRACKING TIMES (LOCAL) MEASURE _____
START 7:13a
STOP _____

SENSOR TYPE 500 9500 399 299
MEMORY CARD 732
BATTERY NO. CO
CONTROLLER NO. _____
SENSOR NO. _____

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
500 0.360

OBSTRUCTIONS: _____

HEIGHT READINGS MTS FT
1.250 _____

STATION DESCRIPTIONS _____

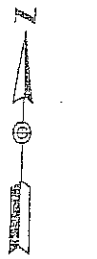
AT502 1.610

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
713	2.4	7/7

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



see previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base

PROJECT 1-100328 111.
OPERATOR MS
DATE 9.12.10

SITE NUMBER)
SITE NAME 101

TRACKING TIMES (LOCAL) MEASURE ✓
START 7:25a.
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 704
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.317

STATION DESCRIPTIONS

AT502 1677

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
725	4.0	7/7

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH

See previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 √PT 1:2 ar

PROJECT 1-100328 111.
OPERATOR MB
DATE 4. 12. 10

SITE NUMBER 1
SITE NAME 5

TRACKING TIMES (LOCAL) MEASURE ✓
START 7:41 a.
STOP 8:06 a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~800~~ ~~0.389~~ 0.360

OBSTRUCTIONS: tree E

HEIGHT READINGS MTS FT
1.425

STATION DESCRIPTIONS conc. pull off area

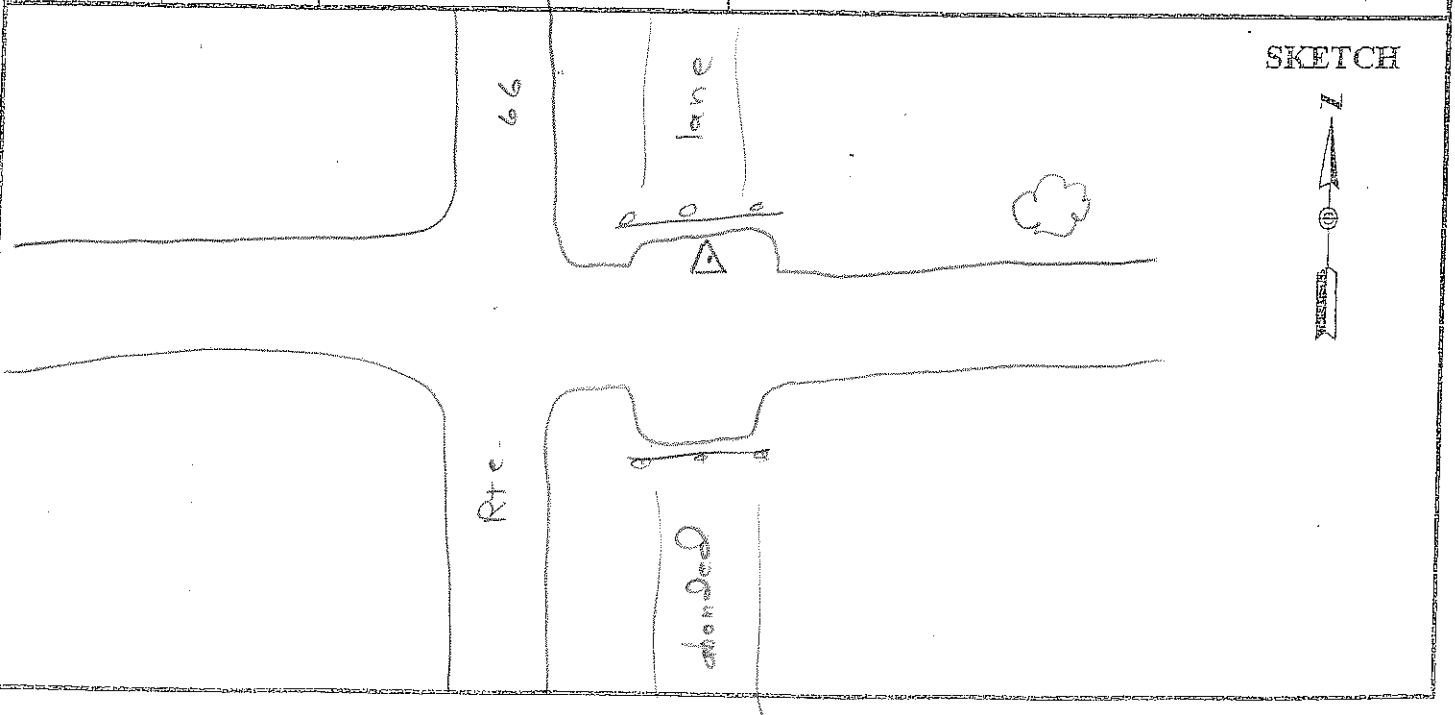
AT502 1785

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
741	4.8	7/7
806		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 1/FT. 1120

PROJECT I-100328 111.
OPERATOR MB
DATE 4.12.10

SITE NUMBER 2
SITE NAME 6

TRACKING TIMES (LOCAL) MEASURE ✓
START 8:19a.
STOP 8:39a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.410

STATION DESCRIPTIONS W. bound lane

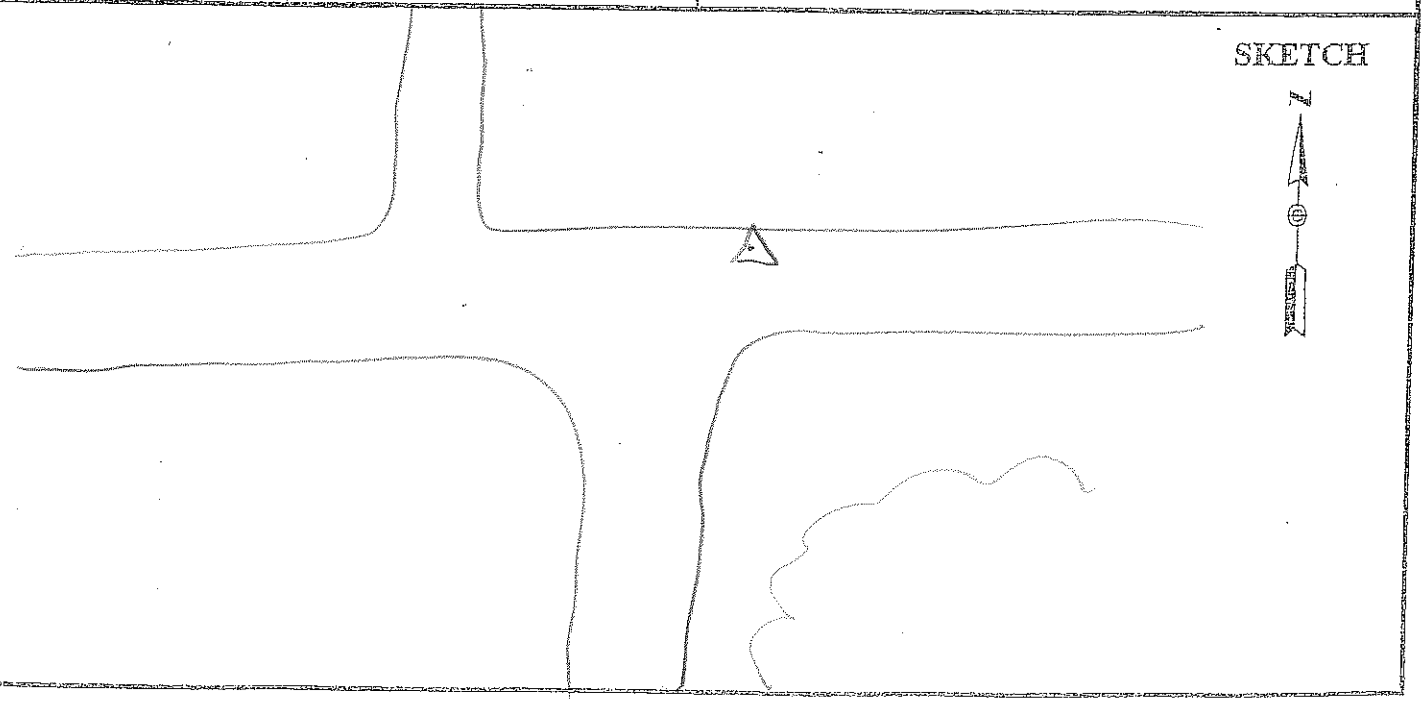
AT502 1.770

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
819	2.2	8/8
839		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 1 pt 1:20 pm

PROJECT 1-100328 111
OPERATOR NB
DATE 4.12.10

SITE NUMBER 3
SITE NAME 7

TRACKING TIMES (LOCAL) MEASURE ✓
START 8:51 a
STOP 9:11 a

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

HEIGHT READINGS MTS FT
1.402

AT502 1.762

OBSTRUCTIONS: none

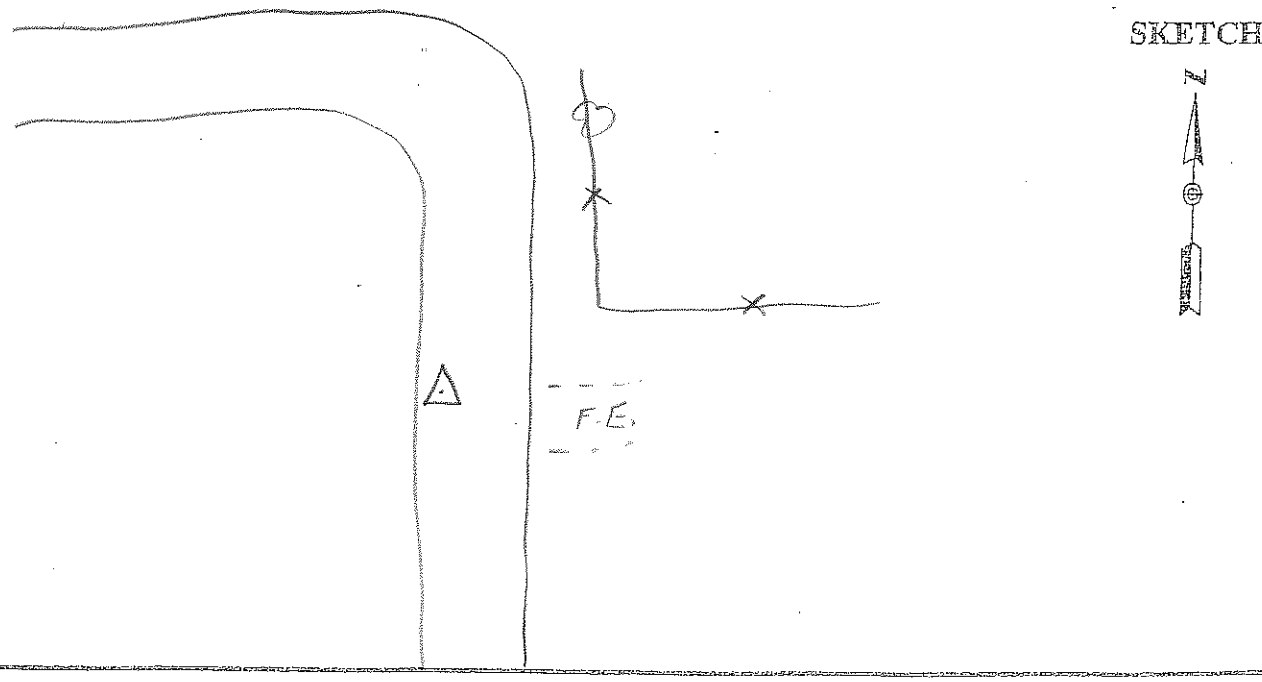
STATION DESCRIPTIONS S. bound lane

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
851	2.4	8/8
911		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 ✓PT lidar

PROJECT 1-006328 1H
OPERATOR NB
DATE 4·12·10

SITE NUMBER 4
SITE NAME 8

TRACKING TIMES (LOCAL) MEASURE _____
START 9:20a.
STOP 9:50a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

HEIGHT READINGS MTS FT
1.388

AT502 1748

OBSTRUCTIONS: Trees SW ⇄ NW

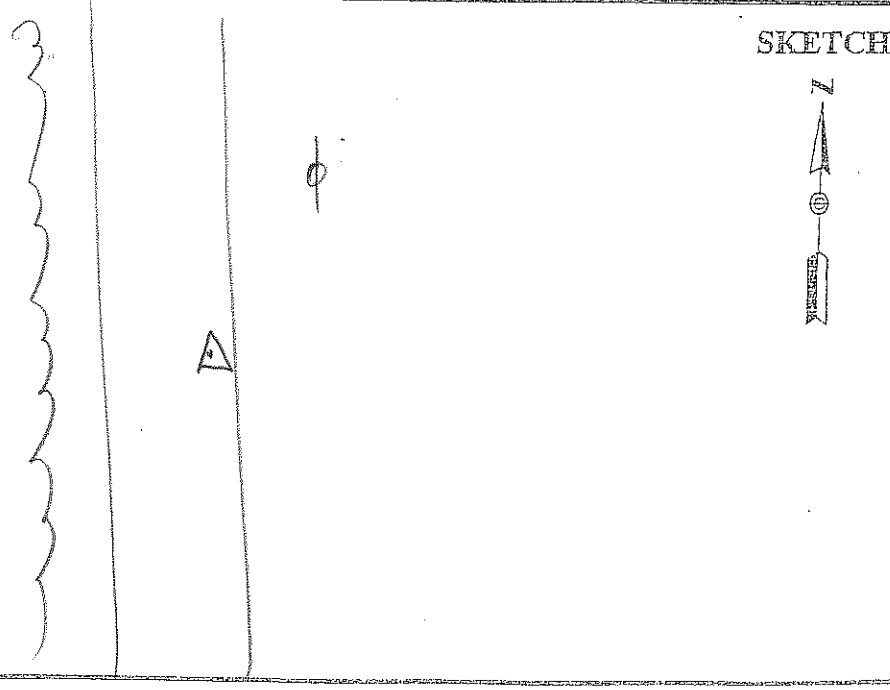
STATION DESCRIPTIONS N bound lane

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
932	3.3	6/6
950		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Lot lidar

PROJECT 1-100328 111
OPERATOR NB
DATE 4.12.10

SITE NUMBER 5
SITE NAME 9

TRACKING TIMES (LOCAL) MEASURE ______

START 9:59a

STOP 10:17a

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT

299/399	0.441
399E/9500	0.389
(500)	(0.360)

OBSTRUCTIONS: none

HEIGHT READINGS

MTS	FT
1.414	

AT502 1.774

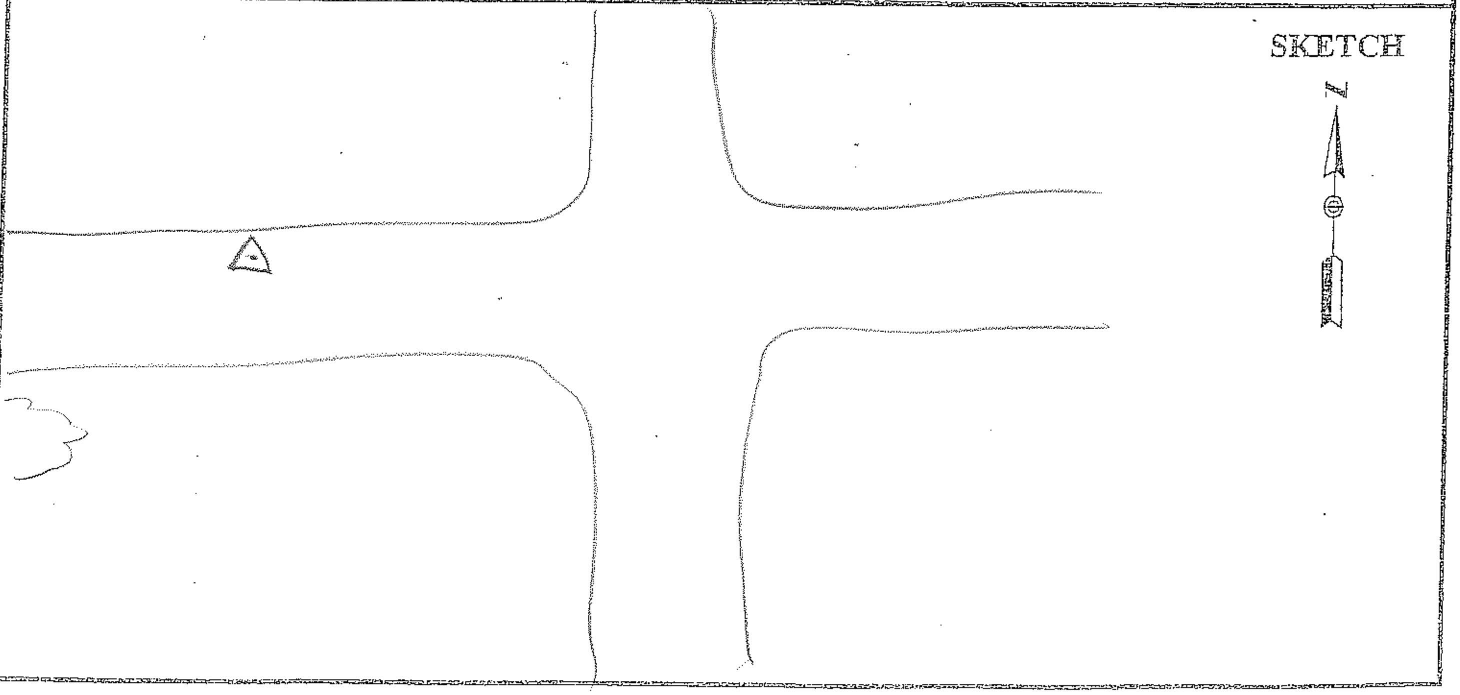
STATION DESCRIPTIONS E bound lane

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
959	1.9	9/9
1017		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 ✓ PT 1.2ac

PROJECT 1-100328 III.
OPERATOR MB
DATE 4-12-10

SITE NUMBER 6
SITE NAME 10

TRACKING TIMES (LOCAL) MEASURE _____
START 10:26a
STOP 10:43a

SENSOR TYPE 500 9500 399 299
MEMORY CARD 231
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
(500) ~~0.360~~

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.396

STATION DESCRIPTIONS W. bound lane

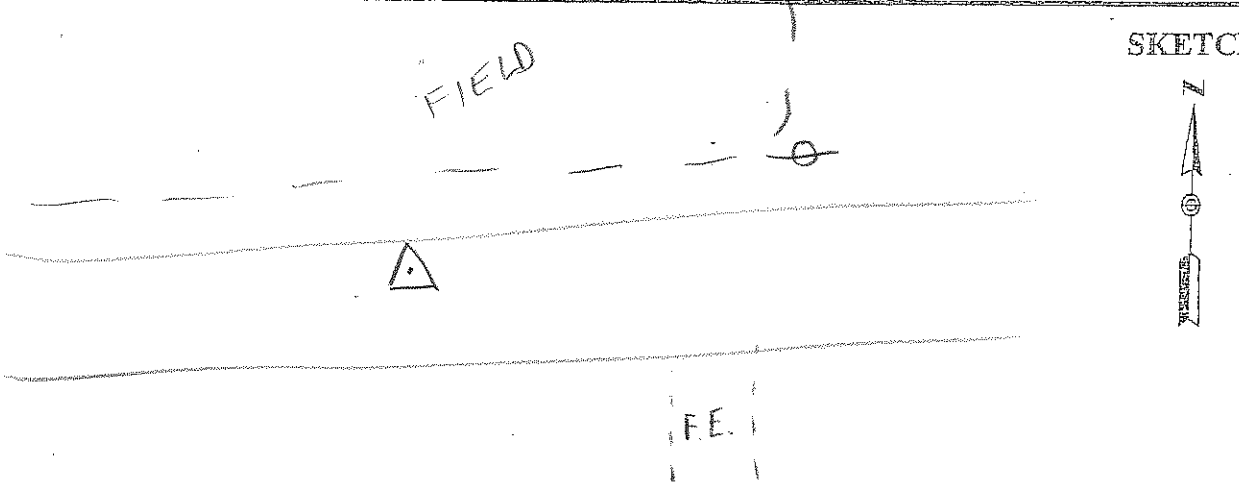
RT 502 1.756

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1026	7.5	10/10
1043		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 √pt 12ar

PROJECT 1-100328 111.
OPERATOR MB
DATE 4.12.10

SITE NUMBER 7
SITE NAME 11

TRACKING TIMES (LOCAL) MEASURE ✓
START 10:58a
STOP 11:16a

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.405

STATION DESCRIPTIONS N. bound lane

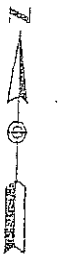
AT502 1.765

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1058	1.8	10/10
1116		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

√ pt lidar

PROJECT 1-100328 111
OPERATOR MB
DATE 4.12.10

SITE NUMBER 8
SITE NAME 12

TRACKING TIMES (LOCAL) MEASURE ✓
START 11:28 a.
STOP 11:44 a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: trees NW ↔ NE

HEIGHT READINGS MTS FT
1.414

STATION DESCRIPTIONS N. bound lane

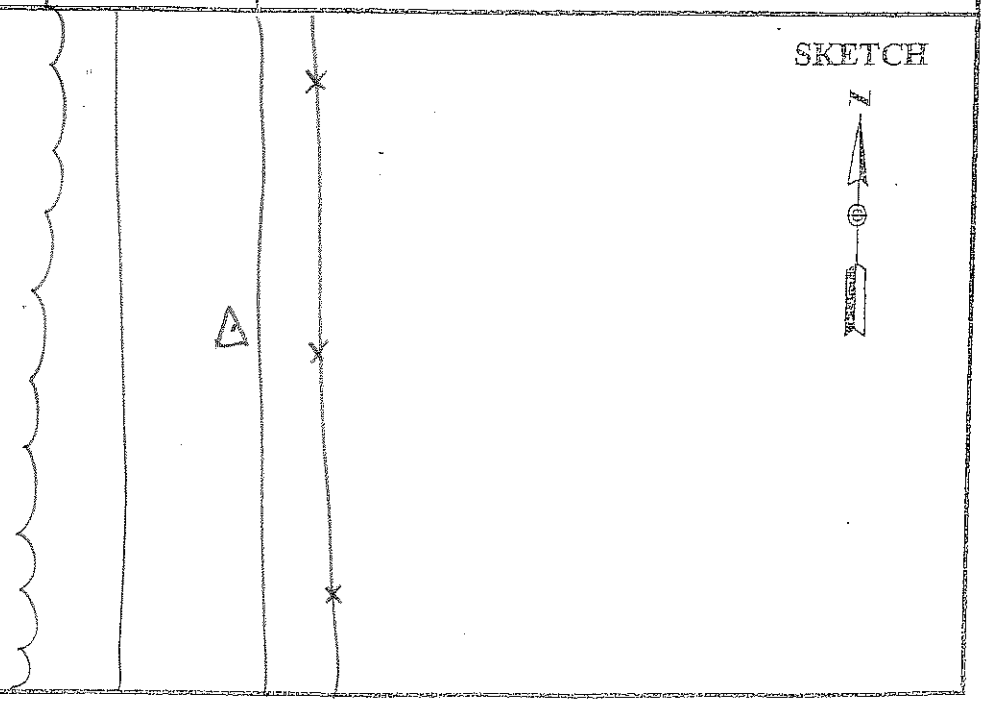
AT502 1.774

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1128	4.4	7/7
1144		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 √ PT lidar

PROJECT 1-100328 111	SITE NUMBER 9
OPERATOR MB	
DATE 4-12-10	SITE NAME 13

TRACKING TIMES (LOCAL) MEASURE ✓

START 11:55 a.

STOP 12:10 p

SENSOR TYPE 500 9500 399 299

MEMORY CARD 731

BATTERY NO.

CONTROLLER NO.

SENSOR NO.

SENSOR CONSTANT

299/399	0.441
~~399E/9500~~	~~0.389~~
(500)	(0.360)

OBSTRUCTIONS: none

HEIGHT READINGS

MTS	FT
1.373	

AT502 1.733

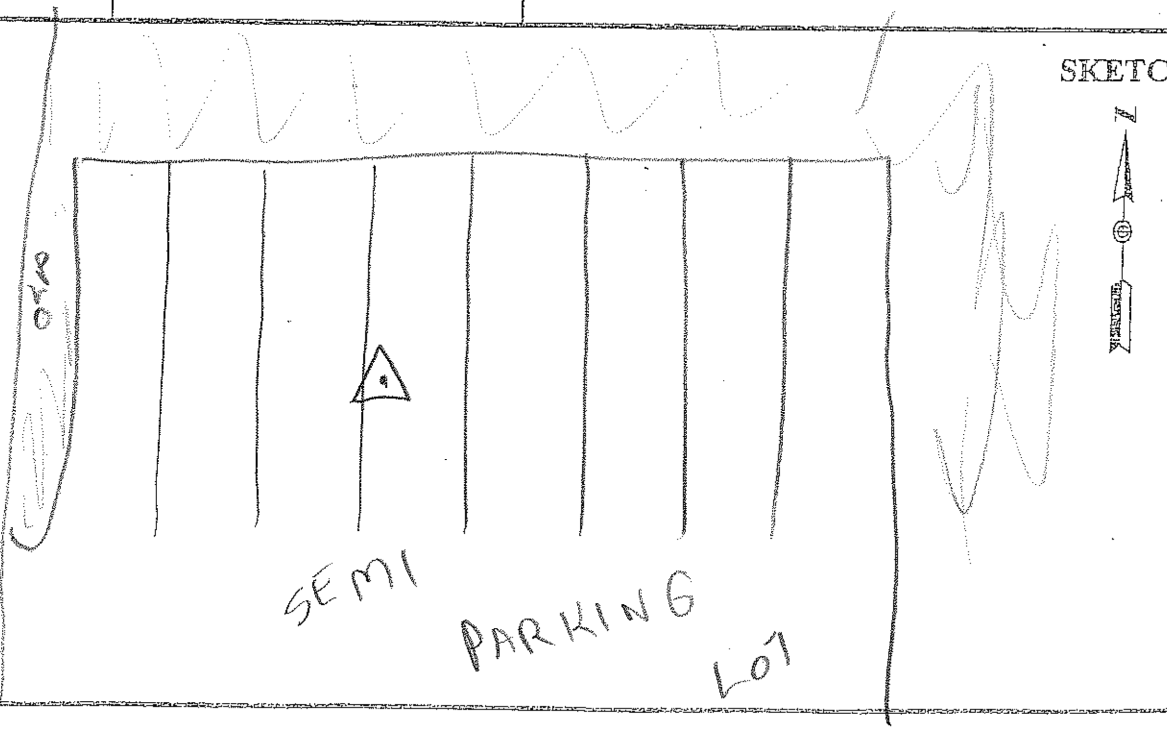
STATION DESCRIPTIONS parking lot

SATELLITE OBSERVATIONS

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

TIME	GDOP	SATELLITES
1155	5.7	10/11
1210		

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

✓PT lidar

PROJECT 1-100328 III.
OPERATOR MB
DATE 4.12.10

SITE NUMBER 10
SITE NAME 14

TRACKING TIMES (LOCAL) MEASURE ✓
START 12:19 p
STOP 12:35 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.437

STATION DESCRIPTIONS in parking lot

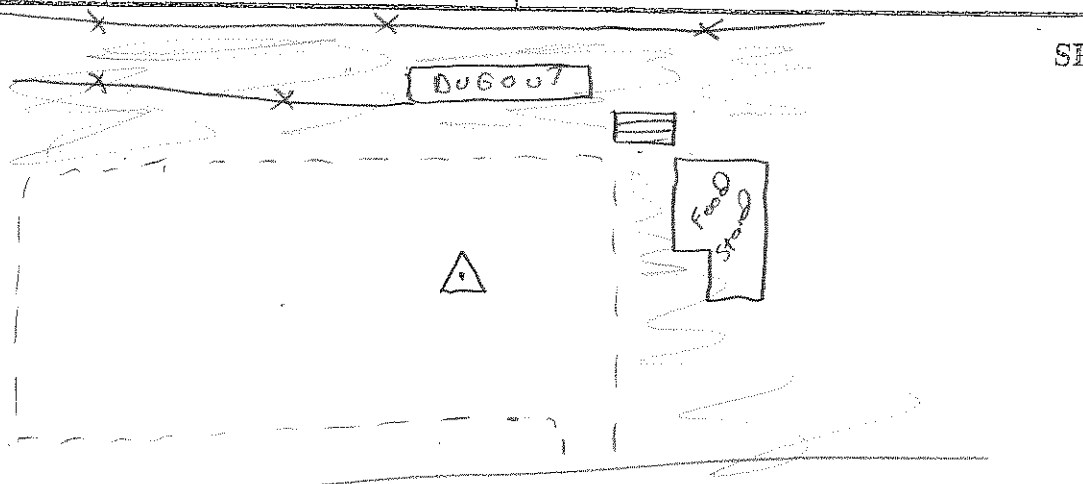
AT502 1797

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1219	53	7/8
1235		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

√FT 1:2ar

PROJECT 1-100328 111.
OPERATOR MB
DATE 4.12.10

SITE NUMBER 11
SITE NAME 15

TRACKING TIMES (LOCAL) MEASURE ____
START 12:48p
STOP 1:04p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.402

STATION DESCRIPTIONS W bound lane

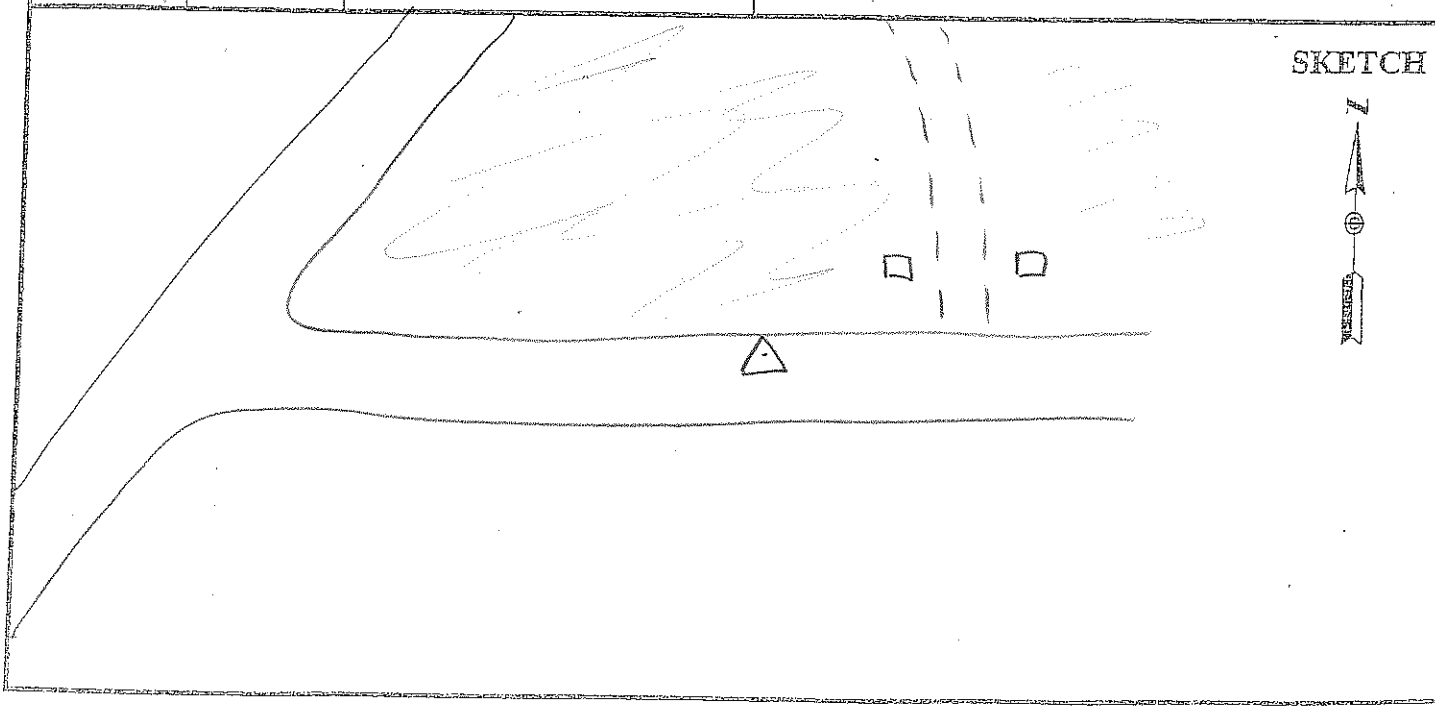
AT502 1.762

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1248	2.4	10/10
1304		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 √PT lidar

PROJECT 1-100328 111
OPERATOR NB
DATE 4.12.10

SITE NUMBER 12
SITE NAME 16

TRACKING TIMES (LOCAL) MEASURE √
START 1:12 p
STOP 1:29 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.339~~
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.430

AT502 1.790

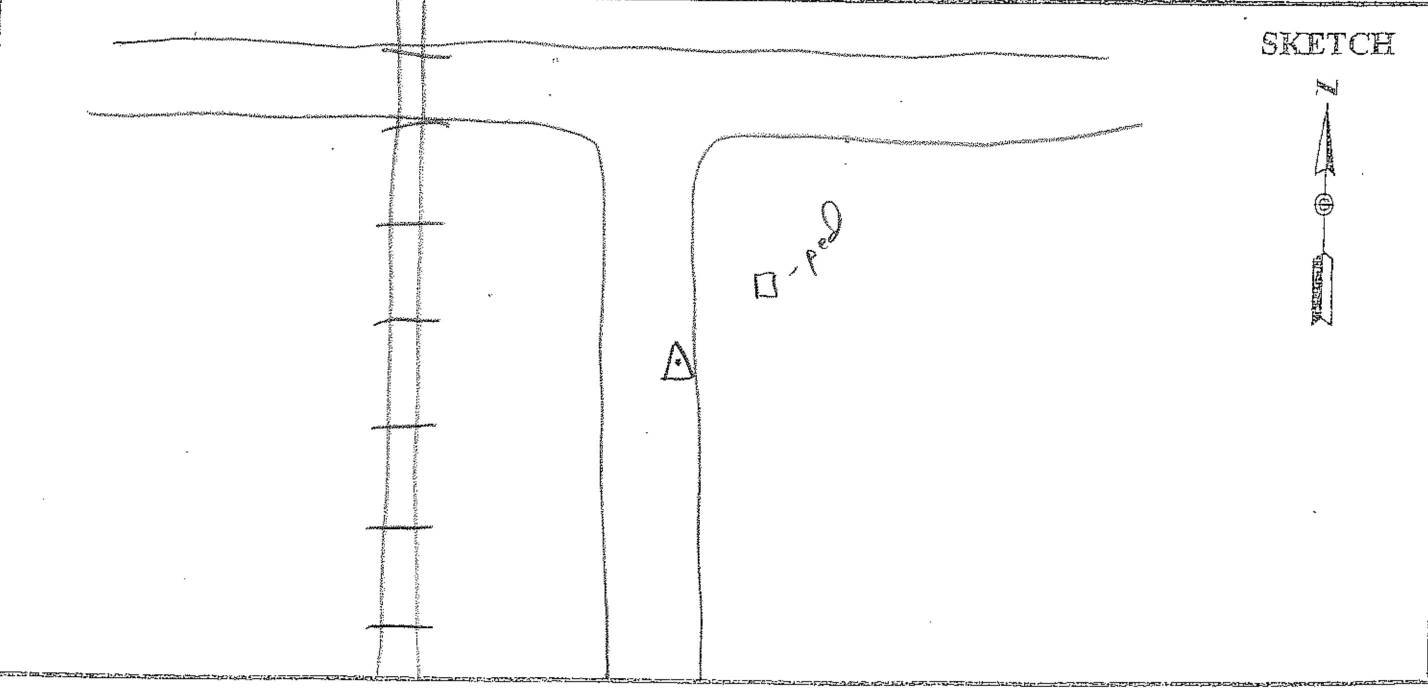
STATION DESCRIPTIONS N. bound lane

SATELLITE OBSERVATIONS

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

TIME	GDOP	SATELLITES
1312	2.2	8/8
1329		

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

✓PT lidar

PROJECT 1-100328 III
OPERATOR MB
DATE 9.12.10

SITE NUMBER 13
SITE NAME 17

TRACKING TIMES (LOCAL) MEASURE ✓
START 1:38 P
STOP 1:55 P

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.390

STATION DESCRIPTIONS in gravel area

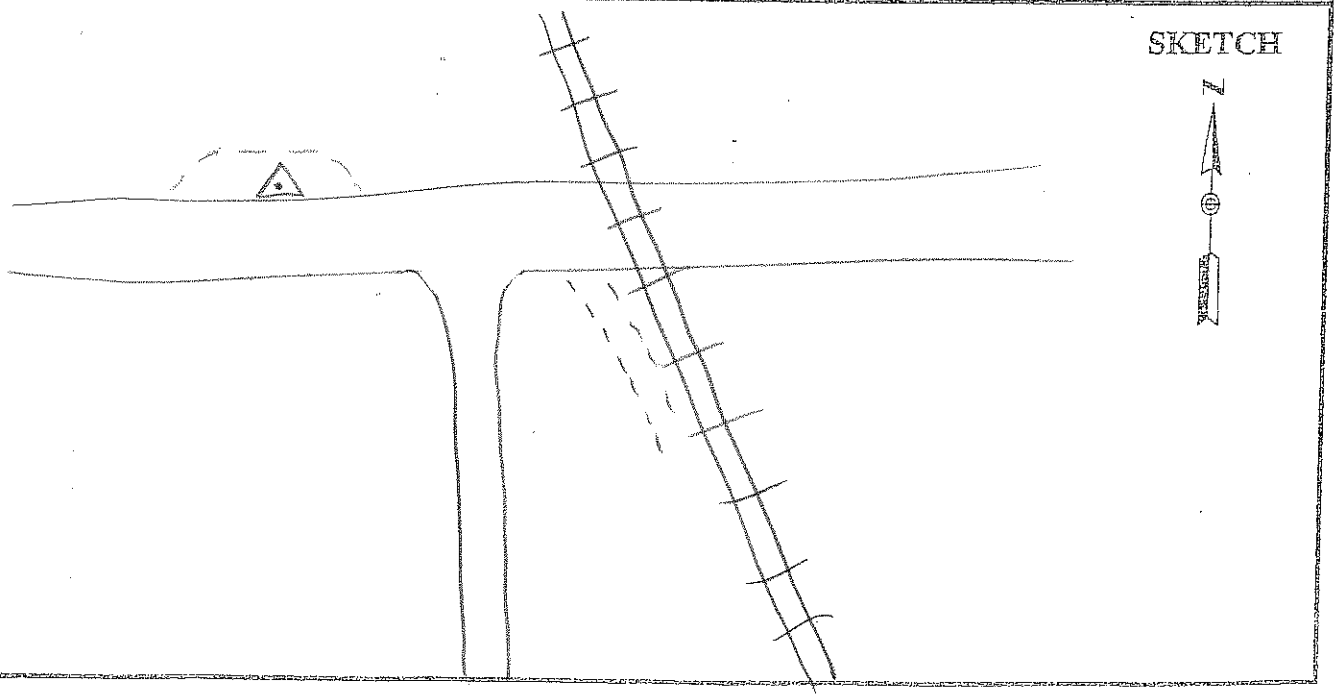
AT502 1.750

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1338	1.6	9/11
1355		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

1 pt 1 lidar

PROJECT 1-100328 III.
OPERATOR MB
DATE 4.12.10

SITE NUMBER 14
SITE NAME 18

TRACKING TIMES (LOCAL) MEASURE ✓
START 2:03 p
STOP 2:21 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.394

STATION DESCRIPTIONS W bound lane

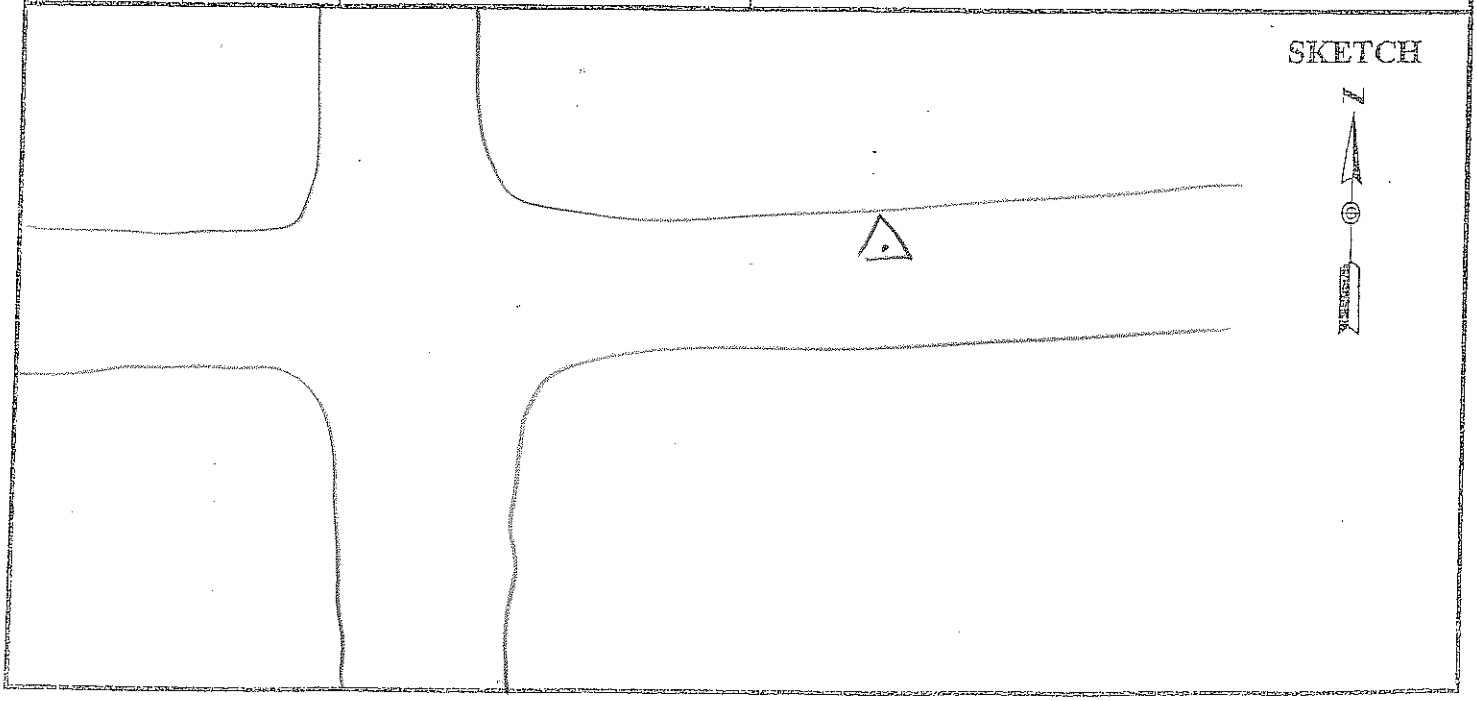
AT502 1.75 M

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1403	2.8	8/8
1421		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

✓ pt 1:0ac

PROJECT 1-100328 111.
OPERATOR MB
DATE 4-12-10

SITE NUMBER 15
SITE NAME 19

TRACKING TIMES (LOCAL) MEASURE ✓
START 2:32 p
STOP 2:49 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
~~500~~ ~~0.360~~

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.404

STATION DESCRIPTIONS SE cornerof intersection

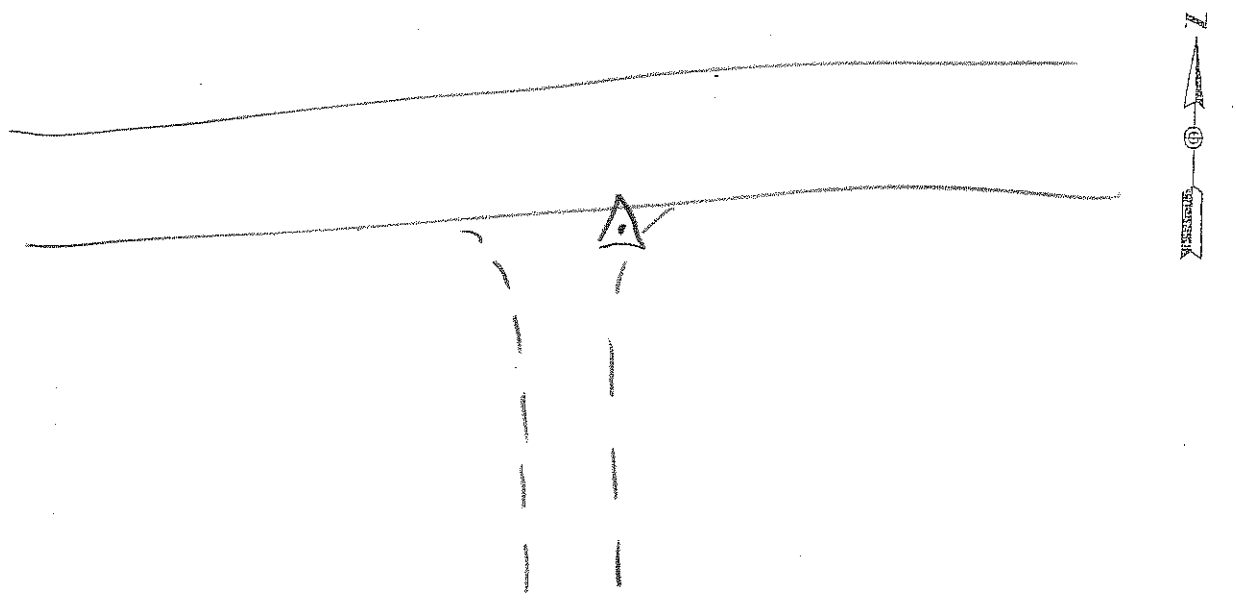
AT502 1.764

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1432	1.9	7/9
1449		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

√ pt 1:2ar

PROJECT 1-100328 111.
OPERATOR MB
DATE 4.12.10

SITE NUMBER 16
SITE NAME 20

TRACKING TIMES (LOCAL) MEASURE √
START 3:02 p
STOP 3:18 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.412

STATION DESCRIPTIONS N bound lane

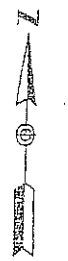
AT502 1.772

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1502	2.9	4/4
1518		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

VRT 1.0cm

PROJECT 1-00328 111.
OPERATOR MB
DATE 4.12.10

SITE NUMBER 17
SITE NAME 21

TRACKING TIMES (LOCAL) MEASURE ✓
START 3:30 P
STOP 3:47 P

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~500~~ 0.389
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.410
AT502 1.770

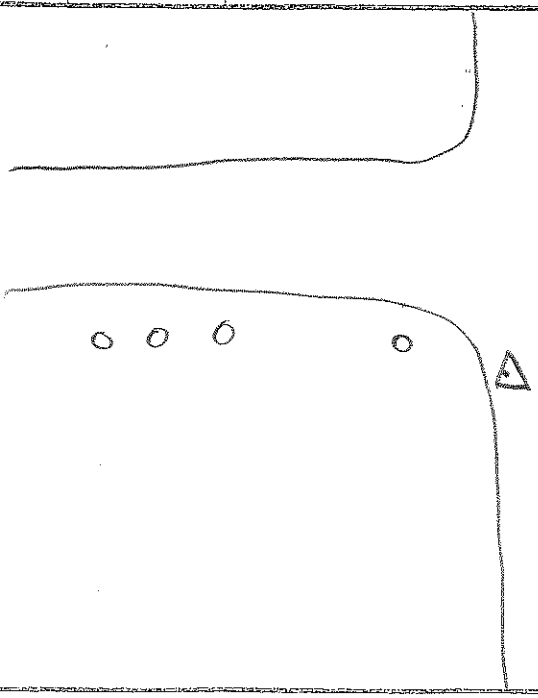
STATION DESCRIPTIONS S. bound lane

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1530	3.6	7/7
1547		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base

PROJECT 1-100328 111
OPERATOR NB
DATE 4-13-10

SITE NUMBER 1
SITE NAME 101

TRACKING TIMES (LOCAL) MEASURE ✓
START 3:24 p
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 704
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
500 0.360

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.320
AT 502 1.680

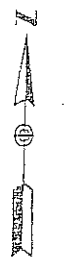
STATION DESCRIPTIONS

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1524	1.9	8/8

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



see previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base Control

PROJECT 1-100328 III.
OPERATOR MB
DATE 4.13.10

SITE NUMBER 1
SITE NAME GINN A2 MK

TRACKING TIMES (LOCAL) MEASURE ✓
START 3:41 P
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
500 0.360

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.305

STATION DESCRIPTIONS

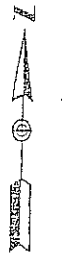
AT502 1665

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1541	2.1	8/8

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



See previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

Base

PROJECT 1-100328 KY
OPERATOR NB
DATE 4.6.10

SITE NUMBER 1
SITE NAME 101

TRACKING TIMES (LOCAL) MEASURE ✓
START 1:18
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 732
BATTERY NO. 10
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
~~500~~ 0.360

OBSTRUCTIONS: PP east

HEIGHT READINGS MTS FT
1,261

STATION DESCRIPTIONS set rebar + cap

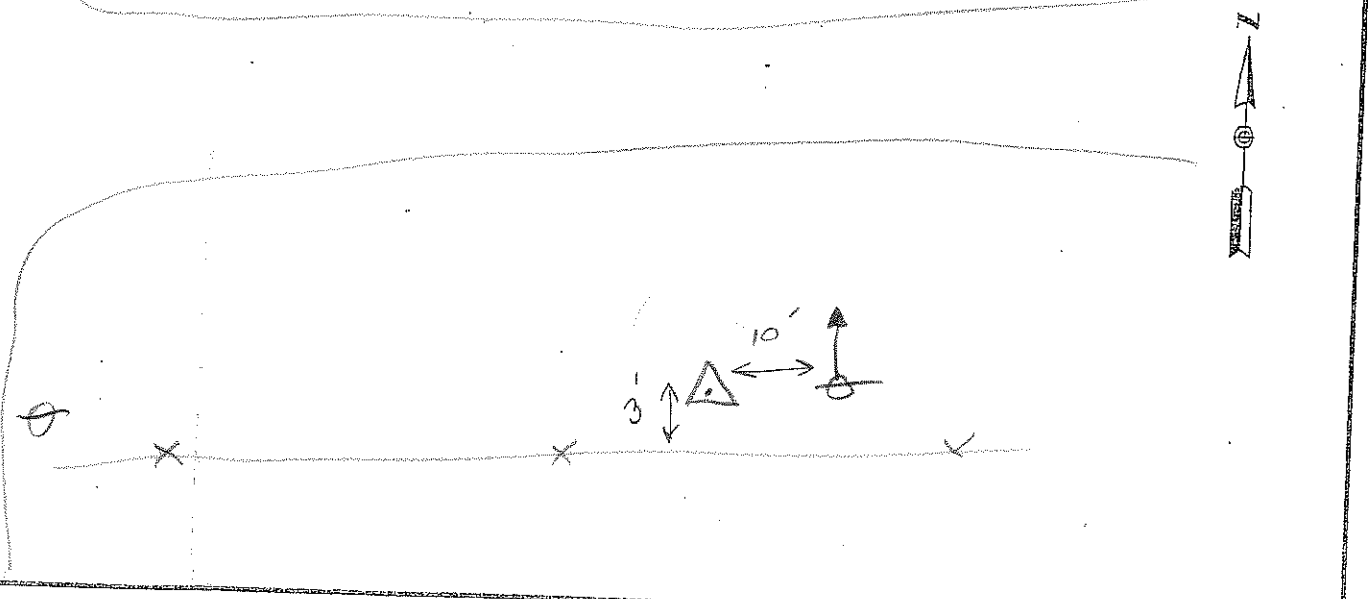
ATS 02 1621

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1318	2.7	7/8

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS
36 50 07.1
087 26 40.2
CAN BE USED AS ✓PT.

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

Base

PROJECT 1-100328 Ky
OPERATOR NMS
DATE 4.6.10

SITE NUMBER 1
SITE NAME 102

TRACKING TIMES (LOCAL) MEASURE
START 1:35 P
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 791
BATTERY NO. C10
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.380

STATION DESCRIPTIONS rebar + cap

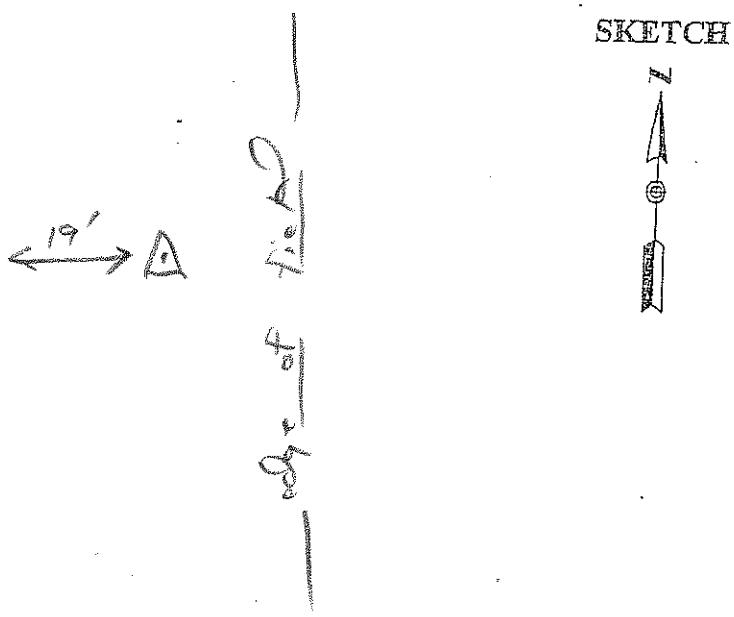
AT 502 1.740

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1335	2.3	7/8

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS
36 51 20.5
087 03 51.0
CAN BE USED AS √PT.

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

CONTROL

PROJECT 1-100328 KY
OPERATOR MB
DATE 4.6.10

SITE NUMBER 1
SITE NAME R 392

TRACKING TIMES (LOCAL) MEASURE ✓
START 2:08 p
STOP 2:33 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 704
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: trees NW + NE

HEIGHT READINGS MTS FT
1.187

STATION DESCRIPTIONS fnd USC + GS
cap in W. end N. headwall
"R 392 1968"

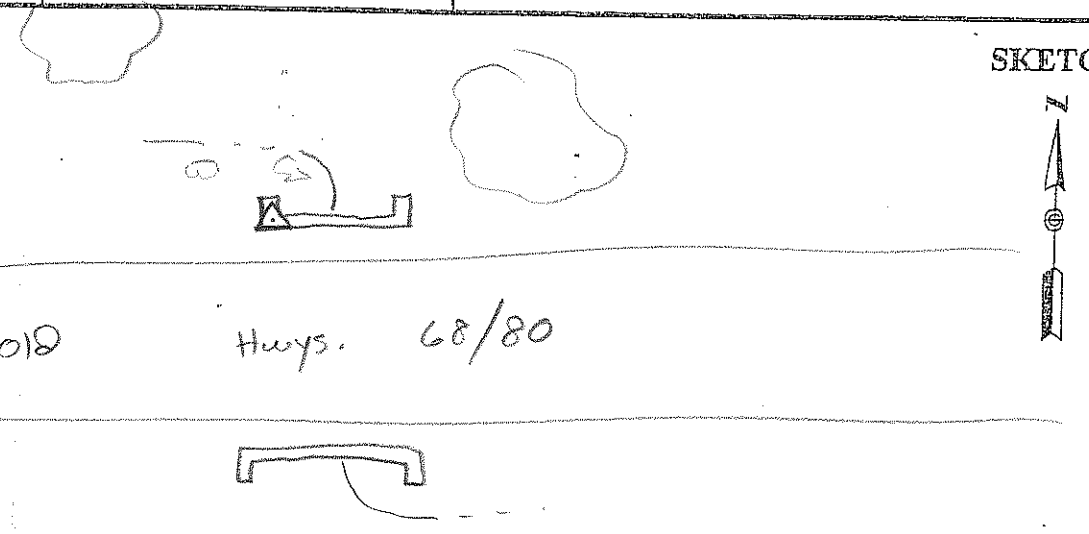
AT502 1547

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1408	2.3	5/9
1433		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 CONTROL

PROJECT 1-100328 KY
OPERATOR MB
DATE 4.6.10

SITE NUMBER 2
SITE NAME N134

TRACKING TIMES (LOCAL) MEASURE ✓
START 3:38 p
STOP 4:30 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 704
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: trees above

HEIGHT READINGS MTS FT
1.337

STATION DESCRIPTIONS fnd cap/conc. mon. "N 134 1949"

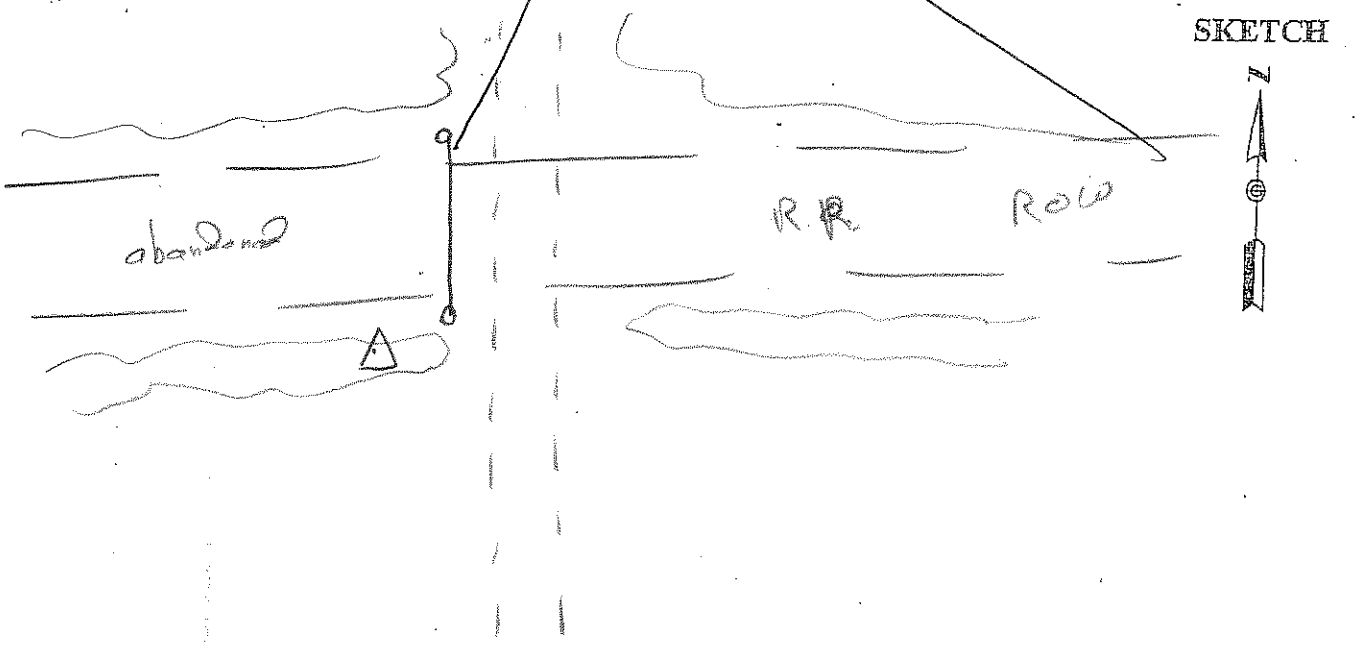
AT502 1697

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1538	5.0	4/4
1630		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base

PROJECT 1-100328 KY.
OPERATOR MG
DATE 4.7.10

SITE NUMBER 1
SITE NAME 101

TRACKING TIMES (LOCAL) MEASURE _____
START 7:14 a.
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 232
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.261

STATION DESCRIPTIONS

AT502 1.621

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
714	2.6	7/7

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS
CAN BE USED AS √PT.

SKETCH

See previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.7.10

SITE NUMBER 1
SITE NAME 102

TRACKING TIMES (LOCAL) MEASURE _____
START 7:25 a
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 704
BATTERY NO. C0
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.334

AT 502 1.694

STATION DESCRIPTIONS

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
725	3.3	7/7

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS
CAN BE USED AS √PT.

SKETCH

See previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 CONTROL

PROJECT 1-108328 Ky
OPERATOR MB
DATE 4.7.10

SITE NUMBER 1
SITE NAME M 133

TRACKING TIMES (LOCAL) MEASURE V
START 7:56a.
STOP 8:29a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: trees S

HEIGHT READINGS MTS FT
1.327

STATION DESCRIPTIONS fnd cap/conc. mon. "M 133 1949"

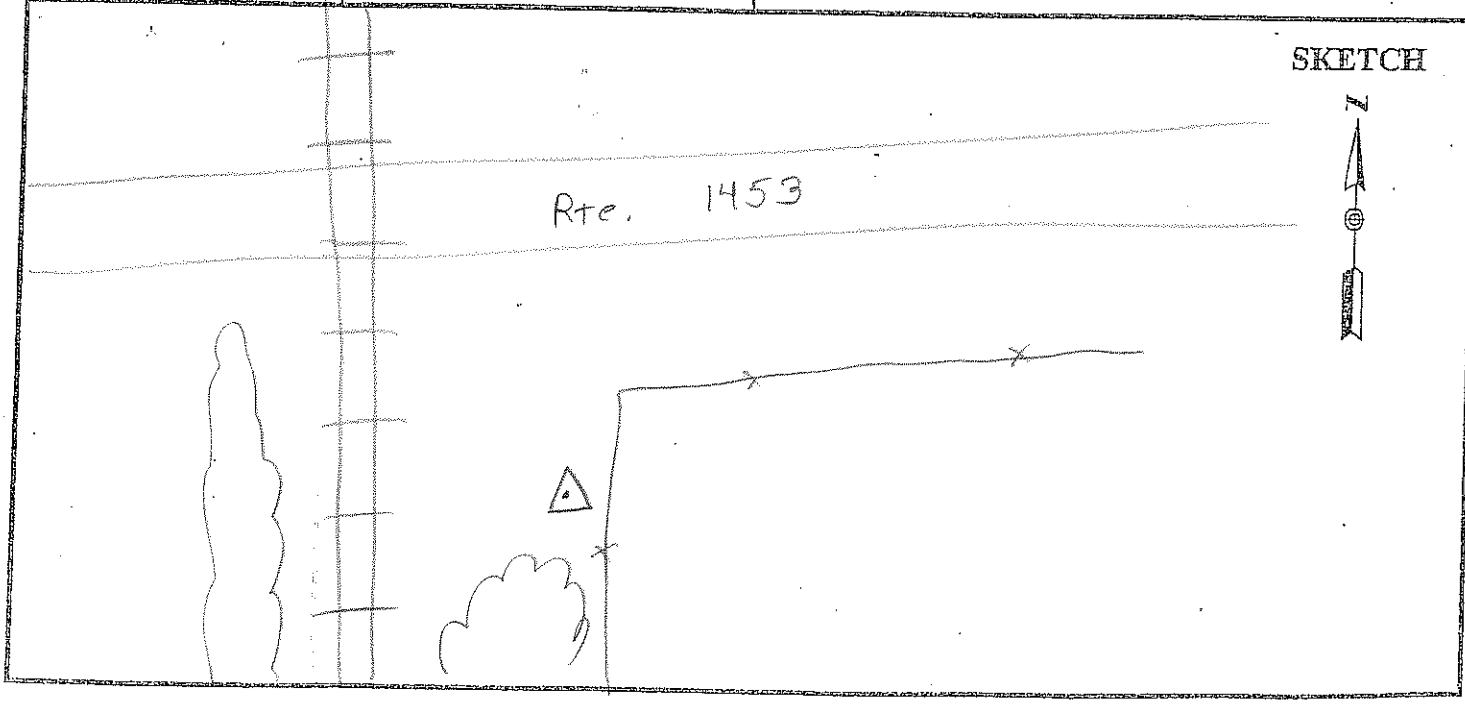
KT 502 1687

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
756	5.5	5/5
829		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 √PT. LiDar

PROJECT 1-100328 Ky.
OPERATOR MB
DATE 4.7.10

SITE NUMBER 2
SITE NAME 1

TRACKING TIMES (LOCAL) MEASURE ✓
START 9:49a.
STOP 10:09a

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.377

AT502 1.737

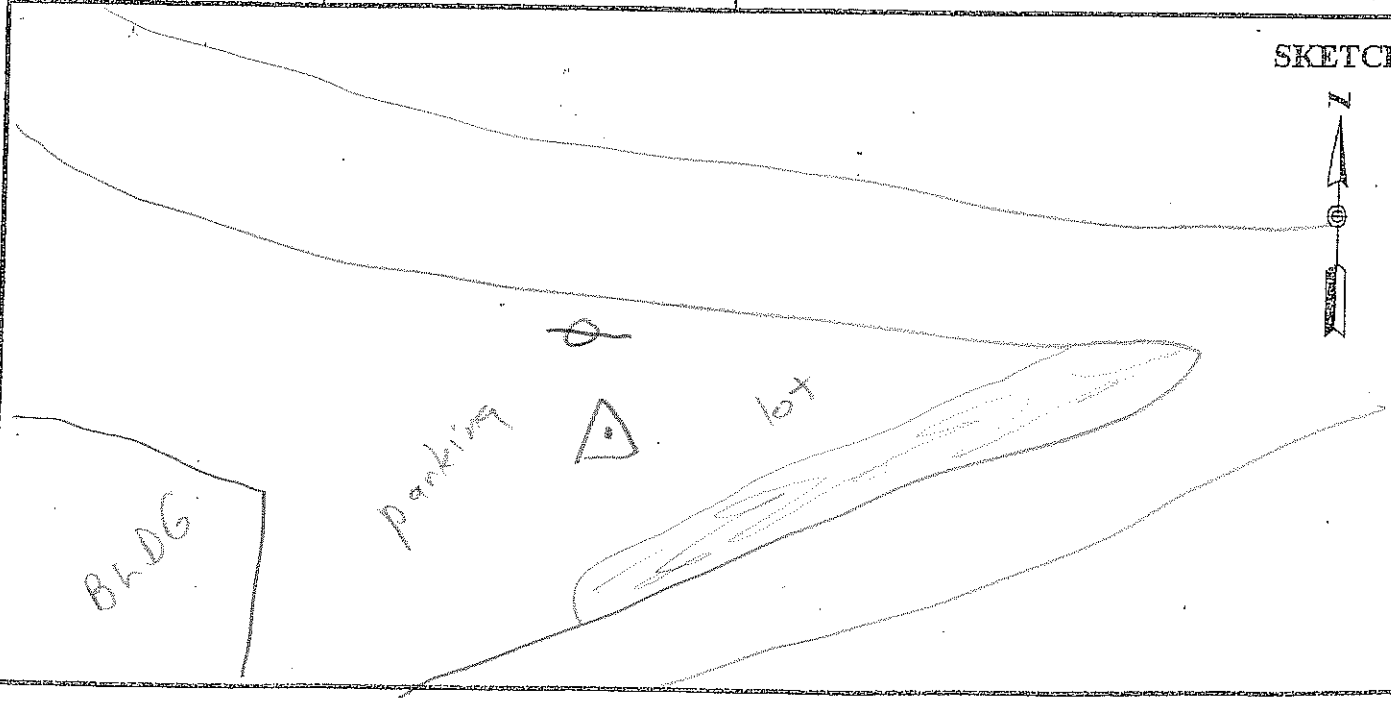
STATION DESCRIPTIONS in parking lot

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
949	2.6	7/7
1009		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 ✓ PT Lidar

PROJECT: 1-100328 Ky
OPERATOR: MB
DATE: 4.7.10

SITE NUMBER: 3
SITE NAME: 2

TRACKING TIMES (LOCAL) MEASURE ______

START: 10:20 a
STOP: 10:40 a

SENSOR TYPE: 500 9500 399 299
MEMORY CARD: 731
BATTERY NO.:
CONTROLLER NO.:
SENSOR NO.:

SENSOR CONSTANT:

299/399	0.441
399E/9500	0.389
500 (circled)	0.360 (circled)

OBSTRUCTIONS: none

HEIGHT READINGS

MTS	FT
1.355	

AT502 1715

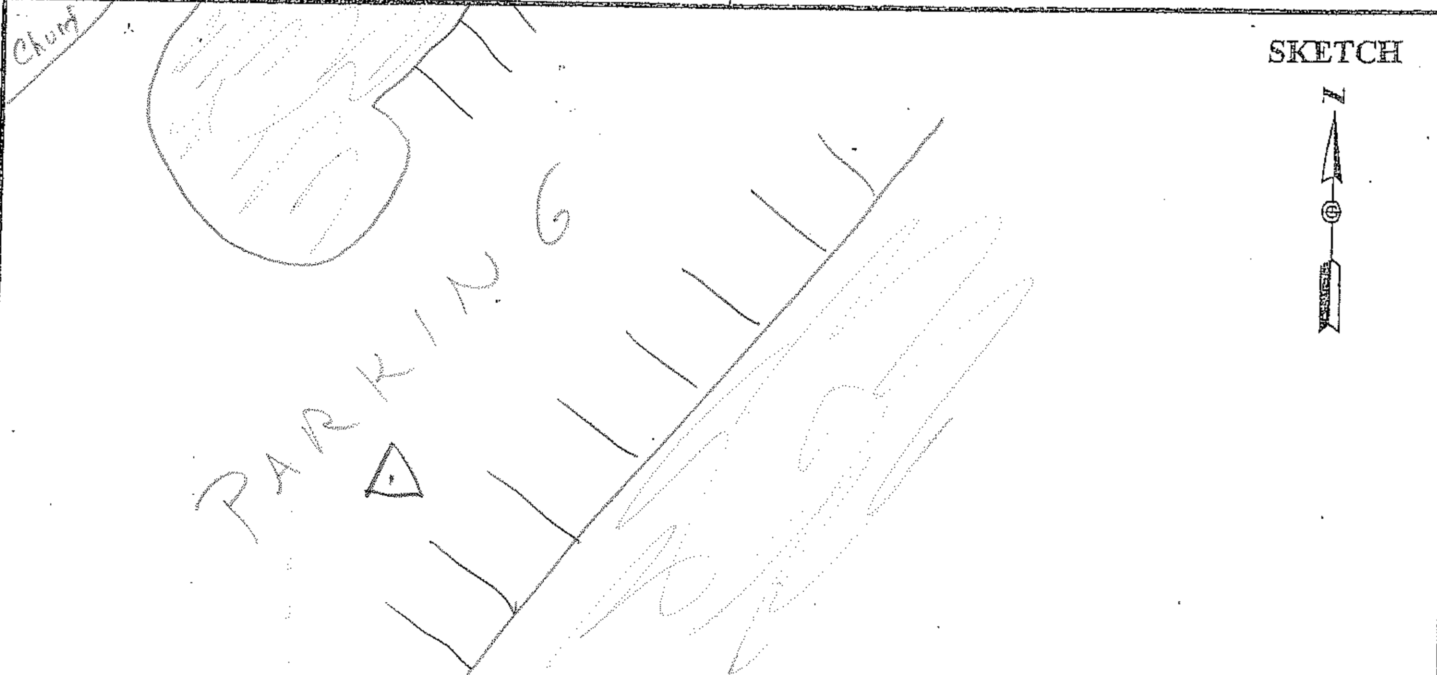
STATION DESCRIPTIONS: in parking lot

SATELLITE OBSERVATIONS

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

TIME	GDOP	SATELLITES
1020	3.4	9/9
1040		

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

PROJECT 1-100328 Ky
OPERATOR NB
DATE 4.7.10

SITE NUMBER 4
SITE NAME 3

TRACKING TIMES (LOCAL) MEASURE ✓
START 10:48 a.
STOP 11:08 a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.338

STATION DESCRIPTIONS parking lot

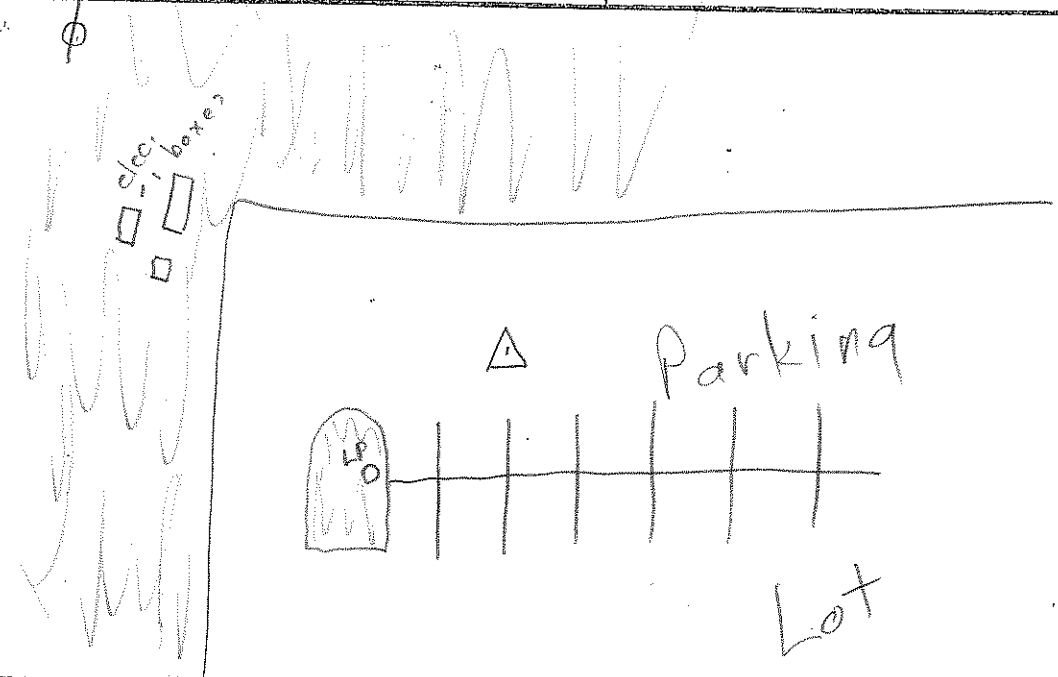
AT 502 1.698

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1048	5.0	9/9
1108		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 √ PT lidar

PROJECT 1-100328 Ky
OPERATOR NB
DATE 4.7.10

SITE NUMBER 5
SITE NAME 4

TRACKING TIMES (LOCAL) MEASURE √
START 11:18 a.
STOP 11:38 a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: tree NW

HEIGHT READINGS MTS FT
1.282

STATION DESCRIPTIONS N bound side of road

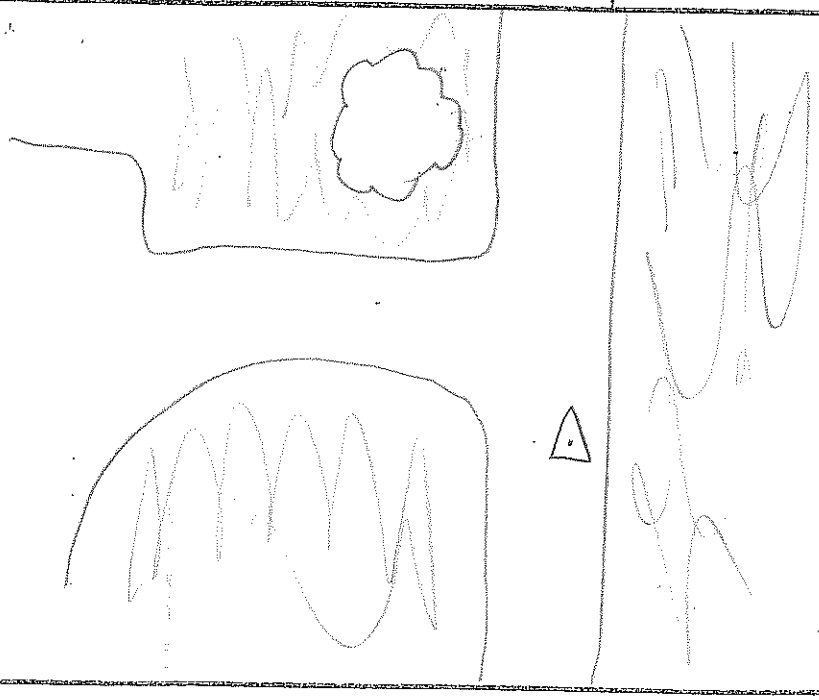
AT502 1642

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1118	4.7	7/8
1138		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 V PT Lidar

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.7.10

SITE NUMBER 6
SITE NAME 5

TRACKING TIMES (LOCAL) MEASURE ✓
START 11:48 a.
STOP 12:08 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.387

AT 502 1.747

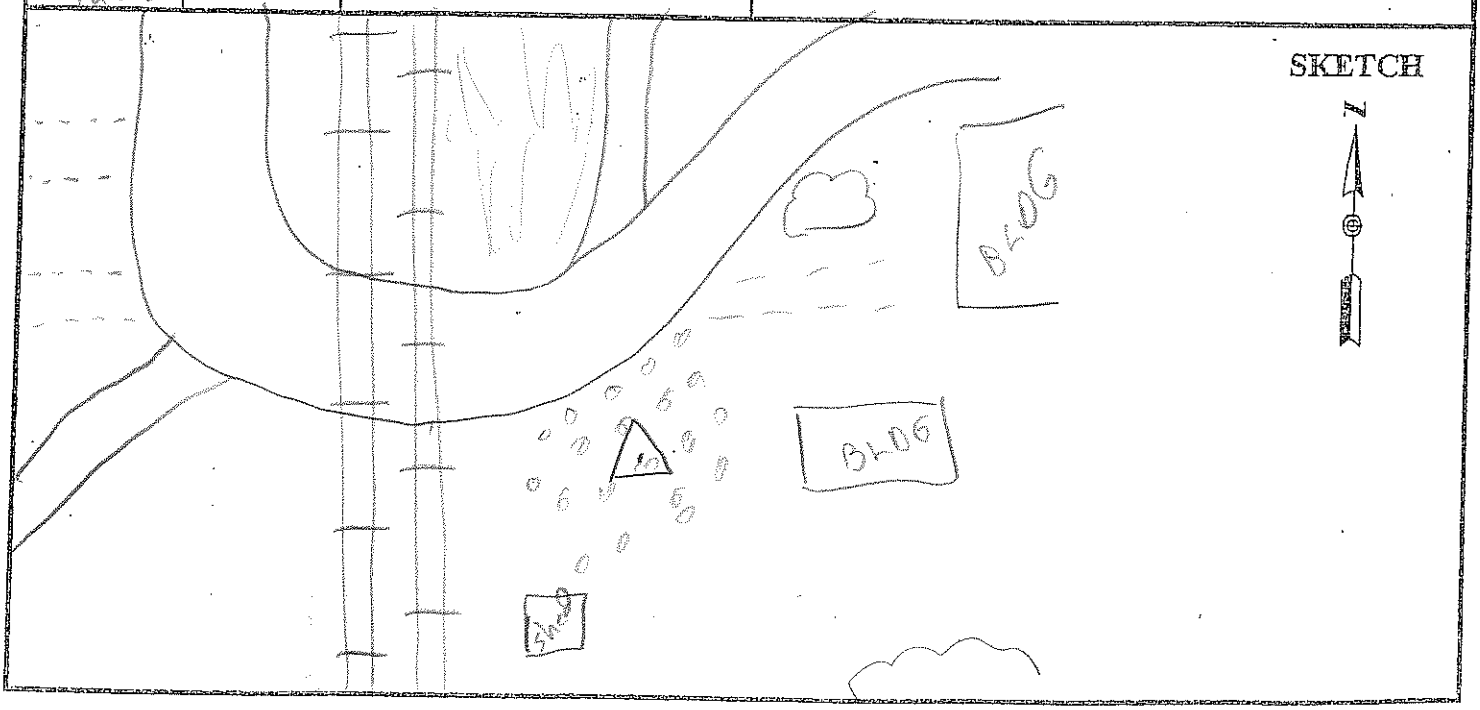
STATION DESCRIPTIONS In grave) area

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1148	2.0	10/10
1208		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 VPT Lidar

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.7.10

SITE NUMBER 7
SITE NAME 6

TRACKING TIMES (LOCAL) MEASURE ✓
START 12:17 p
STOP 12:35 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 231
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.326

STATION DESCRIPTIONS paved area

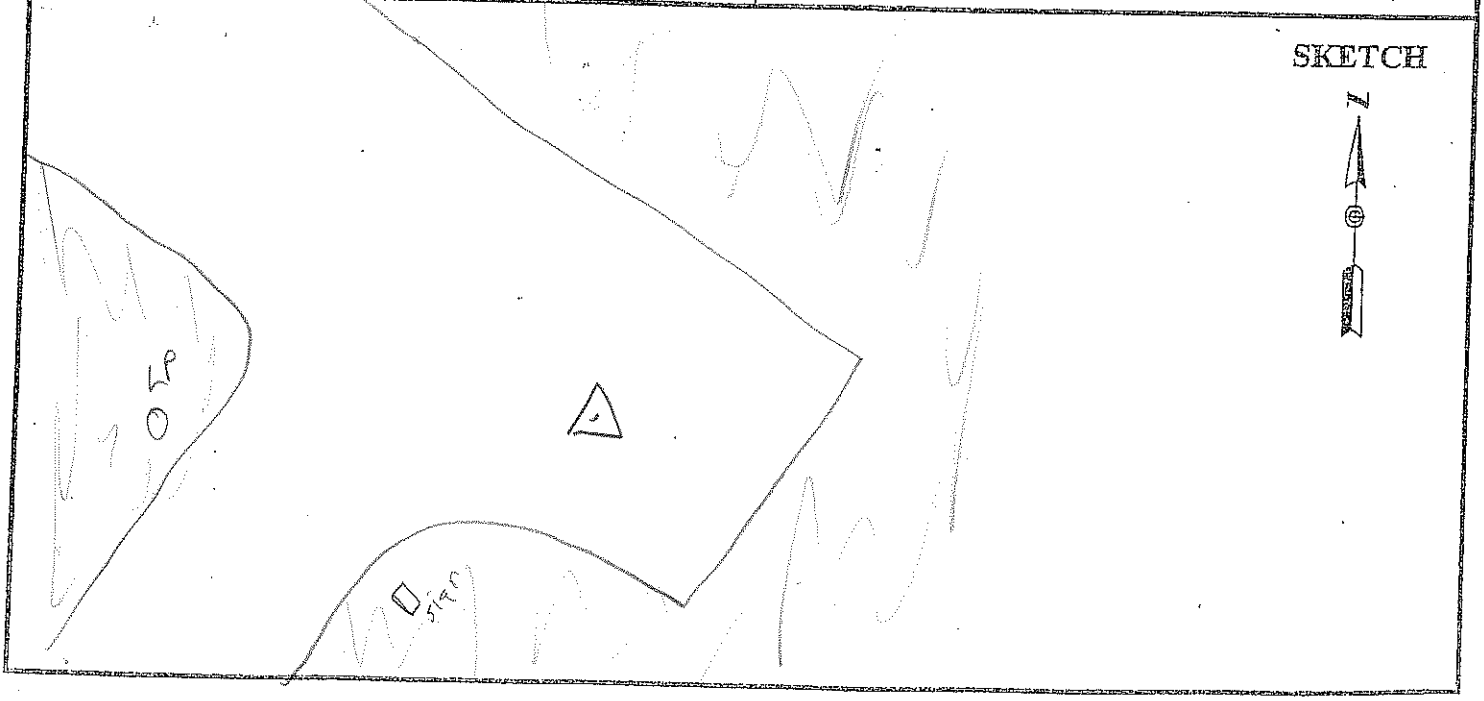
AT502 1686

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1217	2.6	10/10
1235		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

VRT Widow

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.7.10

SITE NUMBER 8
SITE NAME 7

TRACKING TIMES (LOCAL) MEASURE ✓
START 12:46 p
STOP 1:04 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: ~~none~~ tree NW

HEIGHT READINGS MTS FT
1.315

AT 502 1.675

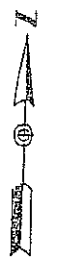
STATION DESCRIPTIONS E bound lane

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1246	1.9	11/11
1304		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

✓ pt Lidar

PROJECT 1-100328 Ky
OPERATOR NB
DATE 4.7.10

SITE NUMBER 9
SITE NAME 8

TRACKING TIMES (LOCAL) MEASURE ✓
START 1:14 p
STOP 1:34 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.332

STATION DESCRIPTIONS parking area

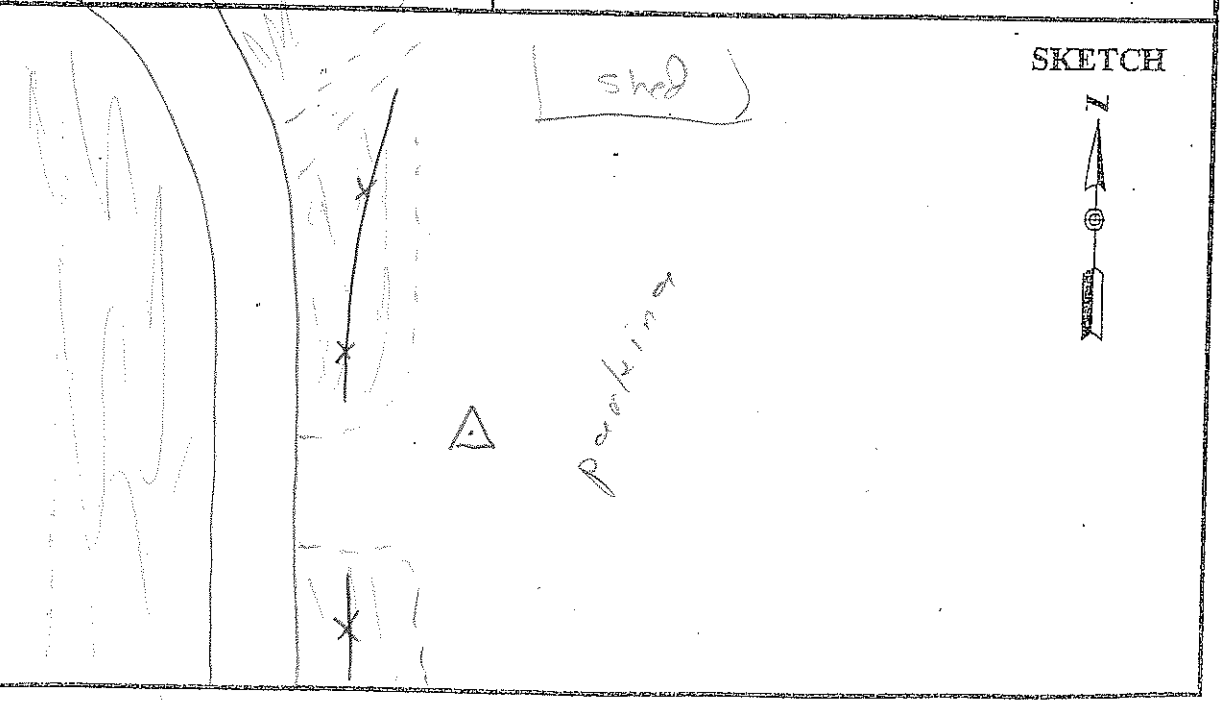
AT502 1.692

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1314	3.9	5/5
1334		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

✓ PT Lidar

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.7.10

SITE NUMBER 10
SITE NAME 9

TRACKING TIMES (LOCAL) MEASURE ✓
START 1:43p
STOP 2:03p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
~~399E/9500 0.389~~
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.380

AT502 1.740

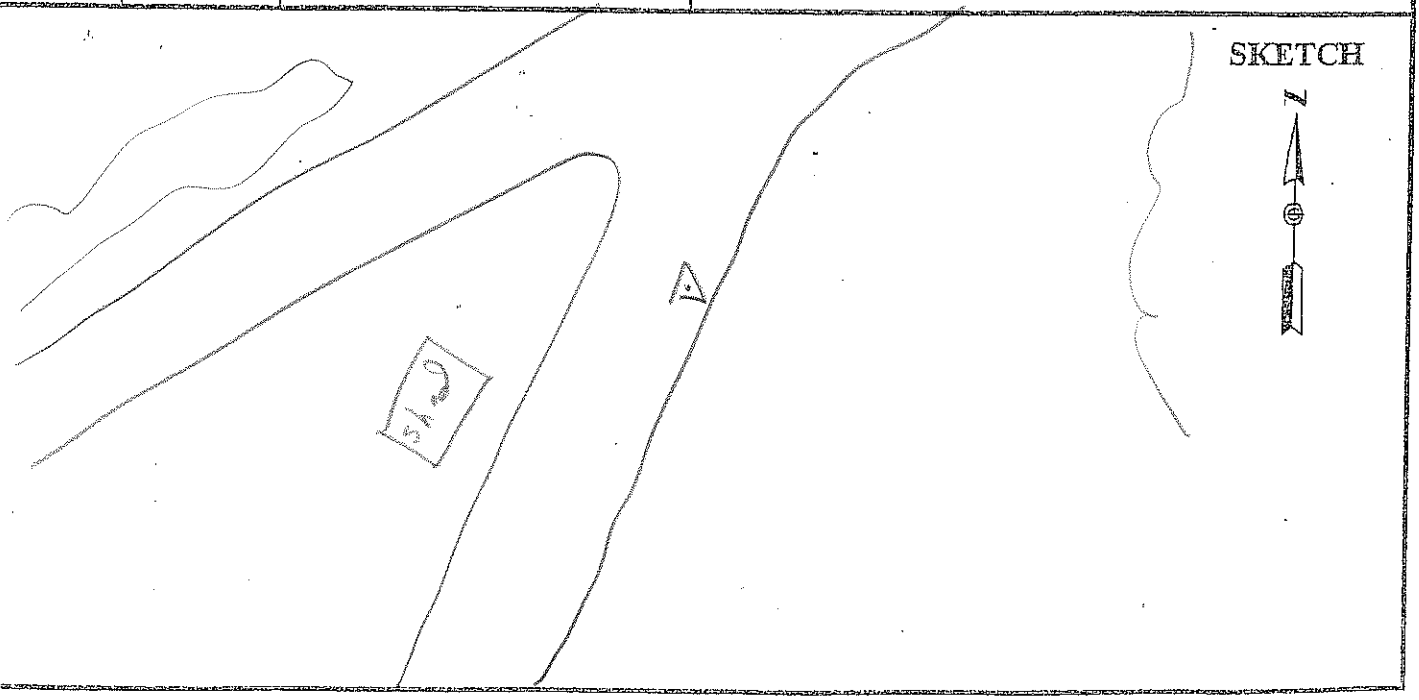
STATION DESCRIPTIONS N bound lane

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1343		9/9
1403		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 √PT Lidar

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.7.10

SITE NUMBER 11
SITE NAME 10

TRACKING TIMES (LOCAL) MEASURE ✓

START 2:11 p
STOP 2:31 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT

299/399	0.441
399E/9500	0.389
(500)	(0.360)

OBSTRUCTIONS: trees NW

HEIGHT READINGS

MTS	FT
1.341	

AT502 1701

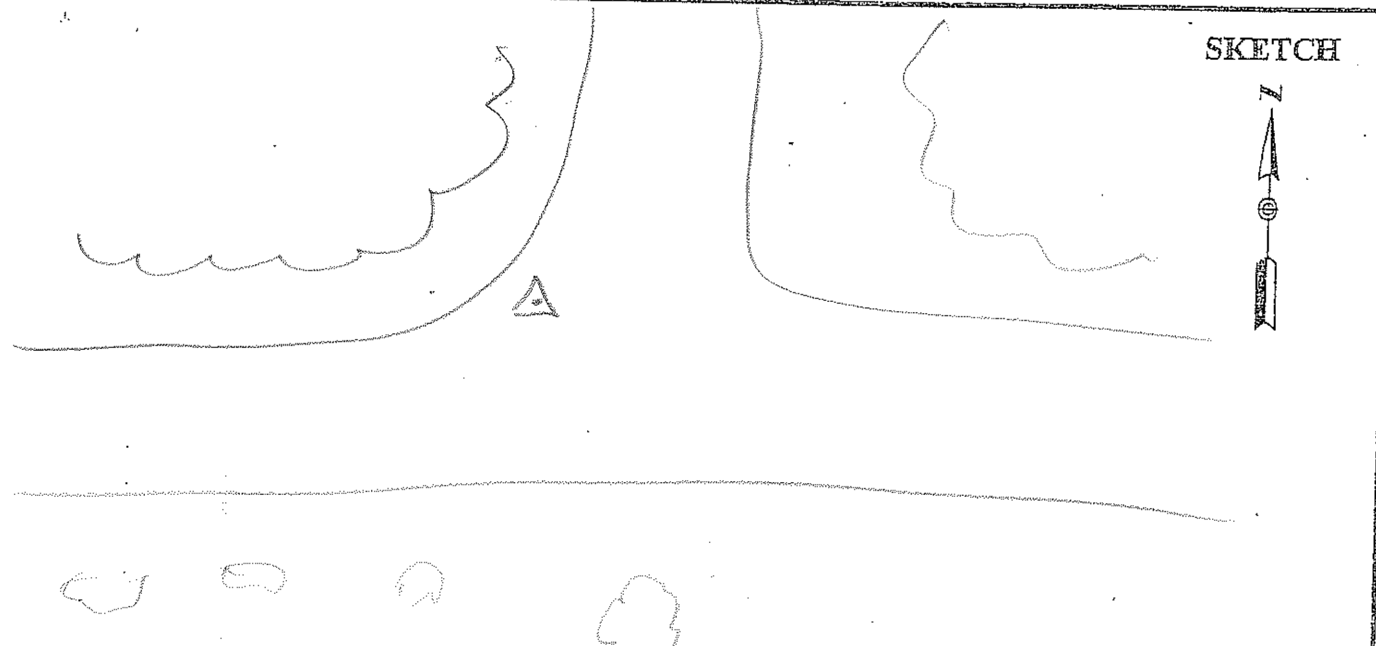
STATION DESCRIPTIONS NW area of intersection

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1411	3.0	8/9
1431		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 √RT 1.Dan

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.7.10

SITE NUMBER 12
SITE NAME 11

TRACKING TIMES (LOCAL) MEASURE √
START 2:43 p
STOP 3:03 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.400

STATION DESCRIPTIONS E bound lane

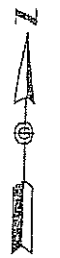
AT502 1.760

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1443	3.3	7/7
1503		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 ✓ PT lidar

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4-7-10

SITE NUMBER 13
SITE NAME 12

TRACKING TIMES (LOCAL) MEASURE ✓
START 3:11 p
STOP 3:30 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT

299/399	0.441
399E/9500	0.389
(500)	(0.360)

OBSTRUCTIONS: trees NW

HEIGHT READINGS

MTS	FT
1.350	

AT502 1.710

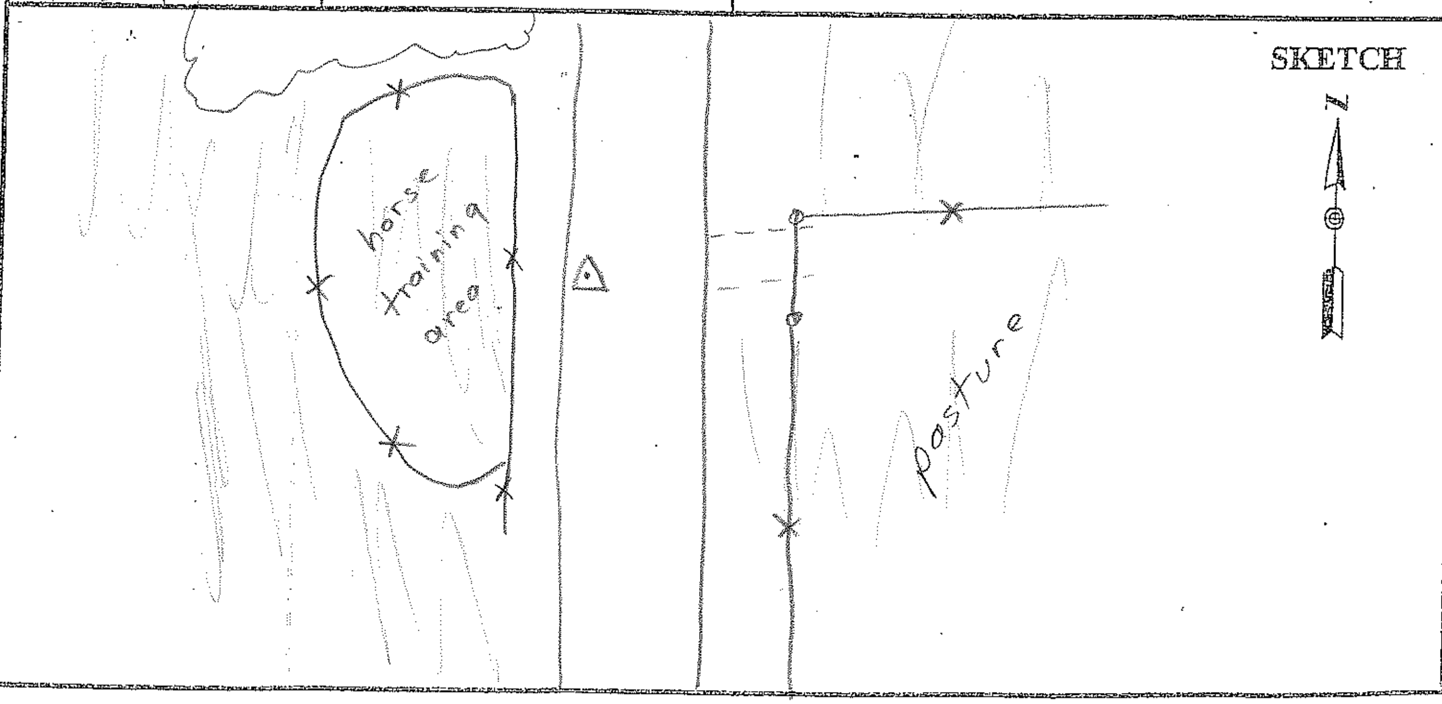
STATION DESCRIPTIONS S bound lane

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1511	4.5	6/6
1530		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base

PROJECT 1-100328 Ky
OPERATOR MD
DATE 4.8.10

SITE NUMBER 1
SITE NAME 101

TRACKING TIMES (LOCAL) MEASURE ✓
START 7:13a.
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 732
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT
299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.262

AT502 1.622

STATION DESCRIPTIONS

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
713	2.5	7/7

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH

See previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base

PROJECT 1-100328 Ky
OPERATOR MD
DATE 4.8.10

SITE NUMBER 1
SITE NAME 102

TRACKING TIMES (LOCAL) MEASURE ✓
START 7:24a.
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 704
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.326

STATION DESCRIPTIONS

AT502 1.686

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
724	2.4	7/7

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH

see previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 ✓PT. 11/10/10

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4-8-10

SITE NUMBER 1
SITE NAME 13

TRACKING TIMES (LOCAL) MEASURE ✓
START 7:41a.
STOP 8:00a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT
299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.333

AT 502
1.693

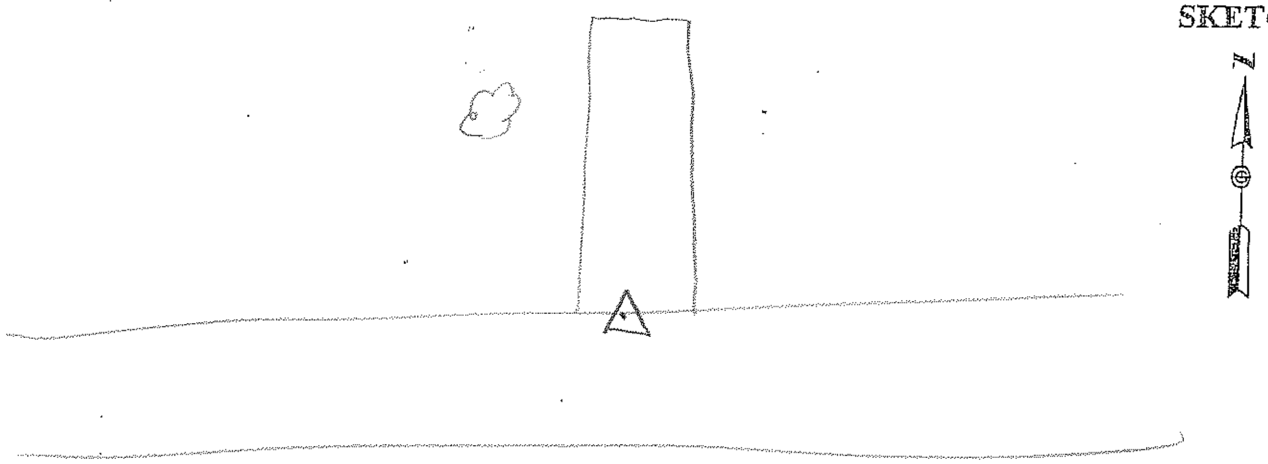
STATION DESCRIPTIONS N side road

SATELLITE OBSERVATIONS

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

TIME	GDOP	SATELLITES
741	2.9	7/7
800		

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 ✓MT lidar

PROJECT 1-900328 Ky
OPERATOR MB
DATE 4.8.10

SITE NUMBER 2
SITE NAME 14

TRACKING TIMES (LOCAL) MEASURE ✓

START 8:18a.
STOP 8:38a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT
299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: trees NE

HEIGHT READINGS

MTS	FT
1.365	

AT502 1.725

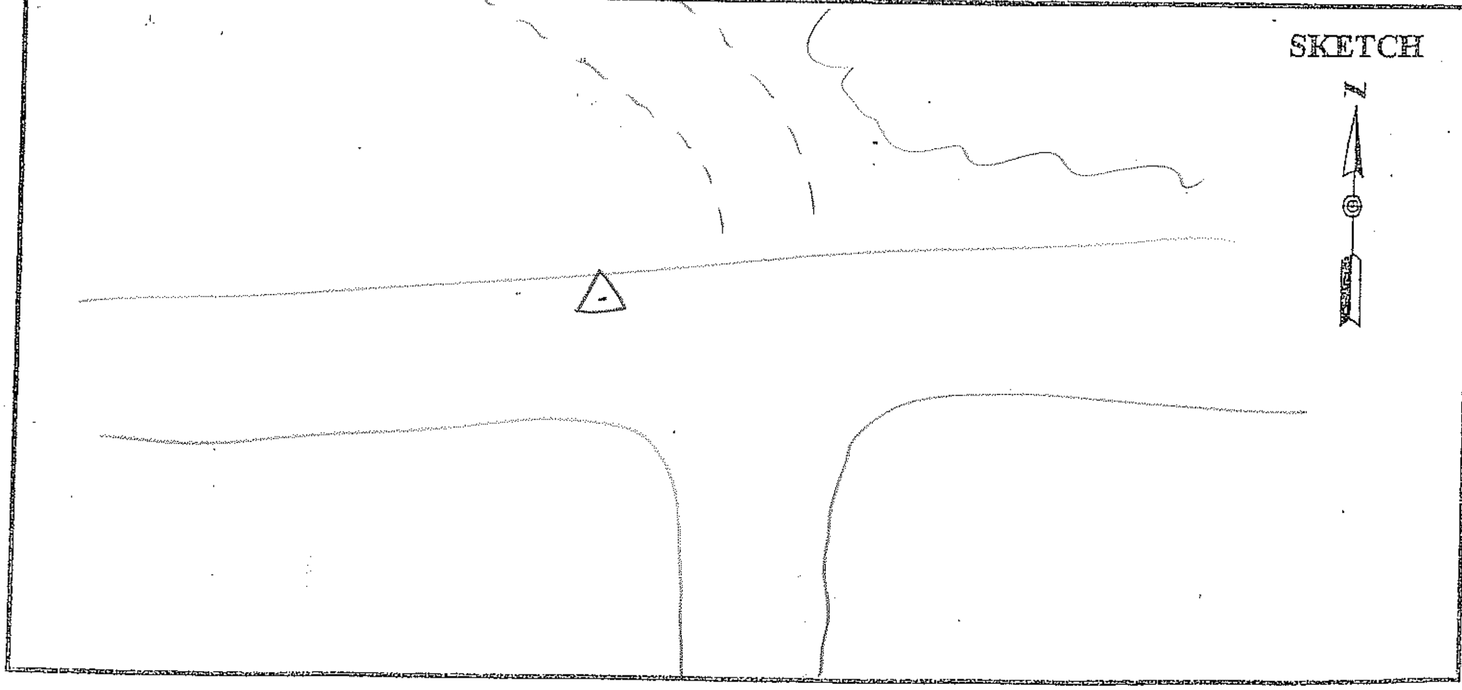
STATION DESCRIPTIONS N. shoulder

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
818	2.6	7/7
838		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

√PT 1:2an

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.8.10

SITE NUMBER 3
SITE NAME 15

TRACKING TIMES (LOCAL) MEASURE √
START 8:46a
STOP 9:06a

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.359

STATION DESCRIPTIONS in parking lot

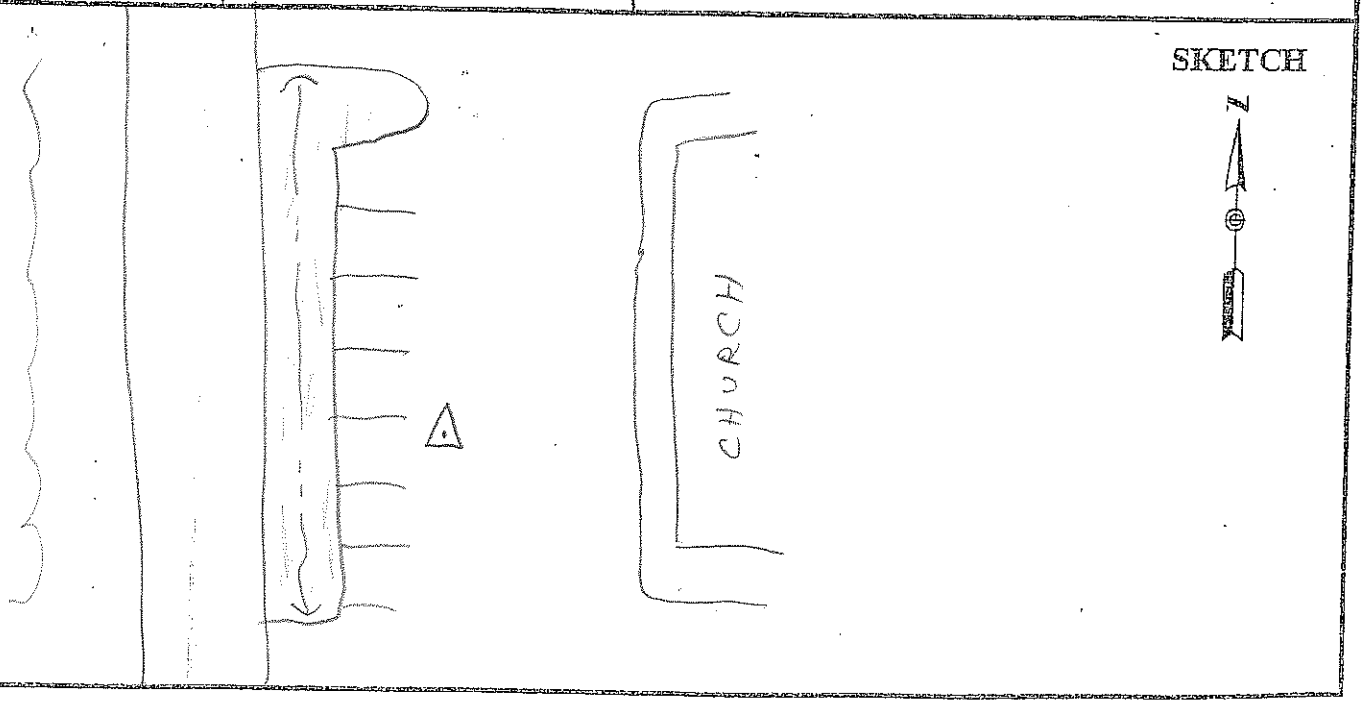
AT502 1.719

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
846	2.5	6/7
906		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

✓ PT   lidar

PROJECT: 1-100328 Ky	
OPERATOR: MB	SITE NUMBER: 4
DATE: 4 · 8 · 10	SITE NAME: 16

TRACKING TIMES (LOCAL) MEASURE ✓

START: 9:16 a.

STOP: 9:37 a.

SENSOR TYPE: 500 9500 399 299

MEMORY CARD: 731

BATTERY NO.

CONTROLLER NO.

SENSOR NO.

SENSOR CONSTANT

299/399	0.441
399E/9500	0.389
(500)	(0.360)

OBSTRUCTIONS: none

HEIGHT READINGS

MTS	FT
1.362	

AT502   1.722

STATION DESCRIPTIONS: in gravel area

SATELLITE OBSERVATIONS

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

TIME	GDOP	SATELLITES
916	1.9	9/9
937		

SKETCH

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 CONTROL

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.8.10

SITE NUMBER 5
SITE NAME B 22

TRACKING TIMES (LOCAL) MEASURE ✓
START 10:10a
STOP 11:05a

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.310
AT502 1.670

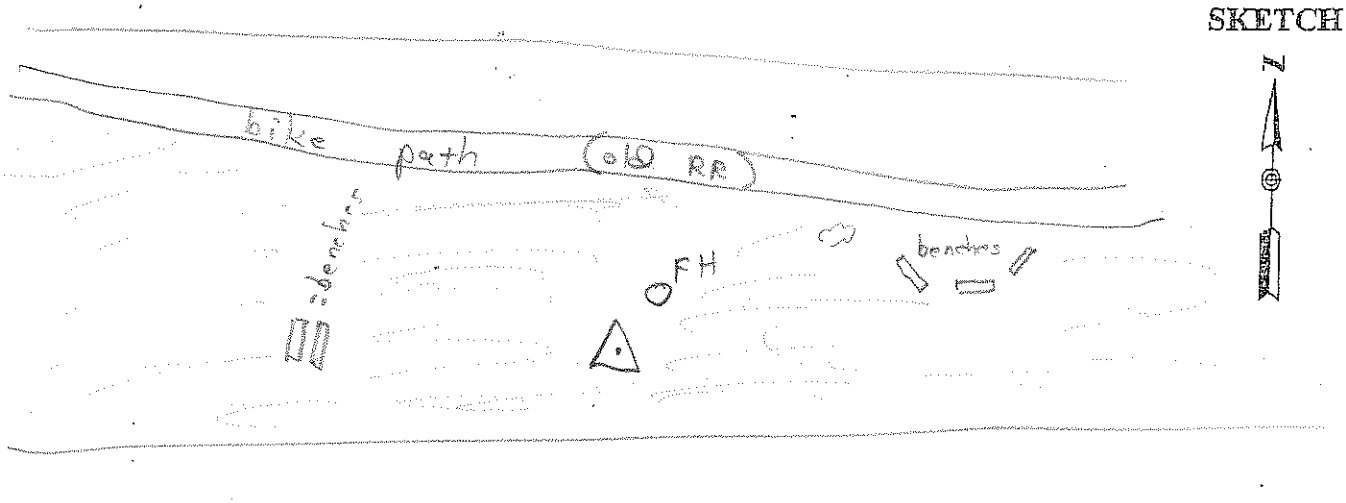
STATION DESCRIPTIONS fnd USC + GS cap/conc mon 1" B 22 1934"

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1010	3.1	6/6
1105		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



"Sonic" "Cadiz Hardware"

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

1/pt lidar

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.8.10

SITE NUMBER 6
SITE NAME 17

TRACKING TIMES (LOCAL) MEASURE ✓
START 11:32a.
STOP 11:53a.

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: trees NW ↔ NE

HEIGHT READINGS MTS FT
1.378

STATION DESCRIPTIONS in paved area

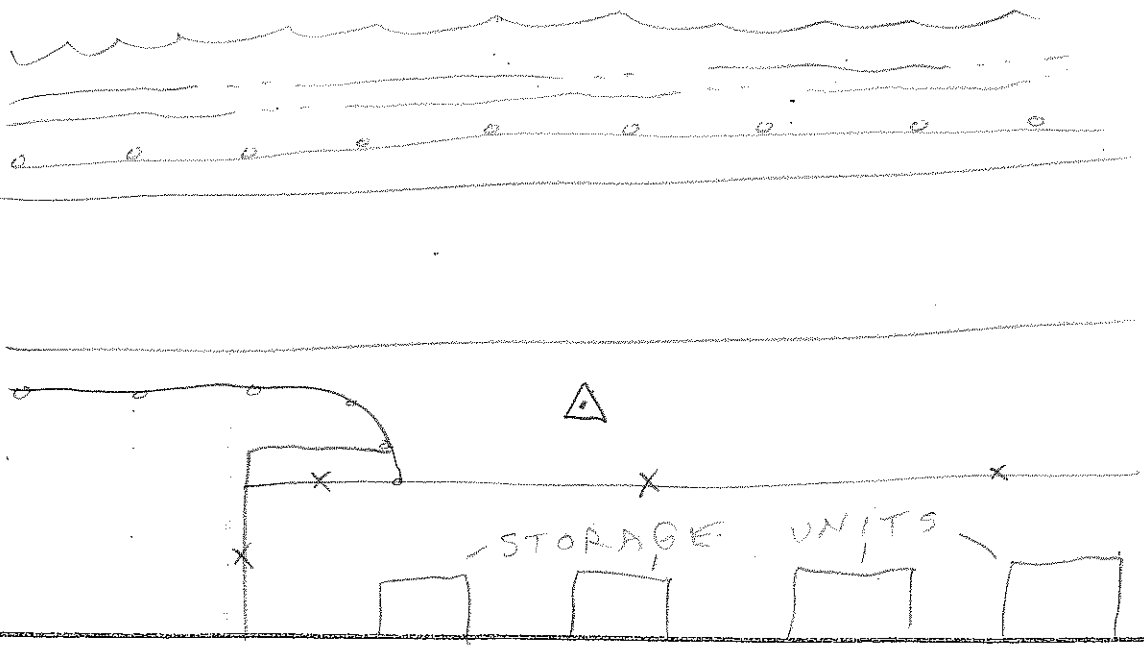
AT502 1.732

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1132	2.4	7/7
1153		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

VPT lidar

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.8.10

SITE NUMBER 7
SITE NAME 18

TRACKING TIMES (LOCAL) MEASURE ✓
START 12:03p
STOP 12:23p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: none

HEIGHT READINGS MTS FT
1.357

STATION DESCRIPTIONS in gravel parking area

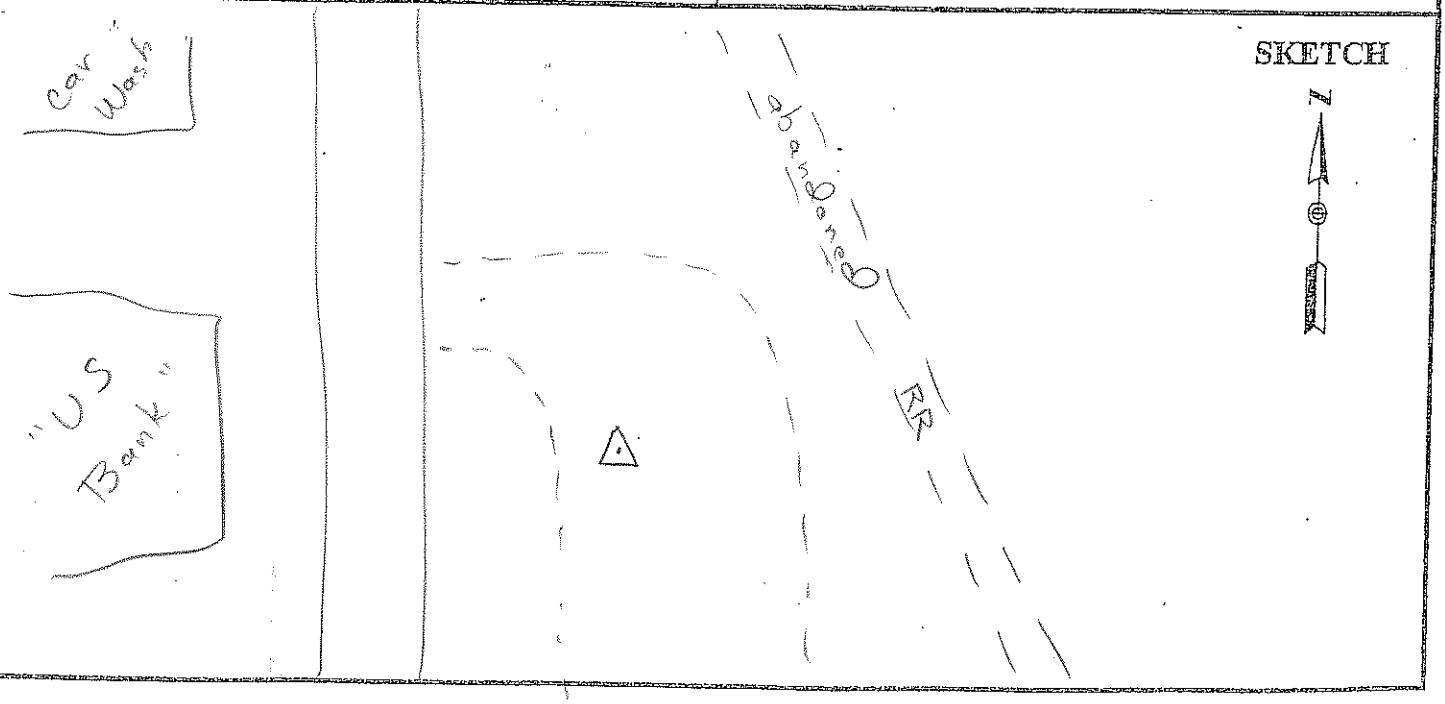
AT502 1717

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1203	5.5	10/10
1223		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 √pt 1:2ar

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.8.10

SITE NUMBER 8
SITE NAME 19

TRACKING TIMES (LOCAL) MEASURE _____
START 12:36 p
STOP 12:57 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS: trees E

HEIGHT READINGS MTS FT
1.350

AT502 1.710

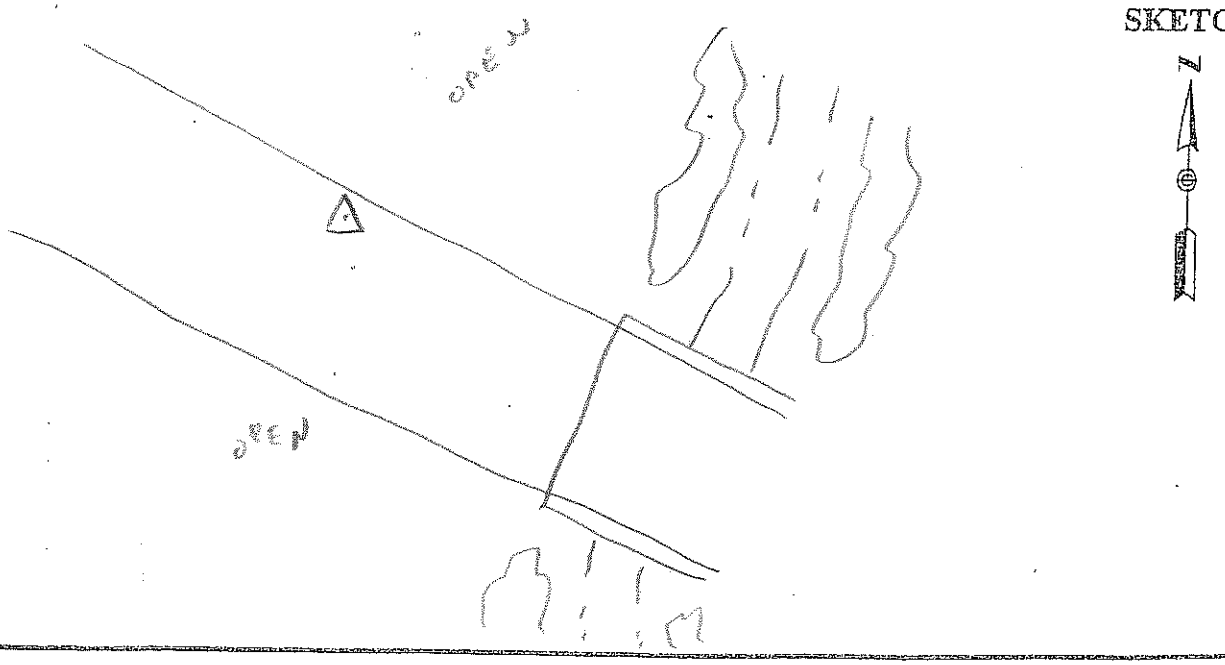
STATION DESCRIPTIONS N side road

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1236	2.0	10/10
1257		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 ✓PT lidar

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.8.10

SITE NUMBER 9
SITE NAME 20

TRACKING TIMES (LOCAL) MEASURE ✓
START 1:08p
STOP 1:28p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: tree SE

HEIGHT READINGS MTS FT
1.408

STATION DESCRIPTIONS in parking

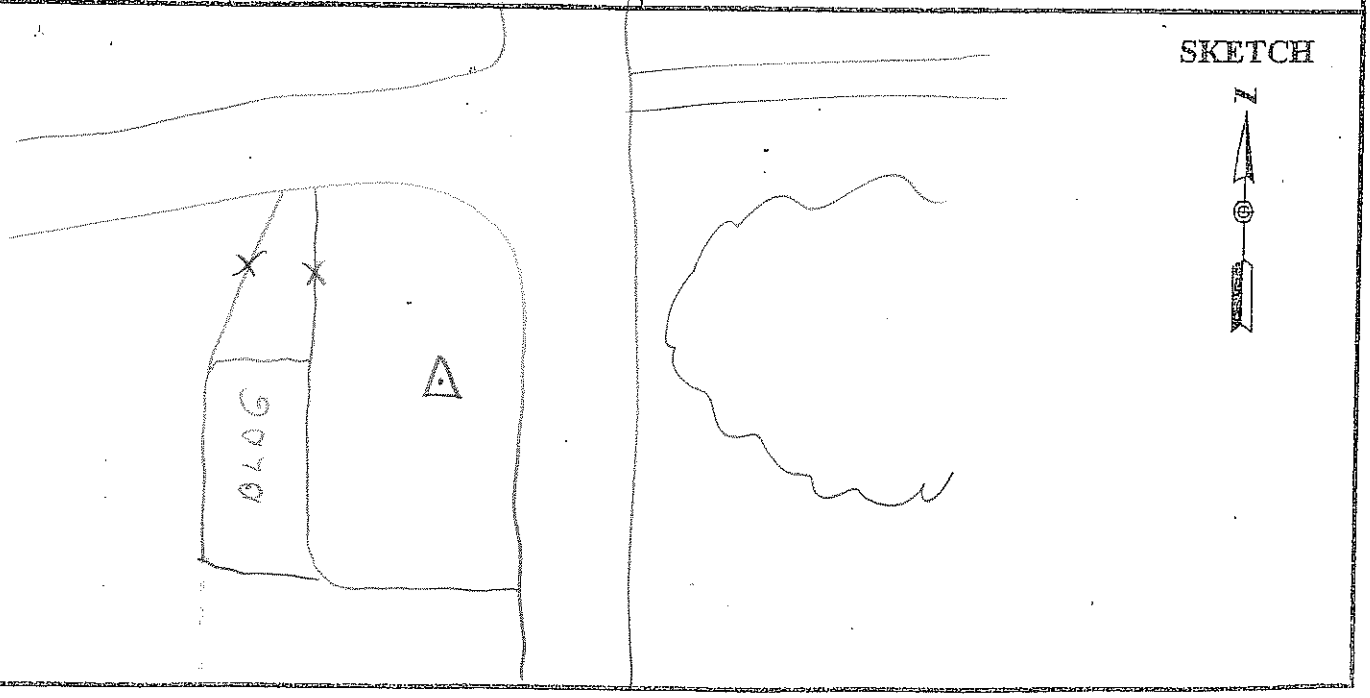
NT502 1.768

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1308	4.9	9/9
1328		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083

✓ PT lidar

PROJECT 1-100328
OPERATOR MB
DATE 4·8·10

SITE NUMBER 10
SITE NAME 21

TRACKING TIMES (LOCAL) MEASURE ✓
START 1:38 p
STOP 1:56 p

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS: trees W + E

HEIGHT READINGS MTS FT
1.395

STATION DESCRIPTIONS in parking area

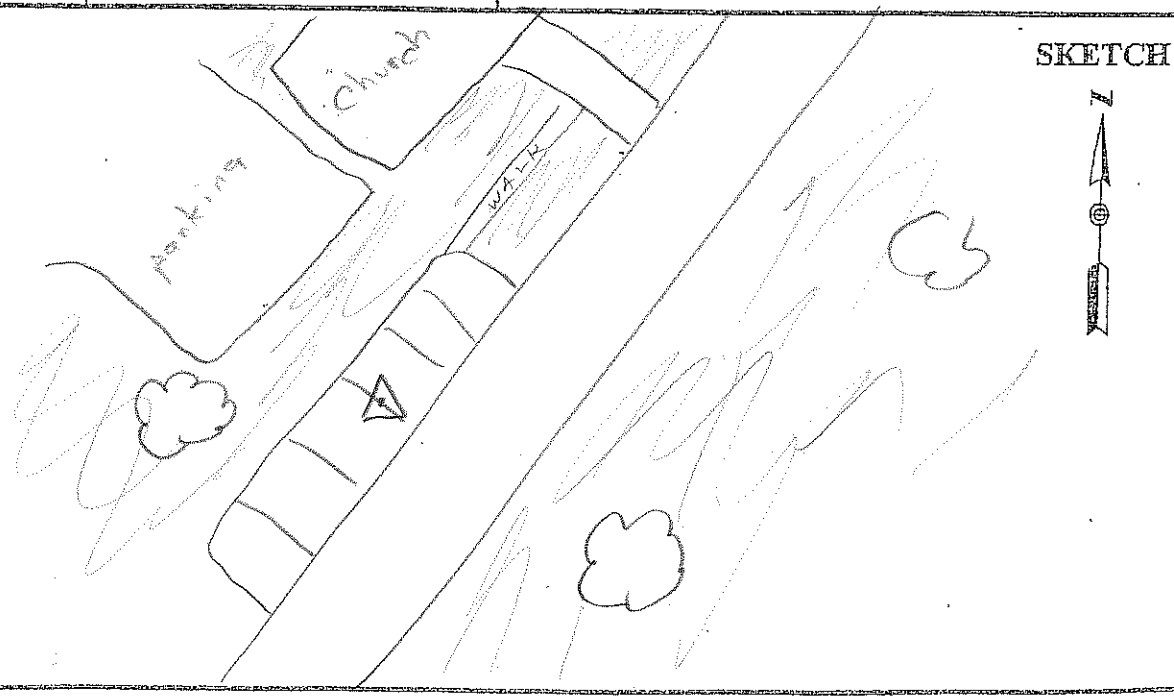
AT502 1755

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
1338	2.4	9/9
1356		

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.9.10

SITE NUMBER 1
SITE NAME 102

TRACKING TIMES (LOCAL) MEASURE L
START 7:490
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 704
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.310

AT502 1.670

STATION DESCRIPTIONS

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
749	4.9	6/6

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH

See previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base

PROJECT 1-100328 KY
OPERATOR MB
DATE 4.9.10

SITE NUMBER 1
SITE NAME 101

TRACKING TIMES (LOCAL) MEASURE ✓
START 7:41a.
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 ~~0.389~~
500 0.360

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.284

STATION DESCRIPTIONS

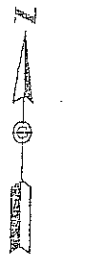
AT502 1.644

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
741	4.5	6/6

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH



See previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Base

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.10.10

SITE NUMBER 1
SITE NAME 101

TRACKING TIMES (LOCAL) MEASURE ✓
START 6:59a
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 731
BATTERY NO.
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
500 0.360

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.283

STATION DESCRIPTIONS

AT502 1,643

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
659	2.0	7/7

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH

see previous

AERO-METRIC, INC.
4020 TECHNOLOGY PARKWAY
SHEBOYGAN, WISCONSIN 53083 Case

PROJECT 1-100328 Ky
OPERATOR MB
DATE 4.10.10

SITE NUMBER 1
SITE NAME 107

TRACKING TIMES (LOCAL) MEASURE ✓
START 7:13 a.
STOP

SENSOR TYPE 500 9500 399 299
MEMORY CARD 204
BATTERY NO. CB
CONTROLLER NO.
SENSOR NO.

SENSOR CONSTANT 299/399 0.441
399E/9500 0.389
(500) (0.360)

OBSTRUCTIONS:

HEIGHT READINGS MTS FT
1.344

STATION DESCRIPTIONS

AT 532 1.704

SATELLITE OBSERVATIONS

TIME	GDOP	SATELLITES
713	2.4	7/7

WEATHER CONDITIONS/IMPORTANT OBSERVATIONS

SKETCH

See previous

```
================================================================================
                     USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                 GRS 80             UNITS: m,DMS          Page 0001
================================================================================
17:31:56, Sat May 15, 2010

INI file:    C:\WINNT\GEOLAB.INI
Input file:  R:\1100328\GEOM~56O\SURVEY\IL_SITE\GEO\C.IOB
Output file: R:\1100328\GEOM~56O\SURVEY\IL_SITE\GEO\C.LST

Geoid File:  C:\GEOLAB2\G2009U07.GEO
```

PARAMETERS		OBSERVATIONS	
Description	Number	Description	Number
No. of Stations	26	Directions	0
Coord Parameters	71	Distances	0
Free Latitudes	24	Azimuths	0
Free Longitudes	24	Vertical Angles	0
Free Heights	23	Zenithal Angles	0
Fixed Coordinates	7	Angles	0
Astro. Latitudes	0	Heights	0
Astro. Longitudes	0	Height Differences	0
Geoid Records	0	Auxiliary Params.	0
All Aux. Pars.	0	2-D Coords.	0
Direction Pars.	0	2-D Coord. Diffs.	0
Scale Parameters	0	3-D Coords.	0
Constant Pars.	0	3-D Coord. Diffs.	153
Rotation Pars.	0		
Translation Pars.	0		
	--------		--------
Total Parameters	71	Total Observations	153
Degrees of Freedom =	82		

SUMMARY OF SELECTED OPTIONS

OPTION	SELECTION
Computation Mode	Adjustment
Maximum Iterations	5
Convergence Criterion	0.00100
Confidence Level for Statistics	95.000
Covariance Matrix Computation	Connected Portion Only
Residual Rejection Criterion	Tau Max
Confidence Region Types	3D Station Relative
Relative Confidence Regions	Connected Only
Variance Factor (VF) Known	Yes
CMULT (Multiply Parm Cov With VF)	Yes
RMULT (Multiply Res Cov With VF)	No
Force Convergence in Max Iters	Yes
Distances Affect 3D	No
Full Inverse Computed	No
Normals Reordered	Yes
Coordinates Generated	No
Geoid Interpolation Method	Bi-Linear

```
================================================================================
                      USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                  GRS 80             UNITS: m,DMS          Page 0002
================================================================================
--------------------------------------------------------------------------------
```

```
================================================================================
                      USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                  GRS 80             UNITS: m,DMS          Page 0003
================================================================================
Adjusted NEO Coordinates:
                                  NORTHING          EASTING   O-HEIGHT
 CODE FFF STATION                  STD DEV          STD DEV    STD DEV MAPPROJ
 ---- --- ------------ ---------------- ---------------- ---------- -------
 NEO  000 1                  4322633.244       263748.362    193.391 UTM 16
                                   0.008            0.008      0.008
 SFMC     1                   1.00028733   -1 43  8.157702 UTM 16
 NEO  000 10                 4334021.702       267832.189    208.310 UTM 16
                                   0.002            0.002      0.002
 SFMC     10                  1.00026375   -1 41 43.593251 UTM 16
 NEO  000 101                4336917.561       265073.175    204.948 UTM 16
                                   0.001            0.001      0.001
 SFMC     101                 1.00027962   -1 43  1.752950 UTM 16
 NEO  000 11                 4334568.710       262788.467    202.610 UTM 16
                                   0.003            0.002      0.003
 SFMC     11                  1.00029291   -1 43 57.083873 UTM 16
 NEO  000 12                 4338011.184       265114.882    202.290 UTM 16
                                   0.002            0.001      0.002
 SFMC     12                  1.00027937   -1 43  2.823370 UTM 16
 NEO  000 13                 4340015.747       268968.137    205.942 UTM 16
                                   0.002            0.002      0.002
 SFMC     13                  1.00025726   -1 41 25.450344 UTM 16
 NEO  000 14                 4339435.241       270770.129    209.964 UTM 16
                                   0.002            0.002      0.003
 SFMC     14                  1.00024705   -1 40 36.930391 UTM 16
 NEO  000 15                 4341994.826       271436.480    207.286 UTM 16
                                   0.004            0.004      0.004
 SFMC     15                  1.00024329   -1 40 24.344462 UTM 16
 NEO  000 16                 4345968.099       272244.294    201.876 UTM 16
                                   0.006            0.006      0.006
 SFMC     16                  1.00023874   -1 40 10.727229 UTM 16
 NEO  000 17                 4346260.478       268542.027    202.120 UTM 16
                                   0.005            0.005      0.006
 SFMC     17                  1.00025968   -1 41 48.865001 UTM 16
 NEO  000 18                 4346385.253       263678.760    202.415 UTM 16
                                   0.006            0.006      0.006
 SFMC     18                  1.00028770   -1 43 57.277459 UTM 16
 NEO  000 19                 4343108.262       262728.142    204.171 UTM 16
                                   0.004            0.004      0.004
 SFMC     19                  1.00029325   -1 44 15.760062 UTM 16
 NEO  000 2                  4323164.447       269617.221    191.922 UTM 16
                                   0.008            0.008      0.008
 SFMC     2                   1.00025360   -1 40 35.685783 UTM 16
 NEO  000 20                 4343028.206       266791.853    203.763 UTM 16
                                   0.004            0.004      0.004
 SFMC     20                  1.00026970   -1 42 28.620797 UTM 16
 NEO  000 21                 4339810.027       262633.579    203.967 UTM 16
                                   0.003            0.003      0.003
 SFMC     21                  1.00029380   -1 44 11.640803 UTM 16
 NEO  000 3                  4325619.405       271365.474    182.459 UTM 16
                                   0.007            0.007      0.007
 SFMC     3                   1.00024371   -1 39 54.667181 UTM 16
 NEO  000 4                  4327458.011       268470.980    192.823 UTM 16
                                   0.005            0.005      0.005
 SFMC     4                   1.00026011   -1 41 14.029910 UTM 16
 NEO  000 5                  4326763.381       261991.612    199.763 UTM 16
```

```
================================================================================
                      USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                  GRS 80             UNITS: m,DMS          Page 0004
================================================================================
Adjusted NEO Coordinates:
                                  NORTHING          EASTING   O-HEIGHT
 CODE FFF STATION                  STD DEV          STD DEV    STD DEV MAPPROJ
 ---- --- ------------ ---------------- ---------------- ---------- -------
                                    0.006            0.006      0.006
 SFMC     5                   1.00029758   -1 44  2.364925 UTM 16
 NEO  000 6                 4330398.699       263720.889    203.789 UTM 16
                                    0.004            0.004      0.004
 SFMC     6                   1.00028747   -1 43 24.306215 UTM 16
 NEO  000 7                 4330620.407       268574.833    202.486 UTM 16
                                    0.004            0.004      0.004
 SFMC     7                   1.00025951   -1 41 17.468225 UTM 16
 NEO  000 8                 4330373.550       271483.609    186.887 UTM 16
                                    0.004            0.004      0.004
 SFMC     8                   1.00024304   -1 40  0.714476 UTM 16
 NEO  000 9                 4334697.595       271578.040    198.172 UTM 16
                                    0.002            0.002      0.002
 SFMC     9                   1.00024250   -1 40  6.557847 UTM 16
 NEO  111 GINN AZ MK        4336437.724       269332.733    207.631 UTM 16
                                    0.000            0.000      0.000
 SFMC     GINN AZ MK          1.00025519   -1 41  8.898941 UTM 16
 NEO  001 Q 218             4378314.084       269331.221    193.970 UTM 16
                                    0.023            0.023      0.000
 SFMC     Q 218               1.00025515   -1 42 30.816546 UTM 16
 NEO  111 RENT              4323474.184       262738.640    195.787 UTM 16
                                    0.000            0.000      0.000
 SFMC     RENT                1.00029321   -1 43 36.241720 UTM 16
 NEO  000 T 93              4337367.101       284521.146    191.979 UTM 16
                                    0.009            0.009      0.009
 SFMC     T 93                1.00017174   -1 34 31.498781 UTM 16
```

```
================================================================================
                      USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                  GRS 80             UNITS: m,DMS          Page 0005
================================================================================
Adjusted PLH Coordinates:
                                        LATITUDE         LONGITUDE  ELIP-HEIGHT
 CODE FFF STATION                        STD DEV           STD DEV      STD DEV
 ---- --- ------------ ----------------- ----------------- ------------
 PLH  000 1            N 39 01  15.03275 W 89 43  44.12491      162.200
                                  0.008             0.008        0.008
 PLH  000 10           N 39 07  28.01063 W 89 41   8.46887      177.059
                                  0.002             0.002        0.002
 PLH  000 101          N 39 08  59.18469 W 89 43   6.85667      173.657
                                  0.001             0.001        0.001
 PLH  000 11           N 39 07  40.84515 W 89 44  38.97694      171.328
                                  0.003             0.002        0.003
 PLH  000 12           N 39 09  34.66235 W 89 43   6.48549      170.989
                                  0.002             0.001        0.002
 PLH  000 13           N 39 10  43.33242 W 89 40  28.56620      174.637
                                  0.002             0.002        0.002
 PLH  000 14           N 39 10  26.23767 W 89 39  12.83368      178.672
                                  0.002             0.002        0.003
 PLH  000 15           N 39 11  49.81270 W 89 38  48.20457      175.961
                                  0.004             0.004        0.004
 PLH  000 16           N 39 13  59.33094 W 89 38  19.38388      170.490
                                  0.006             0.006        0.006
 PLH  000 17           N 39 14   5.27977 W 89 40  54.00447      170.727
                                  0.005             0.005        0.006
 PLH  000 18           N 39 14   4.60525 W 89 44  16.79200      171.018
                                  0.006             0.006        0.006
 PLH  000 19           N 39 12  17.48976 W 89 44  52.25557      172.810
                                  0.004             0.004        0.004
 PLH  000 2            N 39 01  37.88318 W 89 39  40.97284      160.731
                                  0.008             0.008        0.008
 PLH  000 20           N 39 12  18.85630 W 89 42   2.91078      172.412
                                  0.004             0.004        0.004
 PLH  000 21           N 39 10  30.52598 W 89 44  52.02798      172.638
                                  0.003             0.003        0.003
 PLH  000 3            N 39 02  59.09082 W 89 38  31.30464      151.266
                                  0.007             0.007        0.007
 PLH  000 4            N 39 03  55.92700 W 89 40  33.84553      161.619
                                  0.005             0.005        0.005
 PLH  000 5            N 39 03  27.14780 W 89 45   2.28980      168.541
                                  0.006             0.006        0.006
 PLH  000 6            N 39 05  26.63511 W 89 43  54.96449      172.546
                                  0.004             0.004        0.004
 PLH  000 7            N 39 05  38.50355 W 89 40  33.40177      171.265
                                  0.004             0.004        0.004
 PLH  000 8            N 39 05  33.26459 W 89 38  32.14201      155.682
                                  0.004             0.004        0.004
 PLH  000 9            N 39 07  53.47732 W 89 38  33.45070      166.937
                                  0.002             0.002        0.002
 PLH  111 GINN AZ MK   N 39 08  47.73610 W 89 40   9.00079      176.367
                                  0.000             0.000        0.000
 PLH  001 Q 218        N 39 31  24.67725 W 89 41   0.83797      162.051
                                  0.023             0.023        0.000
 PLH  111 RENT         N 39 01  41.29820 W 89 44  27.12080      164.590
                                  0.000             0.000        0.000
 PLH  000 T 93         N 39 09  31.86639 W 89 29  37.93400      160.683
                                  0.009             0.009        0.009
```

```
================================================================================
                      USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                    GRS 80              UNITS: m,DMS          Page 0006
================================================================================
```

Geoid Values:

CODE	NAME	N/S DEFLECTION	E/W DEFLECTION	UNDULATION
GEOI	1	+ 0 0 1.2	+ 0 0 0.0	-31.191
GEOI	10	+ 0 0 1.7	- 0 0 0.9	-31.250
GEOI	101	+ 0 0 2.0	- 0 0 0.9	-31.291
GEOI	11	+ 0 0 1.8	- 0 0 0.9	-31.282
GEOI	12	+ 0 0 2.1	- 0 0 0.9	-31.301
GEOI	13	+ 0 0 2.8	- 0 0 0.7	-31.305
GEOI	14	+ 0 0 2.6	- 0 0 0.7	-31.292
GEOI	15	+ 0 0 3.1	- 0 0 0.4	-31.325
GEOI	16	+ 0 0 3.5	- 0 0 0.1	-31.386
GEOI	17	+ 0 0 3.1	- 0 0 0.1	-31.393
GEOI	18	+ 0 0 2.6	- 0 0 0.1	-31.397
GEOI	19	+ 0 0 2.2	- 0 0 0.5	-31.361
GEOI	2	+ 0 0 0.3	+ 0 0 0.1	-31.191
GEOI	20	+ 0 0 2.6	- 0 0 0.3	-31.351
GEOI	21	+ 0 0 2.0	- 0 0 0.7	-31.328
GEOI	3	+ 0 0 0.3	- 0 0 0.1	-31.193
GEOI	4	+ 0 0 1.1	- 0 0 0.5	-31.204
GEOI	5	+ 0 0 1.6	- 0 0 0.6	-31.221
GEOI	6	+ 0 0 1.6	- 0 0 0.8	-31.242
GEOI	7	+ 0 0 1.5	- 0 0 0.8	-31.221
GEOI	8	+ 0 0 1.3	- 0 0 0.7	-31.205
GEOI	9	+ 0 0 2.1	- 0 0 0.9	-31.235
GEOI	GINN AZ MK	+ 0 0 2.3	- 0 0 0.8	-31.264
GEOI	Q 218	+ 0 0 4.4	- 0 0 0.3	-31.919
GEOI	RENT	+ 0 0 1.4	- 0 0 0.2	-31.197
GEOI	T 93	+ 0 0 3.5	+ 0 0 2.4	-31.297

```
================================================================================
                    USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0007
================================================================================
Residuals (critical value = 3.643):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
GROUP: 041110.ASC  ,obs#:    1
DXCT              GINN AZ MK   1                -5124.28290   -0.008   -0.934
                                                      0.011    0.008     0.51
DYCT              GINN AZ MK   1                -8817.74710    0.003    0.423
                                                      0.011    0.008     0.23
DZCT              GINN AZ MK   1               -10845.71790    0.002    0.233
                                                      0.011    0.008     0.13
GROUP: 041110.ASC  ,obs#:    2
DXCT              101          1                 -852.25410    0.007    0.934
                                                      0.011    0.008     0.49
DYCT              101          1                -9019.92010   -0.003   -0.423
                                                      0.011    0.008     0.22
DZCT              101          1               -11117.81170   -0.002   -0.233
                                                      0.011    0.008     0.12
GROUP: 041110.ASC  ,obs#:    3
DXCT              GINN AZ MK   101              -4272.03490   -0.009   -2.796
                                                      0.003    0.003     1.99
DYCT              GINN AZ MK   101                202.17510    0.005    1.496
                                                      0.003    0.003     1.06
DZCT              GINN AZ MK   101                272.09260    0.005    1.598
                                                      0.003    0.003     1.13
GROUP: 041110.ASC  ,obs#:    4
DXCT              GINN AZ MK   2                  722.37250   -0.002   -0.297
                                                      0.010    0.007     0.15
DYCT              GINN AZ MK   2                -8341.79370    0.001    0.165
                                                      0.010    0.007     0.08
DZCT              GINN AZ MK   2               -10299.18980   -0.002   -0.366
                                                      0.010    0.007     0.19
GROUP: 041110.ASC  ,obs#:    5
DXCT              101          2                 4994.41150    0.002    0.296
                                                      0.011    0.008     0.17
DYCT              101          2                -8543.97090   -0.001   -0.164
                                                      0.011    0.008     0.09
DZCT              101          2               -10571.29270    0.003    0.366
                                                      0.011    0.008     0.20
GROUP: 041110.ASC  ,obs#:    6
DXCT              GINN AZ MK   3                 2388.25690    0.001    0.123
                                                      0.008    0.005     0.06
DYCT              GINN AZ MK   3                -6746.95730    0.004    0.743
                                                      0.008    0.005     0.37
DZCT              GINN AZ MK   3                -8359.98660    0.004    0.711
                                                      0.008    0.005     0.35
GROUP: 041110.ASC  ,obs#:    7
DXCT              101          3                 6660.30190   -0.001   -0.124
                                                      0.010    0.007     0.07
DYCT              101          3                -6949.12730   -0.006   -0.745
                                                      0.010    0.007     0.43
DZCT              101          3                -8632.07490   -0.005   -0.713
                                                      0.010    0.007     0.41
GROUP: 041110.ASC  ,obs#:    8
DXCT              GINN AZ MK   4                  -564.57870   -0.002   -0.393
                                                      0.007    0.005     0.20
```

```
================================================================================
                    USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0008
================================================================================
Residuals (critical value = 3.643):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
DYCT              GINN AZ MK   4                -5668.12850   -0.003   -0.585
                                                       0.007    0.005     0.30
DZCT              GINN AZ MK   4                -6992.43030    0.006    1.335
                                                       0.007    0.005     0.68
GROUP: 041110.ASC  ,obs#:    9
DXCT              101          4                 3707.46070    0.002    0.394
                                                       0.008    0.006     0.22
DYCT              101          4                -5870.31410    0.003    0.580
                                                       0.008    0.006     0.33
DZCT              101          4                -7264.51410   -0.008   -1.333
                                                       0.008    0.006     0.75
GROUP: 041110.ASC  ,obs#:   10
DXCT              GINN AZ MK   Q 218            -1391.34150   -0.005   -0.203
                                                       0.032    0.023     0.11
DYCT              GINN AZ MK   Q 218            26529.35840    0.005    0.174
                                                       0.032    0.028     0.12
DZCT              GINN AZ MK   Q 218            32358.60170    0.000    0.007
                                                       0.032    0.027     0.00
GROUP: 041110.ASC  ,obs#:   11
DXCT              101          Q 218             2880.69290    0.004    0.200
                                                       0.032    0.022     0.11
DYCT              101          Q 218            26327.17790    0.006    0.205
                                                       0.032    0.028     0.14
DZCT              101          Q 218            32086.51340   -0.009   -0.340
                                                       0.032    0.026     0.22
GROUP: 041110.ASC  ,obs#:   12
DXCT              GINN AZ MK   RENT             -6160.91430    0.009    0.786
                                                       0.011    0.011     0.60
DYCT              GINN AZ MK   RENT             -8314.37260   -0.007   -0.662
                                                       0.011    0.011     0.50
DZCT              GINN AZ MK   RENT            -10214.94540   -0.004   -0.386
                                                       0.011    0.011     0.29
GROUP: 041110.ASC  ,obs#:   13
DXCT              101          RENT             -1888.88360    0.021    2.079
                                                       0.010    0.010     1.57
DYCT              101          RENT             -8516.54410   -0.015   -1.502
                                                       0.010    0.010     1.13
DZCT              101          RENT            -10487.04210   -0.005   -0.488
                                                       0.010    0.010     0.37
GROUP: 041110.ASC  ,obs#:   14
DXCT              GINN AZ MK   T 93             15146.22110   -0.004   -0.593
                                                       0.012    0.007     0.28
DYCT              GINN AZ MK   T 93               982.09660    0.003    0.414
                                                       0.012    0.007     0.20
DZCT              GINN AZ MK   T 93              1045.46580   -0.002   -0.275
                                                       0.012    0.007     0.13
GROUP: 041110.ASC  ,obs#:   15
DXCT              101          T 93             19418.25340    0.007    0.593
                                                       0.015    0.012     0.35
DYCT              101          T 93               779.92480   -0.005   -0.413
                                                       0.015    0.012     0.25
DZCT              101          T 93               773.36320    0.003    0.273
```

```
================================================================================
                    USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                GRS 80             UNITS: m,DMS          Page 0009
================================================================================
Residuals (critical value = 3.643):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ------------------ -------- --------
                                                          0.015    0.012     0.16
GROUP: 041210.ASC  ,obs#:   16
DXCT              GINN AZ MK   10                 -1419.51830    0.001    0.724
                                                          0.002    0.001     0.31
DYCT              GINN AZ MK   10                 -1560.35880   -0.001   -0.968
                                                          0.002    0.001     0.44
DZCT              GINN AZ MK   10                 -1906.64240   -0.001   -0.939
                                                          0.002    0.001     0.41
GROUP: 041210.ASC  ,obs#:   17
DXCT              101          10                  2852.52770   -0.002   -0.727
                                                          0.003    0.002     0.43
DYCT              101          10                 -1762.54210    0.002    0.994
                                                          0.003    0.002     0.60
DZCT              101          10                 -2178.74330    0.002    0.967
                                                          0.003    0.002     0.57
GROUP: 041210.ASC  ,obs#:   18
DXCT              GINN AZ MK   101                -4272.04640    0.003    0.983
                                                          0.003    0.003     0.70
DYCT              GINN AZ MK   101                  202.18030   -0.001   -0.214
                                                          0.003    0.003     0.15
DZCT              GINN AZ MK   101                  272.10040   -0.003   -0.969
                                                          0.003    0.003     0.69
GROUP: 041210.ASC  ,obs#:   19
DXCT              GINN AZ MK   11                 -6477.27880    0.002    0.371
                                                          0.005    0.005     0.25
DYCT              GINN AZ MK   11                 -1331.30560   -0.005   -1.101
                                                          0.005    0.005     0.74
DZCT              GINN AZ MK   11                 -1603.21320    0.002    0.464
                                                          0.005    0.005     0.31
GROUP: 041210.ASC  ,obs#:   20
DXCT              101          11                 -2205.23330   -0.000   -0.373
                                                          0.003    0.001     0.12
DYCT              101          11                 -1533.49150    0.001    1.106
                                                          0.003    0.001     0.37
DZCT              101          11                 -1875.30800   -0.001   -0.478
                                                          0.003    0.001     0.16
GROUP: 041210.ASC  ,obs#:   21
DXCT              GINN AZ MK   12                 -4266.53850    0.003    1.069
                                                          0.003    0.003     0.75
DYCT              GINN AZ MK   12                  895.12290   -0.003   -0.813
                                                          0.003    0.003     0.57
DZCT              GINN AZ MK   12                 1118.83380   -0.003   -0.939
                                                          0.004    0.003     0.66
GROUP: 041210.ASC  ,obs#:   22
DXCT              101          12                    5.50850   -0.000   -0.982
                                                          0.001    0.000     0.21
DYCT              101          12                  692.94050    0.000    0.542
                                                          0.001    0.000     0.18
DZCT              101          12                  846.73290    0.000    0.762
                                                          0.002    0.001     0.42
GROUP: 041210.ASC  ,obs#:   23
DXCT              GINN AZ MK   13                  -482.62650    0.001    0.364
```

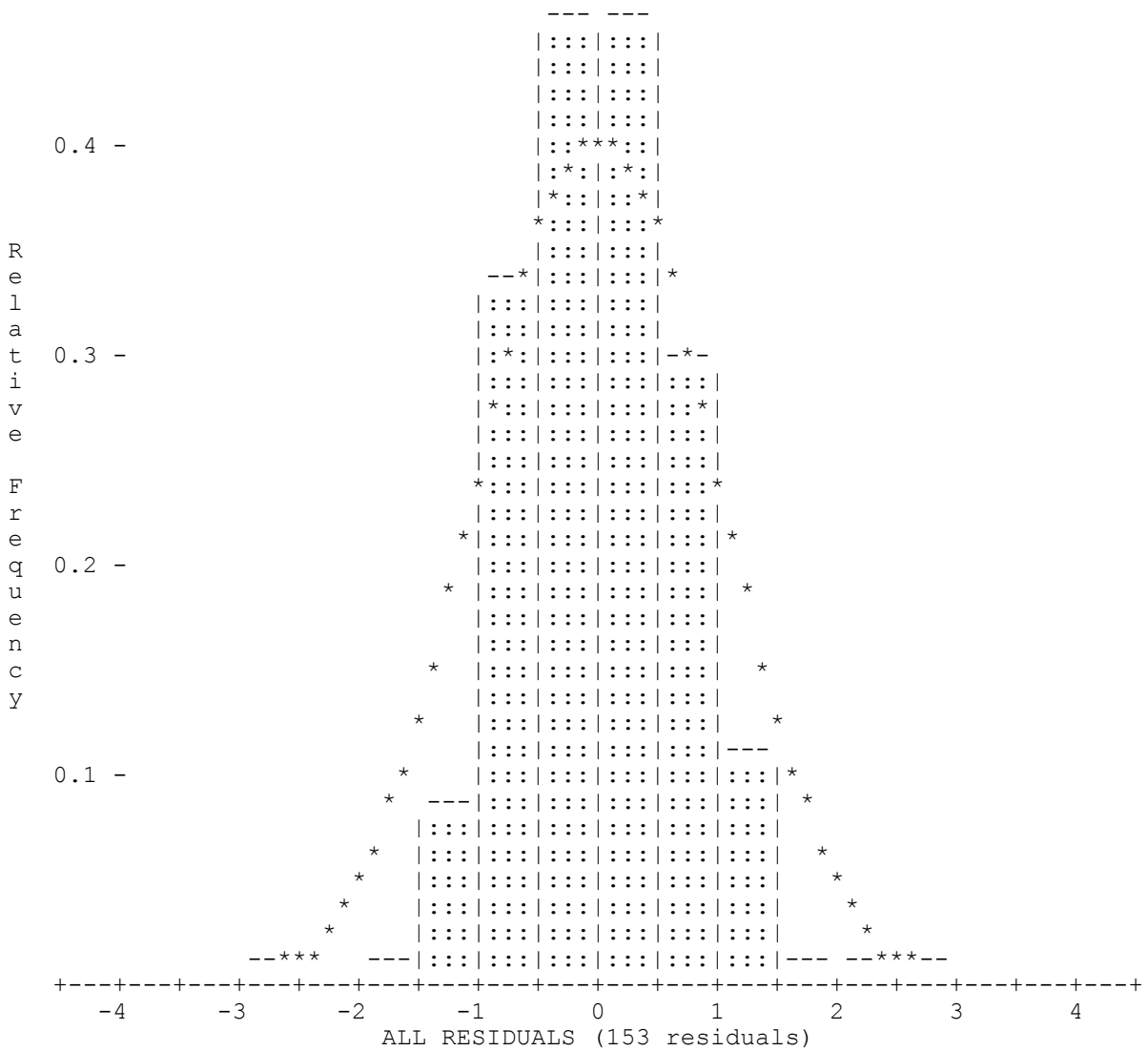
```
================================================================================
                    USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0010
================================================================================
Residuals (critical value = 3.643):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ------------------ -------- --------
                                                          0.003    0.002     0.16
DYCT              GINN AZ MK   13                  2249.94870   -0.005   -3.055
                                                          0.003    0.002     1.36
DZCT              GINN AZ MK   13                  2762.98530    0.001    0.848
                                                          0.003    0.002     0.38
GROUP: 041210.ASC  ,obs#:   24
DXCT              101          13                  3789.41860   -0.001   -0.378
                                                          0.004    0.003     0.23
DYCT              101          13                  2047.75510    0.009    3.045
                                                          0.004    0.003     1.82
DZCT              101          13                  2490.89160   -0.002   -0.806
                                                          0.004    0.003     0.48
GROUP: 041210.ASC  ,obs#:   25
DXCT              GINN AZ MK   14                  1337.17420    0.001    1.039
                                                          0.003    0.001     0.37
DYCT              GINN AZ MK   14                  1924.44660    0.000    0.230
                                                          0.003    0.001     0.09
DZCT              GINN AZ MK   14                  2356.85550   -0.002   -1.234
                                                          0.003    0.001     0.47
GROUP: 041210.ASC  ,obs#:   26
DXCT              101          14                  5609.22300   -0.004   -1.021
                                                          0.005    0.004     0.67
DYCT              101          14                  1722.26780   -0.001   -0.133
                                                          0.005    0.004     0.09
DZCT              101          14                  2084.75150    0.005    1.216
                                                          0.005    0.004     0.80
GROUP: 041210.ASC  ,obs#:   27
DXCT              GINN AZ MK   15                  1918.31840    0.002    0.850
                                                          0.005    0.003     0.38
DYCT              GINN AZ MK   15                  3558.63100   -0.008   -2.851
                                                          0.005    0.003     1.31
DZCT              GINN AZ MK   15                  4352.89680    0.004    1.431
                                                          0.005    0.003     0.64
GROUP: 041210.ASC  ,obs#:   28
DXCT              101          15                  6190.36820   -0.004   -0.839
                                                          0.006    0.005     0.51
DYCT              101          15                  3356.42940    0.014    2.832
                                                          0.006    0.005     1.74
DZCT              101          15                  4080.81010   -0.007   -1.395
                                                          0.006    0.005     0.85
GROUP: 041210.ASC  ,obs#:   29
DXCT              GINN AZ MK   16                  2593.94980    0.006    1.317
                                                          0.008    0.005     0.65
DYCT              GINN AZ MK   16                  6092.45540   -0.002   -0.487
                                                          0.008    0.005     0.24
DZCT              GINN AZ MK   16                  7444.12710    0.002    0.317
                                                          0.008    0.005     0.16
GROUP: 041210.ASC  ,obs#:   30
DXCT              101          16                  6866.00840   -0.009   -1.317
                                                          0.009    0.007     0.75
DYCT              101          16                  5890.27010    0.003    0.485
                                                          0.009    0.007     0.28
```

```
================================================================================
                    USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0011
================================================================================
Residuals (critical value = 3.643):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
DZCT              101          16                  7172.03330   -0.002   -0.316
                                                        0.009    0.007     0.18
GROUP: 041210.ASC  ,obs#:   31
DXCT              GINN AZ MK   17                 -1115.10380    0.006    1.094
                                                        0.007    0.005     0.58
DYCT              GINN AZ MK   17                  6186.31170   -0.002   -0.295
                                                        0.008    0.005     0.16
DZCT              GINN AZ MK   17                  7586.37930    0.002    0.383
                                                        0.007    0.005     0.20
GROUP: 041210.ASC  ,obs#:   32
DXCT              101          17                  3156.95120   -0.006   -1.094
                                                        0.008    0.005     0.59
DYCT              101          17                  5984.12890    0.002    0.295
                                                        0.008    0.005     0.16
DZCT              101          17                  7314.28590   -0.002   -0.383
                                                        0.008    0.005     0.21
GROUP: 041210.ASC  ,obs#:   33
DXCT              GINN AZ MK   18                 -5978.59330    0.003    0.524
                                                        0.009    0.007     0.30
DYCT              GINN AZ MK   18                  6148.28350    0.013    1.961
                                                        0.009    0.007     1.15
DZCT              GINN AZ MK   18                  7570.45620   -0.003   -0.472
                                                        0.009    0.007     0.27
GROUP: 041210.ASC  ,obs#:   34
DXCT              101          18                 -1706.54400   -0.002   -0.520
                                                        0.007    0.005     0.25
DYCT              101          18                  5946.12620   -0.009   -1.961
                                                        0.007    0.005     0.97
DZCT              101          18                  7298.35340    0.002    0.476
                                                        0.007    0.005     0.23
GROUP: 041210.ASC  ,obs#:   35
DXCT              GINN AZ MK   19                 -6819.93830    0.002    0.358
                                                        0.007    0.006     0.22
DYCT              GINN AZ MK   19                  4054.38150    0.002    0.324
                                                        0.007    0.006     0.20
DZCT              GINN AZ MK   19                  5012.35610   -0.004   -0.729
                                                        0.007    0.006     0.45
GROUP: 041210.ASC  ,obs#:   36
DXCT              101          19                 -2547.89180   -0.001   -0.355
                                                        0.005    0.003     0.15
DYCT              101          19                  3852.20470   -0.001   -0.330
                                                        0.005    0.003     0.15
DZCT              101          19                  4740.25230    0.002    0.732
                                                        0.005    0.003     0.32
GROUP: 041210.ASC  ,obs#:   37
DXCT              GINN AZ MK   20                 -2756.86820    0.003    0.644
                                                        0.005    0.004     0.36
DYCT              GINN AZ MK   20                  4100.88060   -0.001   -0.259
                                                        0.005    0.004     0.15
DZCT              GINN AZ MK   20                  5044.75900   -0.002   -0.451
                                                        0.005    0.004     0.25
GROUP: 041210.ASC  ,obs#:   38
```

```
================================================================================
                    USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0012
================================================================================
Residuals (critical value = 3.643):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ------------------ -------- --------
DXCT              101          20                  1515.17980   -0.002   -0.644
                                                        0.005    0.003     0.32
DYCT              101          20                  3898.69910    0.001    0.257
                                                        0.005    0.003     0.13
DZCT              101          20                  4772.65830    0.001    0.449
                                                        0.005    0.003     0.23
GROUP: 041210.ASC  ,obs#:   39
DXCT              GINN AZ MK   21                 -6805.30160    0.001    0.207
                                                        0.006    0.005     0.14
DYCT              GINN AZ MK   21                  1970.12970   -0.003   -0.518
                                                        0.006    0.005     0.35
DZCT              GINN AZ MK   21                  2455.56910   -0.004   -0.844
                                                        0.006    0.005     0.56
GROUP: 041210.ASC  ,obs#:   40
DXCT              101          21                 -2533.25690   -0.000   -0.201
                                                        0.003    0.001     0.07
DYCT              101          21                  1767.94680    0.001    0.484
                                                        0.003    0.001     0.17
DZCT              101          21                  2183.46630    0.001    0.820
                                                        0.003    0.001     0.30
GROUP: 041210.ASC  ,obs#:   41
DXCT              GINN AZ MK   5                  -7015.78750    0.000    0.065
                                                        0.009    0.007     0.04
DYCT              GINN AZ MK   5                  -6265.06300    0.003    0.469
                                                        0.009    0.007     0.27
DZCT              GINN AZ MK   5                  -7677.18700   -0.004   -0.512
                                                        0.009    0.007     0.29
GROUP: 041210.ASC  ,obs#:   42
DXCT              101          5                  -2743.74330   -0.000   -0.065
                                                        0.008    0.005     0.03
DYCT              101          5                  -6467.23690   -0.003   -0.470
                                                        0.008    0.005     0.24
DZCT              101          5                  -7949.29070    0.003    0.513
                                                        0.008    0.005     0.26
GROUP: 041210.ASC  ,obs#:   43
DXCT              GINN AZ MK   6                  -5407.88510    0.000    0.100
                                                        0.006    0.005     0.06
DYCT              GINN AZ MK   6                  -3938.23320    0.004    0.755
                                                        0.006    0.005     0.44
DZCT              GINN AZ MK   6                  -4813.99580   -0.006   -1.157
                                                        0.006    0.005     0.68
GROUP: 041210.ASC  ,obs#:   44
DXCT              101          6                  -1135.84090   -0.000   -0.099
                                                        0.005    0.003     0.05
DYCT              101          6                  -4140.40680   -0.002   -0.760
                                                        0.005    0.003     0.36
DZCT              101          6                  -5086.10250    0.004    1.160
                                                        0.005    0.003     0.55
GROUP: 041210.ASC  ,obs#:   45
DXCT              GINN AZ MK   7                   -565.14830   -0.000   -0.044
                                                        0.004    0.003     0.02
DYCT              GINN AZ MK   7                  -3681.41260    0.000    0.094
```

```
================================================================================
                      USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                 GRS 80             UNITS: m,DMS          Page 0013
================================================================================
Residuals (critical value = 3.643):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ------------------ -------- --------
                                                          0.004    0.003     0.04
DZCT              GINN AZ MK   7                   -4530.73580   -0.002   -0.707
                                                          0.004    0.003     0.34
GROUP: 041210.ASC  ,obs#:   46
DXCT              101          7                    3706.89480    0.000    0.044
                                                          0.005    0.004     0.03
DYCT              101          7                   -3883.59160   -0.000   -0.093
                                                          0.005    0.004     0.05
DZCT              101          7                   -4802.83820    0.003    0.707
                                                          0.005    0.004     0.41
GROUP: 041210.ASC  ,obs#:   47
DXCT              GINN AZ MK   8                    2349.43310   -0.000   -0.036
                                                          0.005    0.003     0.02
DYCT              GINN AZ MK   8                   -3753.85860    0.000    0.155
                                                          0.005    0.003     0.07
DZCT              GINN AZ MK   8                   -4665.95510   -0.002   -0.666
                                                          0.005    0.003     0.29
GROUP: 041210.ASC  ,obs#:   48
DXCT              101          8                    6621.47620    0.000    0.037
                                                          0.007    0.006     0.02
DYCT              101          8                   -3956.03700   -0.001   -0.142
                                                          0.007    0.006     0.09
DZCT              101          8                   -4938.05820    0.004    0.663
                                                          0.007    0.006     0.41
GROUP: 041210.ASC  ,obs#:   49
DXCT              GINN AZ MK   9                    2301.02280    0.001    0.847
                                                          0.002    0.001     0.24
DYCT              GINN AZ MK   9                   -1035.07890    0.000    0.226
                                                          0.002    0.001     0.07
DZCT              GINN AZ MK   9                   -1303.78810   -0.001   -0.840
                                                          0.002    0.001     0.25
GROUP: 041210.ASC  ,obs#:   50
DXCT              101          9                    6573.07090   -0.004   -0.847
                                                          0.005    0.005     0.58
DYCT              101          9                   -1237.25750   -0.001   -0.177
                                                          0.005    0.005     0.12
DZCT              101          9                   -1575.89020    0.004    0.832
                                                          0.005    0.005     0.57
GROUP: 041310.ASC  ,obs#:   51
DXCT              GINN AZ MK   101                 -4272.03690   -0.007   -2.139
                                                          0.003    0.003     1.52
DYCT              GINN AZ MK   101                   202.17080    0.009    2.913
                                                          0.003    0.003     2.06
DZCT              GINN AZ MK   101                   272.09060    0.007    2.258
                                                          0.003    0.003     1.60
```

```
================================================================================
                      USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                  GRS 80             UNITS: m,DMS          Page 0014
================================================================================
```



```
================================================================================
                     USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                 GRS 80             UNITS: m,DMS          Page 0015
================================================================================
```

S T A T I S T I C S S U M M A R Y	
Residual Critical Value Type	Tau Max
Residual Critical Value	3.6426
Number of Flagged Residuals	0
Convergence Criterion	0.0010
Final Iteration Counter Value	2
Confidence Level Used	95.0000
Estimated Variance Factor	1.0385
Number of Degrees of Freedom	82

Chi-Square Test on the Variance Factor:

7.8171e-01 < 1.0000 < 1.4472e+00 ?

THE TEST PASSES

NOTE: All confidence regions were computed using the following factors:

Variance factor used	=	1.0385
3-D expansion factor	=	2.7955

Note that, for relative confidence regions, precisions are computed from the ratio of the major semi-axis and the spatial distance between the two stations.

```
================================================================================
                    USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0016
================================================================================
3D Station Confidence Regions (95.000 percent):
STATION          MAJ-SEMI (AZ,VANG)    MED-SEMI (AZ,VANG)    MIN-SEMI (AZ,VANG)
-----------  --------------------- --------------------- ---------------------
1                  0.023 (  0, 90)       0.022 ( 90,  0)       0.022 (  0,  0)
10                 0.005 (  0, 90)       0.005 (  0,  0)       0.005 ( 90,  0)
101                0.003 (  0, 90)       0.003 (  0,  0)       0.003 ( 90,  0)
11                 0.007 (  0, 90)       0.007 (  0,  0)       0.007 ( 90,  0)
12                 0.005 (  0, 90)       0.004 (  0,  0)       0.004 ( 90,  0)
13                 0.007 (  0, 90)       0.006 (  0,  0)       0.006 ( 90,  0)
14                 0.007 (  0, 90)       0.006 ( 90,  0)       0.006 (  0,  0)
15                 0.011 (  0, 90)       0.010 ( 90,  0)       0.010 (  0,  0)
16                 0.017 (  0, 90)       0.016 ( 90,  0)       0.016 (  0,  0)
17                 0.015 (  0, 90)       0.015 (  0,  0)       0.015 ( 90,  0)
18                 0.016 (  0, 90)       0.016 (  0,  0)       0.016 ( 90,  0)
19                 0.012 (  0, 90)       0.012 (  0,  0)       0.012 ( 90,  0)
2                  0.021 (  0, 90)       0.021 ( 90,  0)       0.021 (  0,  0)
20                 0.011 (  0, 90)       0.010 (  0,  0)       0.010 ( 90,  0)
21                 0.008 (  0, 90)       0.008 (  0,  0)       0.008 ( 90,  0)
3                  0.018 (  0, 90)       0.018 (  0,  0)       0.018 ( 90,  0)
4                  0.015 (  0, 90)       0.015 (  0,  0)       0.015 ( 90,  0)
5                  0.017 (  0, 90)       0.017 (  0,  0)       0.017 ( 90,  0)
6                  0.011 (  0, 90)       0.011 (  0,  0)       0.011 ( 90,  0)
7                  0.010 (  0, 90)       0.010 (  0,  0)       0.010 ( 90,  0)
8                  0.012 (  0, 90)       0.011 ( 90,  0)       0.011 (  0,  0)
9                  0.006 (  0, 90)       0.006 (  0,  0)       0.006 ( 90,  0)
Q 218              0.064 (  0,  0)       0.064 ( 90,  0)       0.000 (  0, 90)
T 93               0.026 (  0, 90)       0.026 (  0,  0)       0.026 ( 90,  0)
```

```
================================================================================
                    USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                 GRS 80             UNITS: m,DMS          Page 0017
================================================================================
3D Relative Confidence Regions (95.000 percent):
                          MAJ-SEMI    MED-SEMI    MIN-SEMI
FROM         TO          (AZ,VANG)   (AZ,VANG)   (AZ,VANG)     DISTANCE      PPM
------------ ------------ ---------- ---------- ---------- ------------ --------
1            101             0.023       0.022       0.022   14341.936     1.57
                         (  0, 90)   ( 90,  0)   (  0,  0)
1            GINN AZ MK      0.023       0.022       0.022   14887.596     1.51
                         (  0, 90)   ( 90,  0)   (  0,  0)
10           101             0.006       0.006       0.005    3998.795     1.43
                         (  0, 90)   (  0,  0)   ( 90,  0)
10           GINN AZ MK      0.005       0.005       0.005    2843.421     1.91
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          11              0.007       0.007       0.006    3275.886     2.02
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          12              0.004       0.003       0.003    1094.146     3.58
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          13              0.007       0.007       0.007    4975.696     1.37
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          14              0.007       0.007       0.007    6227.018     1.19
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          15              0.011       0.011       0.011    8138.751     1.35
                         (  0, 90)   ( 90,  0)   (  0,  0)
101          16              0.017       0.016       0.016   11544.492     1.44
                         (  0, 90)   ( 90,  0)   (  0,  0)
101          17              0.015       0.015       0.015    9963.678     1.54
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          18              0.016       0.016       0.016    9567.372     1.69
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          19              0.012       0.012       0.012    6618.251     1.81
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          2               0.021       0.021       0.021   14480.877     1.47
                         (  0, 90)   ( 90,  0)   (  0,  0)
101          20              0.011       0.010       0.010    6346.173     1.66
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          21              0.008       0.007       0.007    3782.930     2.05
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          3               0.018       0.018       0.018   12929.148     1.43
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          4               0.015       0.015       0.015   10048.836     1.47
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          5               0.017       0.017       0.017   10608.699     1.64
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          6               0.011       0.011       0.011    6655.939     1.71
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          7               0.010       0.010       0.010    7203.512     1.40
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          8               0.012       0.012       0.012    9158.524     1.30
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          9               0.007       0.006       0.006    6871.640     0.98
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          GINN AZ MK      0.003       0.003       0.003    4285.472     0.77
                         (  0, 90)   (  0,  0)   ( 90,  0)
101          Q 218           0.064       0.064       0.003   41604.841     1.53
                         (  0,  0)   ( 90,  0)   (  0, 90)
101          RENT            0.003       0.003       0.003   13641.032     0.24
                         (  0, 90)   (  0,  0)   ( 90,  0)
```

```
================================================================================
                    USGS - Illinois LiDAR - Constrained
GeoLab V2.4d                 GRS 80             UNITS: m,DMS          Page 0018
================================================================================
3D Relative Confidence Regions (95.000 percent):
                           MAJ-SEMI    MED-SEMI    MIN-SEMI
FROM         TO           (AZ,VANG)   (AZ,VANG)   (AZ,VANG)     DISTANCE      PPM
------------ ------------ ----------- ----------- ----------- ------------ --------
101          T 93             0.026       0.026       0.026   19449.298     1.36
                           (  0, 90)   (  0,  0)   ( 90,  0)
11           GINN AZ MK       0.007       0.007       0.007    6804.248     1.04
                           (  0, 90)   (  0,  0)   ( 90,  0)
12           GINN AZ MK       0.005       0.004       0.004    4500.705     1.07
                           (  0, 90)   (  0,  0)   ( 90,  0)
13           GINN AZ MK       0.007       0.006       0.006    3595.729     1.83
                           (  0, 90)   (  0,  0)   ( 90,  0)
14           GINN AZ MK       0.007       0.006       0.006    3323.597     2.12
                           (  0, 90)   ( 90,  0)   (  0,  0)
15           GINN AZ MK       0.011       0.010       0.010    5940.665     1.82
                           (  0, 90)   ( 90,  0)   (  0,  0)
16           GINN AZ MK       0.017       0.016       0.016    9963.014     1.66
                           (  0, 90)   ( 90,  0)   (  0,  0)
17           GINN AZ MK       0.015       0.015       0.015    9852.262     1.56
                           (  0, 90)   (  0,  0)   ( 90,  0)
18           GINN AZ MK       0.016       0.016       0.016   11439.268     1.41
                           (  0, 90)   (  0,  0)   ( 90,  0)
19           GINN AZ MK       0.012       0.012       0.012    9384.734     1.29
                           (  0, 90)   (  0,  0)   ( 90,  0)
2            GINN AZ MK       0.021       0.021       0.021   13273.307     1.61
                           (  0, 90)   ( 90,  0)   (  0,  0)
20           GINN AZ MK       0.011       0.010       0.010    7061.664     1.50
                           (  0, 90)   (  0,  0)   ( 90,  0)
21           GINN AZ MK       0.008       0.008       0.008    7498.221     1.09
                           (  0, 90)   (  0,  0)   ( 90,  0)
3            GINN AZ MK       0.018       0.018       0.018   11005.202     1.67
                           (  0, 90)   (  0,  0)   ( 90,  0)
4            GINN AZ MK       0.015       0.015       0.015    9018.895     1.63
                           (  0, 90)   (  0,  0)   ( 90,  0)
5            GINN AZ MK       0.017       0.017       0.017   12141.314     1.44
                           (  0, 90)   (  0,  0)   ( 90,  0)
6            GINN AZ MK       0.011       0.011       0.011    8241.934     1.39
                           (  0, 90)   (  0,  0)   ( 90,  0)
7            GINN AZ MK       0.010       0.010       0.010    5865.132     1.71
                           (  0, 90)   (  0,  0)   ( 90,  0)
8            GINN AZ MK       0.012       0.011       0.011    6432.919     1.83
                           (  0, 90)   ( 90,  0)   (  0,  0)
9            GINN AZ MK       0.006       0.006       0.006    2840.064     2.17
                           (  0, 90)   (  0,  0)   ( 90,  0)
GINN AZ MK   Q 218            0.064       0.064       0.000   41866.718     1.52
                           (  0,  0)   ( 90,  0)   (  0, 90)
GINN AZ MK   T 93             0.026       0.026       0.026   15213.987     1.74
                           (  0, 90)   (  0,  0)   ( 90,  0)

17:32:13, Sat May 15, 2010
```

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0001
================================================================================
17:05:28, Sat May 15, 2010

INI file:    C:\WINNT\GEOLAB.INI
Input file:  R:\1100328\GEOM~56O\SURVEY\KY_SITE\GEO\C.IOB
Output file: R:\1100328\GEOM~56O\SURVEY\KY_SITE\GEO\C.LST

Geoid File:  C:\GEOLAB2\G2009U07.GEO
```

PARAMETERS		OBSERVATIONS	
Description	Number	Description	Number
No. of Stations	29	Directions	0
Coord Parameters	75	Distances	0
Free Latitudes	25	Azimuths	0
Free Longitudes	25	Vertical Angles	0
Free Heights	25	Zenithal Angles	0
Fixed Coordinates	12	Angles	0
Astro. Latitudes	0	Heights	0
Astro. Longitudes	0	Height Differences	0
Geoid Records	0	Auxiliary Params.	0
All Aux. Pars.	0	2-D Coords.	0
Direction Pars.	0	2-D Coord. Diffs.	0
Scale Parameters	0	3-D Coords.	0
Constant Pars.	0	3-D Coord. Diffs.	177
Rotation Pars.	0		
Translation Pars.	0		
	---		---
Total Parameters	75	Total Observations	177
Degrees of Freedom =	102		

SUMMARY OF SELECTED OPTIONS

OPTION	SELECTION
Computation Mode	Adjustment
Maximum Iterations	5
Convergence Criterion	0.00100
Confidence Level for Statistics	95.000
Covariance Matrix Computation	Connected Portion Only
Residual Rejection Criterion	Tau Max
Confidence Region Types	3D Station Relative
Relative Confidence Regions	Connected Only
Variance Factor (VF) Known	Yes
CMULT (Multiply Parm Cov With VF)	Yes
RMULT (Multiply Res Cov With VF)	No
Force Convergence in Max Iters	Yes
Distances Affect 3D	No
Full Inverse Computed	No
Normals Reordered	Yes
Coordinates Generated	No
Geoid Interpolation Method	Bi-Linear

```
================================================================================
                      USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                  GRS 80             UNITS: m,DMS          Page 0002
================================================================================
--------------------------------------------------------------------------------
```

```
================================================================================
                      USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                  GRS 80             UNITS: m,DMS          Page 0003
================================================================================
Adjusted NEO Coordinates:
                                 NORTHING          EASTING   O-HEIGHT
 CODE FFF STATION                 STD DEV          STD DEV    STD DEV MAPPROJ
 ---- --- ------------ ---------------- ---------------- ---------- -------
 NEO  000 1                  4080742.082       452408.361    168.934 UTM 16
                                   0.014            0.014      0.007
 SFMC     1                   0.99962790    0-19 13.462377 UTM 16
 NEO  000 10                 4084396.052       467090.805    208.413 UTM 16
                                   0.014            0.014      0.006
 SFMC     10                  0.99961334    0-13 18.575207 UTM 16
 NEO  000 101                4076690.201       460370.945    180.340 UTM 16
                                   0.013            0.013      0.005
 SFMC     101                 0.99961935    0-15 59.211423 UTM 16
 NEO  000 102                4078935.667       464568.328    198.666 UTM 16
                                   0.013            0.013      0.005
 SFMC     102                 0.99961547    0-14 18.248881 UTM 16
 NEO  000 11                 4084451.060       463007.246    185.968 UTM 16
                                   0.014            0.014      0.006
 SFMC     11                  0.99961686    0-14 57.679798 UTM 16
 NEO  000 12                 4081114.620       464706.777    183.920 UTM 16
                                   0.014            0.014      0.005
 SFMC     12                  0.99961534    0-14 15.505249 UTM 16
 NEO  000 13                 4085641.511       460928.446    185.132 UTM 16
                                   0.014            0.014      0.006
 SFMC     13                  0.99961881    0-15 48.492134 UTM 16
 NEO  000 14                 4083045.182       458698.770    184.109 UTM 16
                                   0.014            0.014      0.006
 SFMC     14                  0.99962101    0-16 41.765676 UTM 16
 NEO  000 15                 4085946.317       456740.182    173.571 UTM 16
                                   0.014            0.014      0.007
 SFMC     15                  0.99962305    0-17 30.265557 UTM 16
 NEO  000 16                 4083282.900       454253.912    186.274 UTM 16
                                   0.014            0.014      0.007
 SFMC     16                  0.99962578    0-18 29.657020 UTM 16
 NEO  000 17                 4079488.250       453807.446    158.050 UTM 16
                                   0.014            0.014      0.006
 SFMC     17                  0.99962629    0-18 39.095792 UTM 16
 NEO  000 18                 4077295.525       455504.216    172.735 UTM 16
                                   0.014            0.014      0.006
 SFMC     18                  0.99962439    0-17 57.217207 UTM 16
 NEO  000 19                 4080591.054       456389.236    161.519 UTM 16
                                   0.014            0.014      0.006
 SFMC     19                  0.99962343    0-17 36.931925 UTM 16
 NEO  000 2                  4077404.205       452655.123    161.855 UTM 16
                                   0.014            0.014      0.007
 SFMC     2                   0.99962761    0-19  6.229060 UTM 16
 NEO  000 20                 4079338.800       457255.649    179.880 UTM 16
                                   0.014            0.014      0.006
 SFMC     20                  0.99962251    0-17 15.510409 UTM 16
 NEO  000 21                 4080177.333       458938.692    188.751 UTM 16
                                   0.014            0.014      0.005
 SFMC     21                  0.99962077    0-16 35.012388 UTM 16
 NEO  000 3                  4074886.924       454955.806    156.712 UTM 16
                                   0.014            0.014      0.006
 SFMC     3                   0.99962500    0-18  9.633625 UTM 16
 NEO  000 4                  4073427.716       457809.813    168.498 UTM 16
```

```
================================================================================
                     USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                 GRS 80             UNITS: m,DMS          Page 0004
================================================================================
Adjusted NEO Coordinates:
                                 NORTHING          EASTING   O-HEIGHT
 CODE FFF STATION                 STD DEV          STD DEV    STD DEV MAPPROJ
 ---- --- ------------ ---------------- ---------------- ---------- -------
                                   0.014            0.014      0.006
 SFMC     4                  0.99962193    0-17  0.109952 UTM 16
 NEO  000 5                4074694.678       461423.471    185.182 UTM 16
                                   0.014            0.014      0.005
 SFMC     5                  0.99961833    0-15 33.126404 UTM 16
 NEO  000 6                4077705.060       461614.586    168.825 UTM 16
                                   0.014            0.014      0.005
 SFMC     6                  0.99961815    0-15 29.419287 UTM 16
 NEO  000 7                4076635.685       466727.602    183.351 UTM 16
                                   0.014            0.014      0.005
 SFMC     7                  0.99961364    0-13 25.340500 UTM 16
 NEO  000 8                4078108.610       472286.896    207.877 UTM 16
                                   0.014            0.014      0.007
 SFMC     8                  0.99960946    0-11 11.107185 UTM 16
 NEO  000 9                4081819.773       469891.802    184.725 UTM 16
                                   0.014            0.014      0.006
 SFMC     9                  0.99961117    0-12  9.992193 UTM 16
 NEO  110 B 22             4080474.718       427561.729    152.720 UTM 16
                                   0.000            0.000      0.018
 SFMC     B 22               0.99966464    0-29 15.441410 UTM 16
 NEO  110 KYTB             4134172.817       456006.042    165.367 UTM 16
                                   0.000            0.000      0.029
 SFMC     KYTB               0.99962384    0-18  5.033168 UTM 16
 NEO  111 KYTC             4093798.919       546763.886    147.297 UTM 16
                                   0.000            0.000      0.000
 SFMC     KYTC               0.99962694    0 18 58.251931 UTM 16
 NEO  001 M 133            4063986.966       459357.875    178.635 UTM 16
                                   0.015            0.015      0.000
 SFMC     M 133              0.99962035    0-16 19.646376 UTM 16
 NEO  001 R 392            4077437.740       476594.500    182.871 UTM 16
                                   0.015            0.015      0.000
 SFMC     R 392              0.99960675    0 -9 26.670348 UTM 16
 NEO  111 TN48             4017564.656       383577.812    138.220 UTM 16
                                   0.000            0.000      0.000
 SFMC     TN48               0.99976700    0-46  3.379508 UTM 16
```

USGS - Kentucky LiDAR - Constrained

GeoLab V2.4d GRS 80 UNITS: m,DMS

Adjusted PLH Coordinates:

CODE	FFF	STATION	LATITUDE	STD DEV	LONGITUDE	STD DEV	ELIP-HEIGHT	STD DEV
PLH	000	1	N 36 52 17.12125	0.014	W 87 32 2.33300	0.014	139.451	0.007
PLH	000	10	N 36 54 17.95295	0.014	W 87 22 9.86107	0.014	178.807	0.006
PLH	000	101	N 36 50 6.95467	0.013	W 87 26 39.95465	0.013	150.812	0.005
PLH	000	102	N 36 51 20.42447	0.013	W 87 23 50.87360	0.013	169.106	0.005
PLH	000	11	N 36 54 19.19316	0.014	W 87 24 54.88366	0.014	156.398	0.006
PLH	000	12	N 36 52 31.15428	0.014	W 87 23 45.64746	0.014	154.354	0.005
PLH	000	13	N 36 54 57.52323	0.014	W 87 26 19.10737	0.014	155.572	0.006
PLH	000	14	N 36 53 32.92646	0.014	W 87 27 48.70907	0.014	154.574	0.006
PLH	000	15	N 36 55 6.75607	0.014	W 87 29 8.43678	0.014	144.038	0.007
PLH	000	16	N 36 53 39.90246	0.014	W 87 30 48.34180	0.014	156.768	0.007
PLH	000	17	N 36 51 36.68287	0.014	W 87 31 5.54815	0.014	128.559	0.006
PLH	000	18	N 36 50 25.81885	0.014	W 87 29 56.56163	0.014	143.240	0.006
PLH	000	19	N 36 52 12.91239	0.014	W 87 29 21.51086	0.014	132.008	0.006
PLH	000	2	N 36 50 28.84736	0.014	W 87 31 51.61663	0.014	132.383	0.007
PLH	000	20	N 36 51 32.41746	0.014	W 87 28 46.26217	0.014	150.369	0.006
PLH	000	21	N 36 51 59.89804	0.014	W 87 27 38.45660	0.014	159.228	0.005
PLH	000	3	N 36 49 7.56232	0.014	W 87 30 18.18961	0.014	127.222	0.006
PLH	000	4	N 36 48 20.68209	0.014	W 87 28 22.70120	0.014	138.985	0.006
PLH	000	5	N 36 49 2.35275	0.014	W 87 25 57.09731	0.014	155.646	0.005
PLH	000	6	N 36 50 40.07351	0.014	W 87 25 49.93071	0.014	139.289	0.005
PLH	000	7	N 36 50 6.06790	0.014	W 87 22 23.31242	0.014	153.780	0.005
PLH	000	8	N 36 50 54.51331	0.014	W 87 18 39.06279	0.014	178.270	0.007
PLH	000	9	N 36 52 54.68457	0.014	W 87 20 16.30604	0.014	155.112	0.006
PLH	110	B 22	N 36 52 2.75962	0.000	W 87 48 45.77626	0.000	123.527	0.018
PLH	110	KYTB	N 37 21 11.58294	0.000	W 87 29 48.30971	0.000	135.277	0.029
PLH	111	KYTC	N 36 59 20.97709	0.000	W 86 28 28.19418	0.000	116.877	0.000

```
================================================================================
                      USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                  GRS 80             UNITS: m,DMS          Page 0006
================================================================================
```

Adjusted PLH Coordinates:

CODE	FFF	STATION	LATITUDE	STD DEV	LONGITUDE	STD DEV	ELIP-HEIGHT	STD DEV
PLH	001	M 133	N 36 43	14.55273	W 87 27	18.41537	149.067	
				0.015		0.015	0.000	
PLH	001	R 392	N 36 50	33.16141	W 87 15	45.04795	153.245	
				0.015		0.015	0.000	
PLH	111	TN48	N 36 17	45.75598	W 88 17	47.68131	109.778	
				0.000		0.000	0.000	

USGS - Kentucky LiDAR - Constrained

GeoLab V2.4d GRS 80 UNITS: m,DMS

Geoid Values:

CODE	NAME	N/S DEFLECTION	E/W DEFLECTION	UNDULATION
GEOI	1	+ 0 0 0.9	+ 0 0 1.4	-29.483
GEOI	10	+ 0 0 1.3	+ 0 0 1.6	-29.606
GEOI	101	+ 0 0 0.1	+ 0 0 1.1	-29.528
GEOI	102	+ 0 0 0.6	+ 0 0 1.3	-29.560
GEOI	11	+ 0 0 1.1	+ 0 0 1.4	-29.570
GEOI	12	+ 0 0 1.2	+ 0 0 1.4	-29.566
GEOI	13	+ 0 0 0.8	+ 0 0 1.4	-29.559
GEOI	14	+ 0 0 0.8	+ 0 0 0.9	-29.534
GEOI	15	+ 0 0 0.7	+ 0 0 1.1	-29.532
GEOI	16	+ 0 0 0.6	+ 0 0 1.2	-29.505
GEOI	17	+ 0 0 0.7	+ 0 0 1.0	-29.491
GEOI	18	+ 0 0 0.4	+ 0 0 1.3	-29.495
GEOI	19	+ 0 0 0.6	+ 0 0 0.8	-29.511
GEOI	2	+ 0 0 0.7	+ 0 0 1.4	-29.473
GEOI	20	+ 0 0 0.7	+ 0 0 0.7	-29.511
GEOI	21	+ 0 0 0.9	+ 0 0 1.1	-29.523
GEOI	3	- 0 0 0.1	+ 0 0 1.3	-29.490
GEOI	4	- 0 0 0.2	+ 0 0 1.1	-29.513
GEOI	5	- 0 0 0.1	+ 0 0 1.0	-29.536
GEOI	6	+ 0 0 0.4	+ 0 0 1.0	-29.536
GEOI	7	+ 0 0 0.5	+ 0 0 1.0	-29.571
GEOI	8	+ 0 0 1.2	+ 0 0 0.9	-29.607
GEOI	9	+ 0 0 1.4	+ 0 0 1.2	-29.613
GEOI	B 22	+ 0 0 0.6	+ 0 0 2.1	-29.193
GEOI	KYTB	+ 0 0 3.0	+ 0 0 1.8	-30.090
GEOI	KYTC	+ 0 0 4.4	+ 0 0 0.9	-30.420
GEOI	M 133	- 0 0 1.4	+ 0 0 1.2	-29.568
GEOI	R 392	+ 0 0 1.4	+ 0 0 0.6	-29.626
GEOI	TN48	+ 0 0 1.2	+ 0 0 2.1	-28.442

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                GRS 80             UNITS: m,DMS          Page 0008
================================================================================
Residuals (critical value = 3.700):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ------------------ -------- --------
GROUP: 040610.ASC  ,obs#:    1
DXCT              101          102                 4124.46530   -0.006   -1.859
                                                        0.003    0.003     1.26
DYCT              101          102                 1530.64700   -0.002   -0.536
                                                        0.003    0.003     0.37
DZCT              101          102                 1823.44290   -0.005   -1.607
                                                        0.003    0.003     1.09
GROUP: 040610.ASC  ,obs#:    2
DXCT              101          R 392              16187.76480    0.000    0.024
                                                        0.012    0.009     0.01
DYCT              101          R 392               1231.21310   -0.015   -1.413
                                                        0.012    0.011     0.91
DZCT              101          R 392                648.01800    0.003    0.351
                                                        0.012    0.010     0.21
GROUP: 040610.ASC  ,obs#:    3
DXCT              102          R 392              12063.30570    0.000    0.004
                                                        0.009    0.005     0.00
DYCT              102          R 392               -299.45420    0.007    1.116
                                                        0.009    0.006     0.59
DZCT              102          R 392              -1175.41490   -0.001   -0.234
                                                        0.009    0.006     0.11
GROUP: 040710.ASC  ,obs#:    4
DXCT              101          1                  -8084.58150    0.003    0.821
                                                        0.006    0.004     0.34
DYCT              101          1                   2063.56530    0.004    1.013
                                                        0.006    0.004     0.43
DZCT              101          1                   3204.00440   -0.000   -0.004
                                                        0.006    0.004     0.00
GROUP: 040710.ASC  ,obs#:    5
DXCT              102          1                 -12209.03200   -0.006   -0.821
                                                        0.009    0.007     0.47
DYCT              102          1                    532.93100   -0.007   -1.013
                                                        0.009    0.007     0.58
DZCT              102          1                   1380.56670   -0.000   -0.003
                                                        0.009    0.007     0.00
GROUP: 040710.ASC  ,obs#:    6
DXCT              101          10                  6473.82470   -0.001   -0.204
                                                        0.007    0.006     0.12
DYCT              101          10                  4918.10530    0.000    0.044
                                                        0.007    0.006     0.03
DZCT              101          10                  6206.84290    0.004    0.668
                                                        0.007    0.006     0.41
GROUP: 040710.ASC  ,obs#:    7
DXCT              102          10                  2349.36370    0.000    0.201
                                                        0.004    0.002     0.07
DYCT              102          10                  3387.46040   -0.000   -0.037
                                                        0.004    0.002     0.01
DZCT              102          10                  4383.41080   -0.001   -0.666
                                                        0.004    0.002     0.24
GROUP: 040710.ASC  ,obs#:    8
DXCT              101          102                 4124.45640    0.003    0.900
                                                        0.003    0.003     0.61
```

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                GRS 80             UNITS: m,DMS          Page 0009
================================================================================
Residuals (critical value = 3.700):
                                                      OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                         STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ------------------ -------- --------
DYCT              101          102                  1530.64420    0.001    0.329
                                                         0.003    0.003     0.22
DZCT              101          102                  1823.43360    0.004    1.275
                                                         0.003    0.003     0.86
GROUP: 040710.ASC  ,obs#:    9
DXCT              101          11                   2390.76510   -0.001   -0.110
                                                         0.006    0.005     0.06
DYCT              101          11                   4773.06150    0.005    1.119
                                                         0.006    0.005     0.65
DZCT              101          11                   6223.96430   -0.002   -0.449
                                                         0.006    0.005     0.26
GROUP: 040710.ASC  ,obs#:   10
DXCT              102          11                  -1733.69500    0.000    0.120
                                                         0.004    0.002     0.05
DYCT              102          11                   3242.42430   -0.003   -1.124
                                                         0.004    0.002     0.47
DZCT              102          11                   4400.52340    0.001    0.459
                                                         0.004    0.002     0.19
GROUP: 040710.ASC  ,obs#:   11
DXCT              101          12                   4193.82870   -0.004   -0.920
                                                         0.004    0.004     0.60
DYCT              101          12                   2855.07430   -0.002   -0.426
                                                         0.005    0.004     0.28
DZCT              101          12                   3559.00720    0.003    0.702
                                                         0.004    0.004     0.46
GROUP: 040710.ASC  ,obs#:   12
DXCT              102          12                     69.36520    0.000    0.864
                                                         0.002    0.001     0.21
DYCT              102          12                   1324.42700    0.000    0.458
                                                         0.002    0.001     0.13
DZCT              102          12                   1735.57280   -0.000   -0.712
                                                         0.002    0.001     0.20
GROUP: 040710.ASC  ,obs#:   13
DXCT              101          2                   -7733.40830    0.003    1.171
                                                         0.005    0.003     0.45
DYCT              101          2                      80.47660    0.001    0.335
                                                         0.006    0.003     0.13
DZCT              101          2                     529.08030    0.002    0.503
                                                         0.006    0.003     0.19
GROUP: 040710.ASC  ,obs#:   14
DXCT              102          2                  -11857.85580   -0.008   -1.171
                                                         0.009    0.007     0.69
DYCT              102          2                   -1450.16520   -0.002   -0.342
                                                         0.009    0.007     0.20
DZCT              102          2                   -1294.35230   -0.004   -0.506
                                                         0.009    0.007     0.30
GROUP: 040710.ASC  ,obs#:   15
DXCT              101          3                   -5355.50780    0.003    1.628
                                                         0.004    0.002     0.55
DYCT              101          3                   -1315.78990   -0.001   -0.253
                                                         0.004    0.002     0.09
DZCT              101          3                   -1479.66900    0.002    1.102
```

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0010
================================================================================
Residuals (critical value = 3.700):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ------------------ -------- --------
                                                         0.004    0.002     0.38
GROUP: 040710.ASC  ,obs#:   16
DXCT              102          3                 -9479.95350   -0.010   -1.622
                                                         0.007    0.006     1.00
DYCT              102          3                 -2846.43710    0.001    0.219
                                                         0.007    0.006     0.14
DZCT              102          3                 -3303.09750   -0.007   -1.089
                                                         0.007    0.006     0.67
GROUP: 040710.ASC  ,obs#:   17
DXCT              101          4                 -2457.33520    0.002    1.285
                                                         0.003    0.001     0.40
DYCT              101          4                 -2064.89270    0.001    0.619
                                                         0.003    0.001     0.20
DZCT              101          4                 -2629.62500    0.001    0.732
                                                         0.003    0.001     0.25
GROUP: 040710.ASC  ,obs#:   18
DXCT              102          4                 -6581.78580   -0.007   -1.280
                                                         0.006    0.006     0.81
DYCT              102          4                 -3595.53350   -0.004   -0.655
                                                         0.006    0.006     0.41
DZCT              102          4                 -4453.05760   -0.004   -0.739
                                                         0.006    0.006     0.47
GROUP: 040710.ASC  ,obs#:   19
DXCT              101          5                  1114.55820    0.000    0.169
                                                         0.002    0.001     0.05
DYCT              101          5                 -1148.87950   -0.001   -1.998
                                                         0.002    0.001     0.61
DZCT              101          5                 -1591.19680    0.001    0.767
                                                         0.002    0.001     0.24
GROUP: 040710.ASC  ,obs#:   20
DXCT              102          5                 -3009.90040   -0.001   -0.178
                                                         0.004    0.003     0.11
DYCT              102          5                 -2679.53270    0.007    1.967
                                                         0.004    0.003     1.24
DZCT              102          5                 -3414.63170   -0.002   -0.674
                                                         0.004    0.003     0.43
GROUP: 040710.ASC  ,obs#:   21
DXCT              101          6                  1210.46250   -0.001   -1.076
                                                         0.001    0.001     0.36
DYCT              101          6                   676.15900    0.002    3.413
                                                         0.001    0.001     1.53
DZCT              101          6                   810.17440    0.001    1.255
                                                         0.001    0.001     0.54
GROUP: 040710.ASC  ,obs#:   22
DXCT              102          6                 -2913.99940    0.002    1.072
                                                         0.002    0.002     0.63
DYCT              102          6                  -854.47630   -0.007   -3.835
                                                         0.002    0.002     2.34
                                                                ^^^^^^^^^^^^^^^^^
DZCT              102          6                 -1013.25870   -0.004   -1.922
                                                         0.002    0.002     1.17
GROUP: 040710.ASC  ,obs#:   23
```

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0011
================================================================================
Residuals (critical value = 3.700):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
DXCT              101          7                   6353.76280    0.006    1.492
                                                        0.005    0.004     0.93
DYCT              101          7                    268.76290    0.000    0.012
                                                        0.005    0.004     0.01
DZCT              101          7                    -20.10720    0.008    1.861
                                                        0.005    0.004     1.19
GROUP: 040710.ASC  ,obs#:   24
DXCT              102          7                   2229.31090   -0.001   -1.489
                                                        0.002    0.001     0.47
DYCT              102          7                  -1261.88240    0.000    0.082
                                                        0.002    0.001     0.03
DZCT              102          7                  -1843.53540   -0.002   -1.849
                                                        0.002    0.001     0.62
GROUP: 040710.ASC  ,obs#:   25
DXCT              101          8                  11863.45670    0.006    0.889
                                                        0.009    0.007     0.53
DYCT              101          8                   1401.37150   -0.009   -1.297
                                                        0.009    0.007     0.78
DZCT              101          8                   1189.76500    0.005    0.755
                                                        0.009    0.007     0.45
GROUP: 040710.ASC  ,obs#:   26
DXCT              102          8                   7739.00640   -0.003   -0.897
                                                        0.006    0.003     0.34
DYCT              102          8                   -129.28710    0.004    1.310
                                                        0.006    0.003     0.52
DZCT              102          8                   -633.66500   -0.002   -0.772
                                                        0.006    0.003     0.30
GROUP: 040710.ASC  ,obs#:   27
DXCT              101          9                   9352.78020    0.008    1.238
                                                        0.008    0.007     0.76
DYCT              101          9                   3527.49290   -0.004   -0.643
                                                        0.008    0.007     0.40
DZCT              101          9                   4139.69050    0.007    1.100
                                                        0.008    0.007     0.68
GROUP: 040710.ASC  ,obs#:   28
DXCT              102          9                   5228.33180   -0.003   -1.254
                                                        0.004    0.002     0.44
DYCT              102          9                   1996.84180    0.002    0.682
                                                        0.004    0.002     0.25
DZCT              102          9                   2316.26250   -0.002   -1.119
                                                        0.004    0.002     0.39
GROUP: 040710.ASC  ,obs#:   29
DXCT              102          M 133              -4738.63470   -0.008   -0.864
                                                        0.011    0.009     0.48
DYCT              102          M 133              -9175.60030   -0.014   -1.493
                                                        0.011    0.010     0.91
DZCT              102          M 133             -12007.09900    0.004    0.420
                                                        0.011    0.009     0.24
GROUP: 040710.ASC  ,obs#:   30
DXCT              101          M 133               -614.18780    0.005    0.860
                                                        0.009    0.006     0.38
DYCT              101          M 133              -7644.97890    0.009    1.337
```

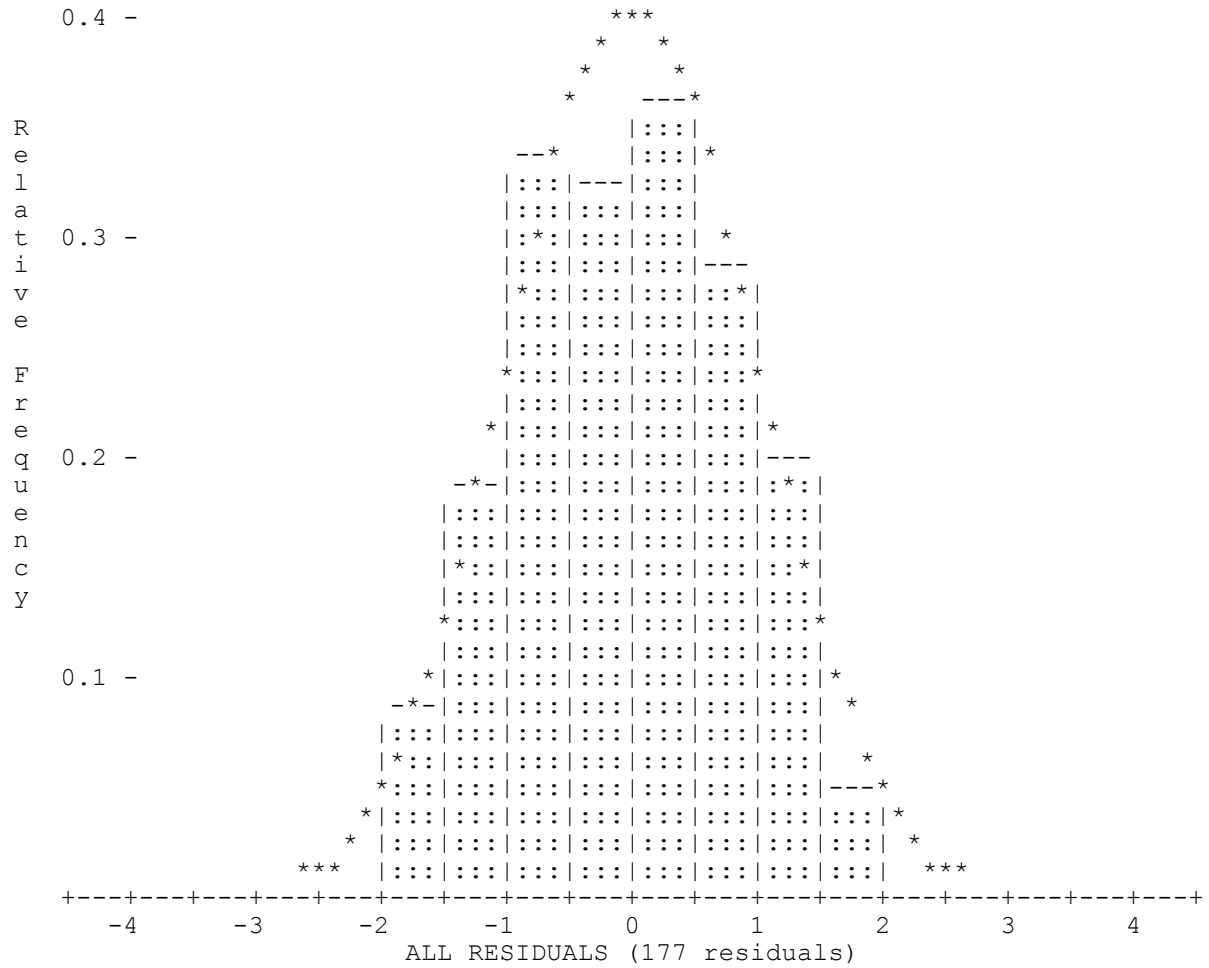
```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                GRS 80             UNITS: m,DMS          Page 0012
================================================================================
Residuals (critical value = 3.700):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ------------------ -------- --------
                                                          0.009    0.007     0.74
DZCT              101          M 133             -10183.65490   -0.003   -0.392
                                                          0.009    0.006     0.20
GROUP: 040810.ASC  ,obs#:   31
DXCT              101          102                 4124.46320   -0.004   -1.211
                                                          0.003    0.003     0.82
DYCT              101          102                 1530.64590   -0.001   -0.199
                                                          0.003    0.003     0.13
DZCT              101          102                 1823.44290   -0.005   -1.615
                                                          0.003    0.003     1.09
GROUP: 040810.ASC  ,obs#:   32
DXCT              101          13                   276.02470   -0.001   -0.229
                                                          0.006    0.005     0.12
DYCT              101          13                  5389.05840   -0.006   -1.126
                                                          0.007    0.005     0.62
DZCT              101          13                  7168.25620   -0.001   -0.167
                                                          0.006    0.005     0.09
GROUP: 040810.ASC  ,obs#:   33
DXCT              102          13                 -3848.43650    0.001    0.230
                                                          0.005    0.003     0.10
DYCT              102          13                  3858.40360    0.004    1.127
                                                          0.006    0.004     0.52
DZCT              102          13                  5344.81710    0.001    0.170
                                                          0.005    0.003     0.08
GROUP: 040810.ASC  ,obs#:   34
DXCT              101          14                 -1870.44470   -0.002   -0.748
                                                          0.005    0.003     0.36
DYCT              101          14                  3726.75960    0.001    0.159
                                                          0.005    0.003     0.08
DZCT              101          14                  5082.28220   -0.005   -1.633
                                                          0.005    0.003     0.78
GROUP: 040810.ASC  ,obs#:   35
DXCT              102          14                 -5994.90910    0.003    0.746
                                                          0.005    0.004     0.39
DYCT              102          14                  2196.11540   -0.001   -0.147
                                                          0.005    0.004     0.08
DZCT              102          14                  3258.83330    0.006    1.632
                                                          0.005    0.004     0.85
GROUP: 040810.ASC  ,obs#:   36
DXCT              101          15                 -3919.22060   -0.002   -0.392
                                                          0.007    0.005     0.19
DYCT              101          15                  5383.46940    0.000    0.027
                                                          0.007    0.005     0.01
DZCT              101          15                  7388.88980   -0.004   -0.809
                                                          0.007    0.005     0.40
GROUP: 040810.ASC  ,obs#:   37
DXCT              102          15                 -8043.68390    0.002    0.392
                                                          0.007    0.005     0.20
DYCT              102          15                  3852.82440   -0.000   -0.024
                                                          0.007    0.005     0.01
DZCT              102          15                  5565.44380    0.004    0.809
                                                          0.007    0.005     0.42
```

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0013
================================================================================
Residuals (critical value = 3.700):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
GROUP: 040810.ASC  ,obs#:   38
DXCT              101          16               -6319.55500   -0.001   -0.178
                                                      0.006    0.004     0.08
DYCT              101          16                3659.08330   -0.002   -0.595
                                                      0.006    0.004     0.26
DZCT              101          16                5255.58170    0.001    0.130
                                                      0.006    0.004     0.06
GROUP: 040810.ASC  ,obs#:   39
DXCT              102          16              -10444.01610    0.001    0.178
                                                      0.008    0.006     0.10
DYCT              102          16                2128.43200    0.004    0.595
                                                      0.008    0.006     0.33
DZCT              102          16                3432.14530   -0.001   -0.127
                                                      0.008    0.006     0.07
GROUP: 040810.ASC  ,obs#:   40
DXCT              101          17               -6647.45730   -0.002   -0.550
                                                      0.005    0.003     0.21
DYCT              101          17                1385.79610    0.001    0.326
                                                      0.005    0.003     0.13
DZCT              101          17                2200.14120   -0.002   -0.789
                                                      0.005    0.003     0.31
GROUP: 040810.ASC  ,obs#:   41
DXCT              102          17              -10771.92160    0.003    0.550
                                                      0.008    0.006     0.32
DYCT              102          17                -144.84620   -0.002   -0.324
                                                      0.008    0.006     0.19
DZCT              102          17                 376.69630    0.005    0.788
                                                      0.008    0.006     0.46
GROUP: 040810.ASC  ,obs#:   42
DXCT              101          18               -4882.51590   -0.001   -0.538
                                                      0.003    0.002     0.18
DYCT              101          18                 139.47140    0.001    0.787
                                                      0.004    0.002     0.27
DZCT              101          18                 460.87800   -0.002   -1.176
                                                      0.004    0.002     0.40
GROUP: 040810.ASC  ,obs#:   43
DXCT              102          18               -9006.97920    0.003    0.547
                                                      0.007    0.006     0.34
DYCT              102          18               -1391.16820   -0.004   -0.762
                                                      0.007    0.006     0.47
DZCT              102          18               -1362.56830    0.007    1.162
                                                      0.007    0.006     0.72
GROUP: 040810.ASC  ,obs#:   44
DXCT              101          19               -4102.01010   -0.000   -0.213
                                                      0.004    0.002     0.08
DYCT              101          19                2164.67970   -0.002   -0.770
                                                      0.004    0.002     0.32
DZCT              101          19                3095.74220   -0.000   -0.032
                                                      0.004    0.002     0.01
GROUP: 040810.ASC  ,obs#:   45
DXCT              102          19               -8226.47090    0.001    0.213
                                                      0.006    0.005     0.12
```

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0014
================================================================================
Residuals (critical value = 3.700):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ------------------ -------- --------
DYCT              102          19                   634.02890    0.004    0.774
                                                         0.006    0.005     0.45
DZCT              102          19                  1272.30410    0.000    0.067
                                                         0.006    0.005     0.04
GROUP: 040810.ASC  ,obs#:   46
DXCT              101          20                 -3196.23300   -0.001   -0.936
                                                         0.003    0.001     0.32
DYCT              101          20                  1440.13540   -0.003   -1.702
                                                         0.003    0.002     0.65
DZCT              101          20                  2108.01490    0.000    0.071
                                                         0.003    0.001     0.03
GROUP: 040810.ASC  ,obs#:   47
DXCT              102          20                 -7320.69800    0.004    0.979
                                                         0.005    0.004     0.60
DYCT              102          20                   -90.52030    0.008    1.729
                                                         0.005    0.004     1.06
DZCT              102          20                   284.57720    0.000    0.022
                                                         0.005    0.004     0.01
GROUP: 040810.ASC  ,obs#:   48
DXCT              101          21                 -1540.41940    0.000    0.049
                                                         0.003    0.001     0.02
DYCT              101          21                  2014.90300   -0.004   -2.386
                                                         0.003    0.002     1.06
DZCT              101          21                  2791.10970    0.001    0.781
                                                         0.003    0.002     0.31
GROUP: 040810.ASC  ,obs#:   49
DXCT              102          21                 -5664.87880    0.000    0.052
                                                         0.004    0.003     0.03
DYCT              102          21                   484.24570    0.008    2.364
                                                         0.004    0.003     1.40
DZCT              102          21                   967.67540   -0.002   -0.661
                                                         0.004    0.003     0.39
GROUP: 040810.ASC  ,obs#:   50
DXCT              101          B 22             -32907.25580   -0.015   -0.792
                                                         0.023    0.019     0.46
DYCT              101          B 22                 801.89060    0.029    1.724
                                                         0.024    0.017     0.89
DZCT              101          B 22                2840.24670    0.019    1.078
                                                         0.023    0.018     0.58
GROUP: 040810.ASC  ,obs#:   51
DXCT              102          B 22             -37031.71800   -0.012   -0.543
                                                         0.026    0.022     0.33
DYCT              102          B 22                -728.72390   -0.001   -0.064
                                                         0.026    0.021     0.04
DZCT              102          B 22                1016.80410    0.024    1.129
                                                         0.026    0.021     0.65
GROUP: 040910RM.ASC,obs#:   52
DXCT              101          102                 4124.45640    0.003    0.901
                                                         0.003    0.003     0.61
DYCT              101          102                 1530.64390    0.001    0.423
                                                         0.003    0.003     0.29
DZCT              101          102                 1823.43980   -0.002   -0.652
```

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0015
================================================================================
Residuals (critical value = 3.700):
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ------------------ -------- --------
                                                         0.003    0.003     0.44
GROUP: 040910RM.ASC,obs#:   53
DXCT              101          KYTB              -6177.56590    0.035    0.898
                                                         0.041    0.038     0.60
DYCT              101          KYTB              34443.02160   -0.021   -0.636
                                                         0.041    0.033     0.36
DZCT              101          KYTB              45841.76420   -0.024   -0.669
                                                         0.041    0.035     0.41
GROUP: 040910RM.ASC,obs#:   54
DXCT              102          KYTB             -10302.01840    0.028    0.747
                                                         0.040    0.037     0.50
DYCT              102          KYTB              32912.37440   -0.019   -0.606
                                                         0.040    0.031     0.34
DZCT              102          KYTB              44018.33480   -0.032   -0.942
                                                         0.040    0.034     0.57
GROUP: 040910RM.ASC,obs#:   55
DXCT              101          KYTC              85768.05100    0.021    0.351
                                                         0.062    0.061     0.24
DYCT              101          KYTC              14854.51690    0.006    0.096
                                                         0.062    0.062     0.07
DZCT              101          KYTC              13635.32360   -0.062   -1.006
                                                         0.062    0.061     0.70
GROUP: 040910RM.ASC,obs#:   56
DXCT              102          KYTC              81643.60350    0.010    0.166
                                                         0.059    0.058     0.11
DYCT              102          KYTC              13323.87770   -0.000   -0.002
                                                         0.059    0.058     0.00
DZCT              102          KYTC              11811.88560   -0.061   -1.058
                                                         0.059    0.058     0.73
GROUP: 040910RM.ASC,obs#:   57
DXCT              101          TN48             -74904.18030   -0.007   -0.104
                                                         0.069    0.067     0.07
DYCT              101          TN48             -38424.04600   -0.071   -1.039
                                                         0.069    0.068     0.73
DZCT              101          TN48             -48084.96270   -0.009   -0.130
                                                         0.069    0.068     0.09
GROUP: 040910RM.ASC,obs#:   58
DXCT              102          TN48             -79028.64520   -0.001   -0.019
                                                         0.072    0.071     0.01
DYCT              102          TN48             -39954.73150   -0.030   -0.426
                                                         0.072    0.071     0.30
DZCT              102          TN48             -49908.37700   -0.032   -0.454
                                                         0.072    0.071     0.32
GROUP: 041010.ASC  ,obs#:   59
DXCT              101          102                4124.45560    0.004    1.149
                                                         0.003    0.003     0.78
DYCT              101          102                1530.64690   -0.002   -0.510
                                                         0.003    0.003     0.34
DZCT              101          102                1823.44550   -0.008   -2.424
                                                         0.003    0.003     1.64
```

```
================================================================================
                      USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                  GRS 80             UNITS: m,DMS          Page 0016
================================================================================
```



```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                GRS 80            UNITS: m,DMS          Page 0017
================================================================================
```

S T A T I S T I C S S U M M A R Y	
Residual Critical Value Type	Tau Max
Residual Critical Value	3.7001
Number of Flagged Residuals	1
Convergence Criterion	0.0010
Final Iteration Counter Value	2
Confidence Level Used	95.0000
Estimated Variance Factor	0.9960
Number of Degrees of Freedom	102

Chi-Square Test on the Variance Factor:

7.7058e-01 < 1.0000 < 1.3377e+00 ?

THE TEST PASSES

NOTE: All confidence regions were computed using the following factors:

Variance factor used	=	0.9960
3-D expansion factor	=	2.7955

Note that, for relative confidence regions, precisions are computed from the ratio of the major semi-axis and the spatial distance between the two stations.

3D Station Confidence Regions (95.000 percent):

STATION	MAJ-SEMI	(AZ,VANG)	MED-SEMI	(AZ,VANG)	MIN-SEMI	(AZ,VANG)
1	0.040	(0, 0)	0.040	(90, 0)	0.020	(0, 90)
10	0.039	(0, 0)	0.039	(90, 0)	0.017	(0, 90)
101	0.038	(0, 0)	0.038	(90, 0)	0.014	(0, 90)
102	0.038	(0, 0)	0.038	(90, 0)	0.014	(0, 90)
11	0.039	(0, 0)	0.039	(90, 0)	0.017	(0, 90)
12	0.038	(0, 0)	0.038	(90, 0)	0.015	(0, 90)
13	0.039	(0, 0)	0.039	(90, 0)	0.018	(0, 90)
14	0.039	(0, 0)	0.039	(90, 0)	0.017	(0, 90)
15	0.040	(0, 0)	0.040	(90, 0)	0.020	(0, 90)
16	0.040	(0, 0)	0.040	(90, 0)	0.020	(0, 90)
17	0.040	(0, 0)	0.039	(90, 0)	0.018	(0, 90)
18	0.039	(0, 0)	0.039	(90, 0)	0.016	(0, 90)
19	0.039	(0, 0)	0.039	(90, 0)	0.017	(0, 90)
2	0.040	(0, 0)	0.040	(90, 0)	0.019	(0, 90)
20	0.038	(90, 0)	0.038	(0, 0)	0.016	(0, 90)
21	0.038	(90, 0)	0.038	(0, 0)	0.015	(0, 90)
3	0.039	(0, 0)	0.039	(90, 0)	0.017	(0, 90)
4	0.038	(0, 0)	0.038	(90, 0)	0.016	(0, 90)
5	0.038	(0, 0)	0.038	(90, 0)	0.015	(0, 90)
6	0.038	(0, 0)	0.038	(90, 0)	0.014	(0, 90)
7	0.038	(90, 0)	0.038	(0, 0)	0.015	(0, 90)
8	0.040	(90, 0)	0.040	(0, 0)	0.019	(0, 90)
9	0.039	(90, 0)	0.039	(0, 0)	0.018	(0, 90)
B 22	0.051	(0, 90)	0.000	(0, 0)	0.000	(90, 0)
KYTB	0.080	(0, 90)	0.000	(0, 0)	0.000	(90, 0)
M 133	0.043	(0, 0)	0.043	(90, 0)	0.000	(0, 90)
R 392	0.042	(0, 0)	0.042	(90, 0)	0.000	(0, 90)

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                 GRS 80             UNITS: m,DMS          Page 0019
================================================================================
3D Relative Confidence Regions (95.000 percent):
                          MAJ-SEMI   MED-SEMI   MIN-SEMI
FROM         TO          (AZ,VANG)  (AZ,VANG)  (AZ,VANG)    DISTANCE      PPM
------------ ------------ ---------- ---------- ---------- ----------- --------
1            101             0.015      0.014      0.014    8937.806     1.63
                          (  0, 90)  (  0,  0)  ( 90,  0)
1            102             0.015      0.014      0.014   12298.397     1.19
                          (  0, 90)  (  0,  0)  ( 90,  0)
10           101             0.011      0.011      0.011   10228.544     1.06
                          (  0, 90)  (  0,  0)  ( 90,  0)
10           102             0.011      0.010      0.010    6017.365     1.77
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          102             0.003      0.003      0.003    4762.244     0.60
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          11              0.010      0.010      0.010    8199.733     1.19
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          12              0.005      0.005      0.005    6197.270     0.88
                          (  0, 90)  ( 90,  0)  (  0,  0)
101          13              0.012      0.012      0.012    8972.289     1.32
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          14              0.010      0.010      0.010    6573.953     1.51
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          15              0.014      0.014      0.014    9946.742     1.45
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          16              0.014      0.014      0.014    8997.044     1.56
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          17              0.012      0.012      0.012    7137.910     1.66
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          18              0.009      0.009      0.009    4906.203     1.80
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          19              0.010      0.009      0.009    5576.373     1.73
                          (  0, 90)  ( 90,  0)  (  0,  0)
101          2               0.013      0.013      0.013    7751.900     1.69
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          20              0.008      0.007      0.007    4090.675     1.88
                          (  0, 90)  ( 90,  0)  (  0,  0)
101          21              0.007      0.006      0.006    3771.341     1.84
                          (  0, 90)  ( 90,  0)  (  0,  0)
101          3               0.010      0.010      0.010    5709.829     1.81
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          4               0.008      0.008      0.008    4149.360     1.91
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          5               0.005      0.004      0.004    2257.005     2.01
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          6               0.004      0.003      0.003    1605.863     2.43
                          (  0, 90)  (  0,  0)  ( 90,  0)
101          7               0.007      0.006      0.006    6359.482     1.06
                          (  0, 90)  ( 90,  0)  (  0,  0)
101          8               0.013      0.013      0.013   12005.046     1.12
                          (  0, 90)  ( 90,  0)  (  0,  0)
101          9               0.011      0.011      0.011   10819.192     1.03
                          (  0, 90)  ( 90,  0)  (  0,  0)
101          B 22            0.049      0.038      0.038   33039.350     1.48
                          ( 90, 90)  (  0,  0)  (270,  0)
101          KYTB            0.079      0.038      0.038   57671.027     1.37
                          (180, 90)  (  0,  0)  ( 90,  0)
```

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                 GRS 80             UNITS: m,DMS          Page 0020
================================================================================
3D Relative Confidence Regions (95.000 percent):
                          MAJ-SEMI    MED-SEMI    MIN-SEMI
FROM         TO          (AZ,VANG)   (AZ,VANG)   (AZ,VANG)    DISTANCE      PPM
------------ ------------ ---------- ---------- ---------- ----------- --------
101          KYTC            0.038       0.038       0.014   88106.410     0.43
                          (  0,  0)   ( 90,  0)   (  0, 90)
101          M 133           0.020       0.020       0.014   12748.712     1.55
                          (  0,  0)   ( 90,  0)   (  0, 90)
101          R 392           0.019       0.019       0.014   16247.446     1.19
                          (  0,  0)   ( 90,  0)   (  0, 90)
101          TN48            0.038       0.038       0.014   96949.546     0.39
                          (  0,  0)   ( 90,  0)   (  0, 90)
102          11              0.010       0.009       0.009    5734.423     1.68
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          12              0.005       0.004       0.004    2184.292     2.23
                          (  0, 90)   ( 90,  0)   (  0,  0)
102          13              0.012       0.012       0.012    7633.141     1.54
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          14              0.010       0.010       0.010    7168.114     1.39
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          15              0.014       0.014       0.014   10512.815     1.38
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          16              0.014       0.014       0.014   11197.647     1.26
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          17              0.012       0.012       0.012   10779.476     1.11
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          18              0.009       0.009       0.009    9215.072     0.98
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          19              0.010       0.009       0.009    8348.387     1.17
                          (  0, 90)   ( 90,  0)   (  0,  0)
102          2               0.013       0.013       0.013   12016.126     1.10
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          20              0.008       0.007       0.007    7326.782     1.08
                          (  0, 90)   ( 90,  0)   (  0,  0)
102          21              0.007       0.007       0.007    5767.299     1.23
                          (  0, 90)   ( 90,  0)   (  0,  0)
102          3               0.011       0.010       0.010   10434.674     1.01
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          4               0.008       0.008       0.008    8722.250     0.94
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          5               0.005       0.005       0.005    5281.959     0.96
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          6               0.004       0.004       0.004    3201.285     1.35
                          (  0, 90)   (  0,  0)   ( 90,  0)
102          7               0.006       0.006       0.006    3156.073     2.02
                          (  0, 90)   ( 90,  0)   (  0,  0)
102          8               0.013       0.013       0.013    7765.979     1.71
                          (  0, 90)   ( 90,  0)   (  0,  0)
102          9               0.011       0.011       0.011    6057.051     1.81
                          (  0, 90)   ( 90,  0)   (  0,  0)
102          B 22            0.049       0.038       0.038   37052.854     1.32
                          ( 90, 89)   (  0,  0)   (270,  1)
102          KYTB            0.079       0.038       0.038   55919.273     1.42
                          (180, 90)   (  0,  0)   ( 90,  0)
102          KYTC            0.038       0.038       0.014   83562.698     0.45
                          (  0,  0)   ( 90,  0)   (  0, 90)
```

```
================================================================================
                    USGS - Kentucky LiDAR - Constrained
GeoLab V2.4d                 GRS 80             UNITS: m,DMS          Page 0021
================================================================================
3D Relative Confidence Regions (95.000 percent):
                           MAJ-SEMI   MED-SEMI   MIN-SEMI
FROM         TO          (AZ,VANG)  (AZ,VANG)  (AZ,VANG)    DISTANCE      PPM
------------ ------------ ---------- ---------- ---------- ----------- --------
102          M 133           0.020      0.020      0.014   15837.202     1.25
                          (  0,  0)  ( 90,  0)  (  0, 90)
102          R 392           0.019      0.019      0.014   12124.134     1.59
                          (  0,  0)  ( 90,  0)  (  0, 90)
102          TN48            0.038      0.038      0.014  101650.181     0.37
                          (  0,  0)  ( 90,  0)  (  0, 90)

17:05:48, Sat May 15, 2010
```

Project Number: 1100328
Project Name: USGS-NRCS IL-KY LiDAR TASK ORDER (Illinois Site)

Horizontal Datum: NAD83/07
Horizontal Coordinates: UTM16, meters
Vertical Datum: NAVD88

Station	Easting	Northing	Elevation
1	263748.362	4322633.244	193.391
2	269617.221	4323164.447	191.922
3	271365.474	4325619.405	182.459
4	268470.980	4327458.011	192.823
5	261991.612	4326763.381	199.763
6	263720.889	4330398.699	203.789
7	268574.833	4330620.407	202.486
8	271483.609	4330373.550	186.887
9	271578.040	4334697.595	198.172
10	267832.189	4334021.702	208.310
11	262788.467	4334568.710	202.610
12	265114.882	4338011.184	202.290
13	268968.137	4340015.747	205.942
14	270770.129	4339435.241	209.964
15	271436.480	4341994.826	207.286
16	272244.294	4345968.099	201.876
17	268542.027	4346260.478	202.120
18	263678.760	4346385.253	202.415
19	262728.142	4343108.262	204.171
20	266791.853	4343028.206	203.763
21	262633.579	4339810.027	203.967
101	265073.175	4336917.561	204.948
GINN_AZ_MK	269332.733	4336437.724	207.631
Q_218	269331.221	4378314.084	193.970
RENT	262738.640	4323474.184	195.787
T_93	284521.146	4337367.101	191.979

Project Number: 1100328
Project Name: USGS-NRCS IL-KY LiDAR TASK ORDER (Kentucky Site)

Horizontal Datum: NAD83/07
Horizontal Coordinates: UTM16, meters
Vertical Datum: NAVD88

Station	Easting	Northing	Elevation
1	452408.361	4080742.082	168.934
2	452655.123	4077404.205	161.855
3	454955.806	4074886.924	156.712
4	457809.813	4073427.716	168.498
5	461423.471	4074694.678	185.182
6	461614.586	4077705.060	168.825
7	466727.602	4076635.685	183.351
8	472286.896	4078108.610	207.877
9	469891.802	4081819.773	184.725
10	467090.805	4084396.052	208.413
11	463007.246	4084451.060	185.968
12	464706.777	4081114.620	183.920
13	460928.446	4085641.511	185.132
14	458698.770	4083045.182	184.109
15	456740.182	4085946.317	173.571
16	454253.912	4083282.900	186.274
17	453807.446	4079488.250	158.050
18	455504.216	4077295.525	172.735
19	456389.236	4080591.054	161.519
20	457255.649	4079338.800	179.880
21	458938.692	4080177.333	188.751
101	460370.945	4076690.201	180.340
102	464568.328	4078935.667	198.666
B_22	427561.729	4080474.718	152.720
KYTB	456006.042	4134172.817	165.367
KYTC	546763.886	4093798.919	147.297
M_133	459357.875	4063986.966	178.635
R_392	476594.500	4077437.740	182.871
TN48	383577.812	4017564.656	138.220

LIDAR FLIGHT LOG

ALTM

MISSION: ~~KENTUCKY~~ M041310A DATE: 4-13-10

PILOT: Bobbie OPERATOR: Jess AIRCRAFT: 43Q

PROJECT NUMBER	LINE NO. & Hdg	GND SPEED (KTS)	SCAN FREQ	SCAN ANGLE	PRF	ALT (m)	TIME START	TIME STOP	Tranzpak Drive	REMARKS
1100328							1645	1815	184	ferry: Nash → site 1.5
USGS LC in KY	2 test strips flown						1848	1853		static
6100402(AK)	1 S	150	39.6	16	70	1500	0029	0036		
	8 N						0039	0045		
	2 S						0048	0055		
	9 N						0057	0103		
	3 S						0106	0113		
	10 N						0115	0122		
	4 S						0125	0131		small PDOP spike
	~~flt~~ ~~W~~						0135	0139		PDOP spike
	~~flt~~ ~~E~~						0141	0145		
	5 S						0149	0156		
	11 N						0159	0205		
	6 S						0208	0214		
	12 N						0216	0223		
	7 S						0225	0232		
	13 N						0235	0241		
	19 S						0244	0250		
	14 N						0253	0259		
	20 S	↓	↓	↓	↓	↓	0302	0308		

STATUS	TOTAL LINES	FLOWN	LEFT	AIRCRAFT SITE	AIRCRAFT FERRY
⊗ 1100328	106	26	Ø	5.0	2.5
○					
○					

STATIC	START:	STOP:

WX

NOTES:

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 FAX: 920-457-1451 E-Mail: amephoto@aerometric.com

LIDAR FLIGHT LOG

ALTM

MISSION: M041310A | DATE: 4-13-10

PILOT: Robbie | OPERATOR: Jess | AIRCRAFT: 430

PROJECT NUMBER	LINE NO. & Hdg		GND SPEED (KTS)	SCAN FREQ	SCAN ANGLE	PRF	ALT (m)	TIME START	TIME STOP	Tranzpak Drive	REMARKS
1100328	15	N	150	39.6	16	70	1500	0311	0317	184	
6100402(AK)	21	S						0321	0327		
	16	N						0330	0336		
	22	S						0339	0345		
	17	N						0348	0354		
	23	S						0357	0403		
	18	N						0406	0412		
	24	S						0415	0422		
	25	N						0425	0431		
	26	S						0435	0441		
								2349	2354		static
								0025	0125		ferry: Litch → IND 1.0

STATUS	TOTAL LINES	FLOWN	LEFT	AIRCRAFT SITE	AIRCRAFT FERRY
)					
)					
)					

STATIC	START:	STOP:

WX

NOTES:

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 **FAX: 920-457-1451** E-Mail: amephoto@aerometric.com

Flight Log

Project Number: 0
S/N : 0
Operator : ???
Pilot(s) : ???
Aircraft : ???
Airport : ???
Mission : ???
Wheels Up : ???
Flight Length :
HOBBS Start :
HOBBS End :

Weather

Date : April 13, 2010
Julian Day : 103
Temperature : ???
Visibility : ???
Clouds : ???
Precipitation : ???
Wind Dir : ???
Wind Speed : ???
Pressure : ???

Statistics

Laser Time : 02:53:35

START	STOP	LINE#	ALT	PRF	FREQ	ANGLE	MP	DIV	RC	HDG	Plan File
00:12:53.575	00:14:47.072	1	1646	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:17:54.569	00:19:30.067	1	1695	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:29:45.054	00:36:18.047	1	1681	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:39:05.043	00:45:29.036	8	1700	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:48:31.032	00:55:01.525	2	1671	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:57:25.022	01:03:44.515	9	1707	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:06:52.511	01:13:24.504	3	1688	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:15:54.001	01:22:06.493	10	1728	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:25:12.49	01:31:45.982	4	1705	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:35:49.477	01:39:01.974	4	1711	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:41:55.47	01:45:03.967	11	1733	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:49:47.461	01:56:16.453	5	1648	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:59:08.45	02:05:01.943	11	1718	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
02:08:06.939	02:14:37.931	6	1692	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
02:16:53.429	02:22:57.421	12	1705	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
02:25:57.918	02:32:28.91	7	1701	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
02:35:16.907	02:41:17.4	13	1736	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
02:44:13.396	02:50:43.889	19	1691	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
02:53:20.386	02:59:31.378	14	1702	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln

03:02:18.875	03:08:45.868	20	1706	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
03:11:39.364	03:17:47.857	15	1712	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
03:11:39.364	03:17:48.857	15	1712	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
03:21:01.853	03:27:37.846	21	1688	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
03:30:09.343	03:36:10.836	16	1732	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
03:39:19.832	03:45:54.324	22	1677	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
03:48:06.822	03:54:15.314	17	1735	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
03:57:01.311	04:03:44.803	23	1689	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
04:06:20.3	04:12:33.793	18	1685	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
04:15:48.789	04:22:21.782	24	1687	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
04:25:33.278	04:31:39.271	25	1707	70	39.60	16.00	NAR	OFF	OFF	360.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
04:35:14.767	04:41:38.759	26	1702	70	39.60	16.00	NAR	OFF	OFF	180.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln

LIDAR FLIGHT LOG

ALTM

J51

MISSION: M040910A | DATE: 4-9-10 FRI

PILOT: NICK | OPERATOR: JIM | AIRCRAFT: N3443Q

PROJECT NUMBER	LINE NO. & Hdg		GND SPEED (KTS)	SCAN FREQ	SCAN ANGLE	PRF	ALT (m)	GMT TIME START	GMT TIME STOP	Tranzpak Drive	REMARKS
1100328								12:00	12:42	0181	FERRY: TYQ → HVC .7
USGS - KY								16:39	16:53		FERRY: HVC → SITE .3
	2 TEST										
	27	298	150	58.5	17	125	1000	16:53	16:56		TURBULANT
	38	118						17:00	17:05		
	28	298						17:08	17:11		
	39	118						17:15	17:20		
	29	298						17:23	17:26		
	40	118						17:30	17:35		
	30	298						17:37	17:42		
	41	118						17:45	17:50		
	31	298						17:53	17:58		
10	42	118						18:01	18:06		
	32	298						18:09	18:14		
	43	118						18:18	18:23		
	33	298						18:26	18:31		
	44	118						18:34	18:39		
16	34	298						18:42	18:47		
	45	118						18:51	18:54		
17	35	298						18:59	19:04		→ J52

STATUS	TOTAL LINES	FLOWN	LEFT	AIRCRAFT SITE	AIRCRAFT FERRY	STATIC	START:	STOP:	NOTES:
⊘ 1100328	106	20	86	2.7	1.2	3.2	16:39	19:51	
○					3.9	WX SKC			
○									920-457-1451

LIDAR FLIGHT LOG

J-2

MISSION: M046910A **DATE:** 4-9-10 FRI

PILOT: NICK **OPERATOR:** JIM **AIRCRAFT:** N3443Q

PROJECT NUMBER	LINE NO. & Hdg		GND SPEED (KTS)	SCAN FREQ	SCAN ANGLE	PRF	ALT (m)	TIME START	TIME STOP	Tranzpak Drive	REMARKS
1100328 18	46	118	150	58.5	17	125	1000	19:07	19:13	0181	
USGS-KY	36	298						19:16	19:20		
00	37	118						19:24	19:29		
	CROSS	E. END						19:33	19:35		
	CROSS	W. END						19:38	19:39		
									19:51		FERRY: SITE → HVC .2

STATUS	TOTAL LINES	FLOWN	LEFT	AIRCRAFT SITE	AIRCRAFT FERRY	STATIC	START:	STOP:
○								
○						WX		
○								

NOTES:

Flight Log

Project Number: 1100328
S/N : USGS_Kentucky
Operator : Jim
Pilot(s) : Nick
Aircraft : N3443Q
Airport : KHVC
Mission : M040910A
Wheels Up : ???
Flight Length : 3.2
HOBBS Start : 16:39
HOBBS End : 19:51

Weather

Date : April 09, 2010
Julian Day : 099
Temperature : ???
Visibility : ???
Clouds : SKC
Precipitation : ???
Wind Dir : ???
Wind Speed : ???
Pressure : ???

Statistics

Laser Time : 01:32:35

START	STOP	LINE#	ALT	PRF	FREQ	ANGLE	MP	DIV	RC	HDG	Plan File
16:51:02.109	16:51:32.109	27	1187	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:53:53.606	16:56:22.104	27	1183	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
17:00:42.599	17:05:05.094	38	1193	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
17:08:33.09	17:11:19.087	28	1172	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
17:15:22.083	17:19:58.578	39	1182	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
17:23:03.574	17:26:33.57	29	1216	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
17:30:12.066	17:34:58.061	40	1191	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
17:37:42.558	17:42:02.553	30	1172	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
17:45:13.549	17:50:00.044	41	1185	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
17:53:36.04	17:58:12.035	31	1187	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
18:01:38.531	18:06:31.525	42	1182	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
18:09:49.521	18:14:28.516	32	1186	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
18:18:01.512	18:23:10.006	43	1206	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
18:26:15.002	18:30:59.997	33	1185	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
18:34:21.493	18:39:32.987	44	1173	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
18:42:48.483	18:47:24.977	34	1208	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
18:51:18.973	18:56:44.466	45	1186	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
18:59:42.963	19:04:14.958	35	1183	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
19:07:39.954	19:13:04.447	46	1191	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln

19:16:02.444	19:20:43.938	36	1178	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
19:24:52.933	19:29:25.428	37	1190	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
19:33:50.923	19:35:18.421	27	1176	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
19:38:07.918	19:39:54.916	47	1180	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln

LIDAR FLIGHT L

MISSION: M040910B | DATE: 4/9/10 | ALTM | 1.

PILOT: Robbie | OPERATOR: Jess | AIRCRAFT: 430

PROJECT NUMBER	LINE NO. & Hdg	GND SPEED (KTS)	SCAN FREQ	SCAN ANGLE	PRF	ALT (m)	TIME START	TIME STOP	Tranzpak Drive	REMARKS
1100328							1634	1639	111	static
USGS IL & KY	2 test strips		flown				2145	2147		
6100402(AK)	47 W	~~150~~	58	17	125	1000	2150	2156		
	51 E	150					2159	2205		
	48 W						2209	2214		
	52 E						2217	2223		
	49 W						2226	2232		
	53 E						2235	2241		
	50 W						2244	2250		
	54 E						2253	2258		
	60 W						2302	2306		
	55 E						2309	2314		
	61 W						2318	2322		
	56 E						2326	2331		
	62 W						2334	2338		
	57 E						2342	2346		
	63 W						2350	2354		
	58 E						2357	0002		
	64 W						0005	0010		
	59 E						0013	0018		

STATUS	TOTAL LINES	FLOWN	LEFT	AIRCRAFT SITE	AIRCRAFT FERRY
○					
○					
○					

STATIC	START:	STOP:
WX		

NOTES:
got lots of red swath POS looks good. flown @ 3800' = green swath

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 **FAX: 920-457-1451** E-Mail: amephoto@aerometric.com

2540

LIDAR FLIGHT L

ALTM

MISSION: M0409108 DATE: 4/9/10

PILOT: Robbie OPERATOR: Jess AIRCRAFT: 3443Q

PROJECT NUMBER	LINE NO. & Hdg	GND SPEED (KTS)	SCAN FREQ	SCAN ANGLE	PRF	ALT (m)	TIME START	TIME STOP	Tranzpak Drive	REMARKS
1100328	65 W	150	58	17	125	1000	0021	0025	111	
6100402(AK)	69 E						0028	0033		
	70 W						0037	0041		
	66 E						0044	0048		
	71 W						0052	0056		
	67 E						0059	0103		
	72 W						0106	0110		
	68 E						0114	0118		
	73 W						0121	0126		
	74 E						0130	0134		
	75 W						0137	0141		
	76 E						0145	0149		PDOP spike 3.2
	x-flt N						0153	0155		
	x-flt S						0157	0159		
							0206	0211		static

STATUS	TOTAL LINES	FLOWN	LEFT	AIRCRAFT SITE	AIRCRAFT FERRY	STATIC	START:	STOP:	NOTES:
⊘ 1100328	106	49	57	4.4					
○						WX			
○									

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 **FAX: 920-457-1451** E-Mail: amephoto@aerometric.com

Flight Log

Project Number: 0
S/N : 0
Operator : ???
Pilot(s) : ???
Aircraft : ???
Airport : ???
Mission : ???
Wheels Up : ???
Flight Length :
HOBBS Start :
HOBBS End :

Weather

Date : April 09, 2010
Julian Day : 099
Temperature : ???
Visibility : ???
Clouds : ???
Precipitation : ???
Wind Dir : ???
Wind Speed : ???
Pressure : ???

Statistics

Laser Time : 02:20:11

START	STOP	LINE#	ALT	PRF	FREQ	ANGLE	MP	DIV	RC	HDG	Plan File
21:45:30.118	21:46:11.117	47	1104	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
21:46:36.117	21:47:23.616	47	1233	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
21:50:47.112	21:56:45.105	47	1192	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
21:59:54.601	22:05:35.094	51	1190	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
22:09:07.59	22:14:47.584	48	1174	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
22:17:41.081	22:23:05.575	52	1148	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
22:26:58.071	22:32:32.564	49	1135	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
22:35:53.061	22:41:20.055	53	1117	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
22:44:50.051	22:50:23.545	50	1140	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
22:53:42.041	22:58:49.036	54	1144	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
23:02:00.532	23:06:30.527	60	1141	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
23:09:41.524	23:14:56.518	55	1117	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
23:18:18.514	23:22:37.51	61	1155	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
23:26:02.006	23:31:10	56	1176	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
23:34:20.496	23:38:36.992	62	1148	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
23:42:03.988	23:46:54.982	57	1138	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
23:50:05.979	23:54:17.974	63	1130	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
23:57:54.47	00:02:37.965	58	1143	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:05:46.461	00:10:06.456	64	1140	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln

00:05:46.461	00:10:07.456	64	1139	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:13:18.453	00:18:01.947	59	1121	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:21:06.444	00:25:21.939	65	1126	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:28:55.935	00:33:08.43	69	1155	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:37:02.926	00:41:08.421	70	1141	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:44:26.418	00:48:48.413	66	1158	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:52:15.909	00:56:15.904	71	1153	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
00:59:11.901	01:03:22.396	67	1134	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:06:45.392	01:10:49.888	72	1146	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:14:15.884	01:18:40.879	68	1116	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:21:55.375	01:25:56.871	73	1135	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:30:05.366	01:34:10.361	74	1122	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:37:54.857	01:41:54.352	75	1120	125	58.00	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:45:54.848	01:49:54.843	76	1137	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:53:22.339	01:55:47.336	76	1193	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
01:57:32.834	01:59:49.832	76	1254	125	58.00	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln

LIDAR FLIGHT LOG

1/2

MISSION: M04101OA | DATE: 4-10-10 SAT | JS1

PILOT: NICK | OPERATOR: JIM | AIRCRAFT: N3443Q

ALTM

PROJECT NUMBER	LINE NO. & Hdg	GND SPEED (KTS)	SCAN FREQ	SCAN ANGLE	PRF	ALT (m)	GMT TIME START	GMT TIME STOP	Tranzpak Drive	REMARKS
1100328							13:25	13:42	0134	FERRY: HVC → SITE .3
USGS-KY	2 TEST									
	77 298	150	58.5	17	125	1000	13:42	13:46		
	90 118						13:50	13:53		
	78 298						13:57	14:01		
	91 118						14:04	14:07		
	79 298						14:11	14:14		
	92 118						14:17	14:21		
	80 298						14:24	14:28		
	93 118						14:31	14:34		
	81 298						14:38	14:41		
10	94 118						14:44	14:48		
	82 298						14:51	14:55		
	95 118						14:58	15:01		
	83 298						15:05	15:08		
	96 118						15:11	15:15		
15	84 298						15:18	15:22		
	97 118						15:25	15:28		
	~~86~~ 85 298						15:32	15:36		
18	98 118						15:39	15:42		→ JS2

STATUS	TOTAL LINES	FLOWN	LEFT	AIRCRAFT SITE	AIRCRAFT FERRY	STATIC	START:	STOP:	NOTES:
1100328	106	50/30	26	3.3	.5	3.8	13:25	17:14	
KENTUCKY	75%				3.8	WX SKC			
SITE COMPLETE									

AERO-METRIC, INC. N.6216 Resource Drive Sheboygan Falls, WI. 53085 PHONE: 920-467-2655 **FAX: 920-457-1451** E-Mail: amephoto@aerometric.com

LIDAR FLIGHT LOG

ALTM JS2

MISSION: M041010A **DATE:** 4-10-10 SAT

PILOT: NICK **OPERATOR:** JIM **AIRCRAFT:** N3443Q

PROJECT NUMBER	LINE NO.	& Hdg	GND SPEED (KTS)	SCAN FREQ	SCAN ANGLE	PRF	ALT (m)	TIME START	TIME STOP	Tranzpak Drive	REMARKS
1100328	86	298	150	58.5	17	125	1000	15:46	15:49	0134	
USGS-KY 20	99	118						15:53	15:56		
	87	298						15:59	16:03		
	100	118						16:07	16:09		
	88	298						16:12	16:16		
	101	118						16:19	16:21		
25	89	298						16:25	16:29		
	102	118						16:32	16:33		
	103	298						16:37	16:38		
	104	118						16:42	16:43		
	105	298						16:47	16:48		
30	106	118						16:52	16:52		
	CROSS	E. END						16:56	16:58		
	CROSS	W. END						16:59	17:01		
									17:14		FERRY: SITE → HVC .2

STATUS	TOTAL LINES	FLOWN	LEFT	AIRCRAFT SITE	AIRCRAFT FERRY	STATIC	START:	STOP:	NOTES:
						WX			

Flight Log

Project Number: 1100328
S/N : USGS_Kentucky
Operator : Jim
Pilot(s) : Nick
Aircraft : N3443Q
Airport : KHVC
Mission : M041010A
Wheels Up : ???
Flight Length : 3.8
HOBBS Start : 13:25
HOBBS End : 17:14

Weather

Date : April 10, 2010
Julian Day : 100
Temperature : ???
Visibility : ???
Clouds : ???
Precipitation : ???
Wind Dir : ???
Wind Speed : ???
Pressure : ???

Statistics

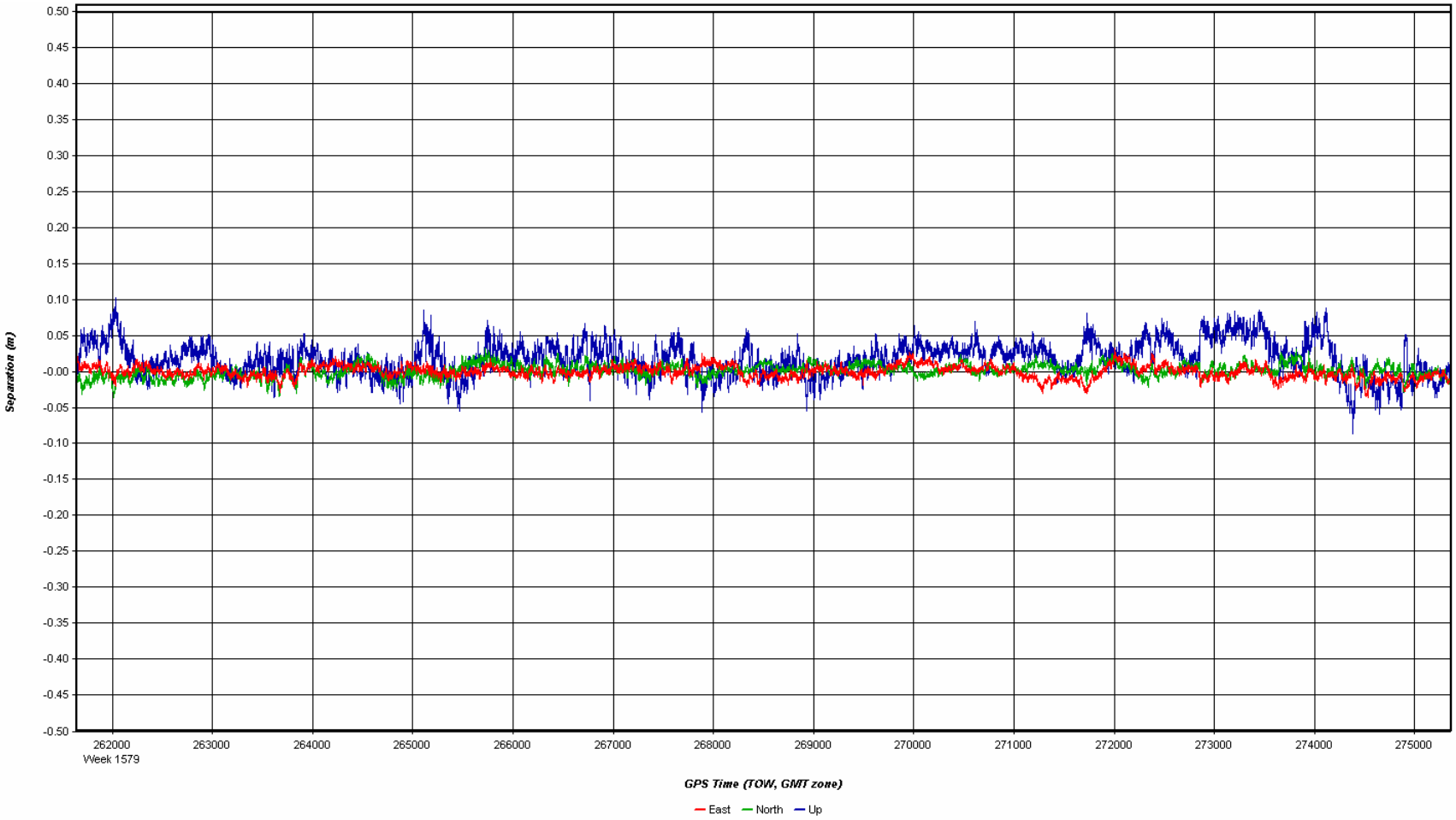
Laser Time : 01:33:26

START	STOP	LINE#	ALT	PRF	FREQ	ANGLE	MP	DIV	RC	HDG	Plan File
13:39:35.053	13:39:57.553	77	1144	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
13:41:35.551	13:41:57.051	77	1149	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
13:42:40.55	13:46:28.546	77	1129	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
13:49:59.543	13:53:50.039	90	1135	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
13:57:12.035	14:01:03.031	78	1142	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
14:04:16.028	14:07:54.524	91	1129	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
14:11:11.52	14:14:47.516	79	1139	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
14:17:48.013	14:21:23.509	92	1138	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
14:24:46.505	14:28:16.501	80	1144	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
14:31:20.997	14:34:55.493	93	1137	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
14:38:21.489	14:41:46.485	81	1150	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
14:44:44.982	14:48:16.977	94	1135	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
14:51:49.473	14:55:11.469	82	1139	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
14:58:23.965	15:01:48.461	95	1135	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
15:05:13.457	15:08:50.453	83	1149	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
15:11:48.95	15:15:07.946	96	1146	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
15:18:53.441	15:22:30.937	84	1138	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
15:25:38.433	15:28:52.429	97	1143	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
15:32:28.425	15:36:07.421	85	1140	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln

15:39:06.417	15:42:21.413	98	1141	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
15:46:04.909	15:49:46.905	86	1154	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
15:53:11.901	15:56:22.397	99	1153	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
15:59:55.893	16:03:38.389	87	1146	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:07:01.885	16:09:49.382	100	1143	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:12:55.378	16:16:28.374	88	1139	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:19:53.37	16:21:33.868	101	1134	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:25:35.363	16:29:08.859	89	1143	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:32:04.356	16:33:29.854	102	1147	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:37:23.85	16:38:09.849	103	1152	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:42:38.343	16:43:29.343	104	1149	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:47:18.838	16:47:57.837	105	1151	125	58.50	17.00	NAR	OFF	OFF	298.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:52:01.333	16:52:43.332	106	1153	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:52:01.333	16:52:46.832	106	1153	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:55:59.328	16:58:04.826	76	1140	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:59:52.324	17:01:51.821	102	1142	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:59:52.324	17:01:53.321	102	1143	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:59:52.324	17:01:54.321	102	1143	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:59:52.324	17:01:55.821	102	1143	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:59:52.324	17:01:56.821	102	1143	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln
16:59:52.324	17:01:58.321	102	1143	125	58.50	17.00	NAR	OFF	OFF	118.00	USGS_NRCS_IL_KY_LiDAR_fixline.pln

Separation Plot

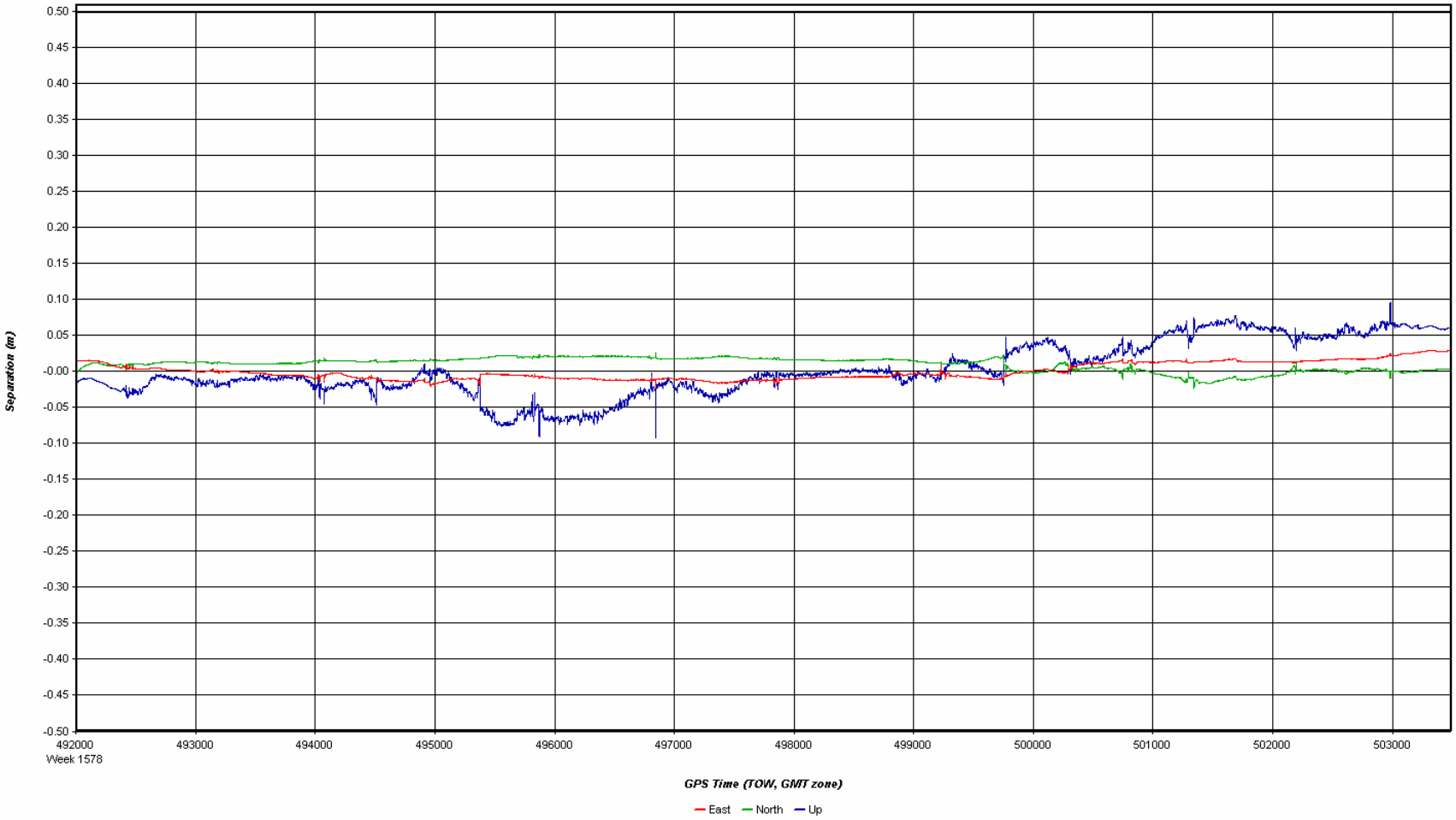
M041310A



N3443Q_M041310A_Sep_GINN-Fwd_STL8-Rev.doc

Separation Plot

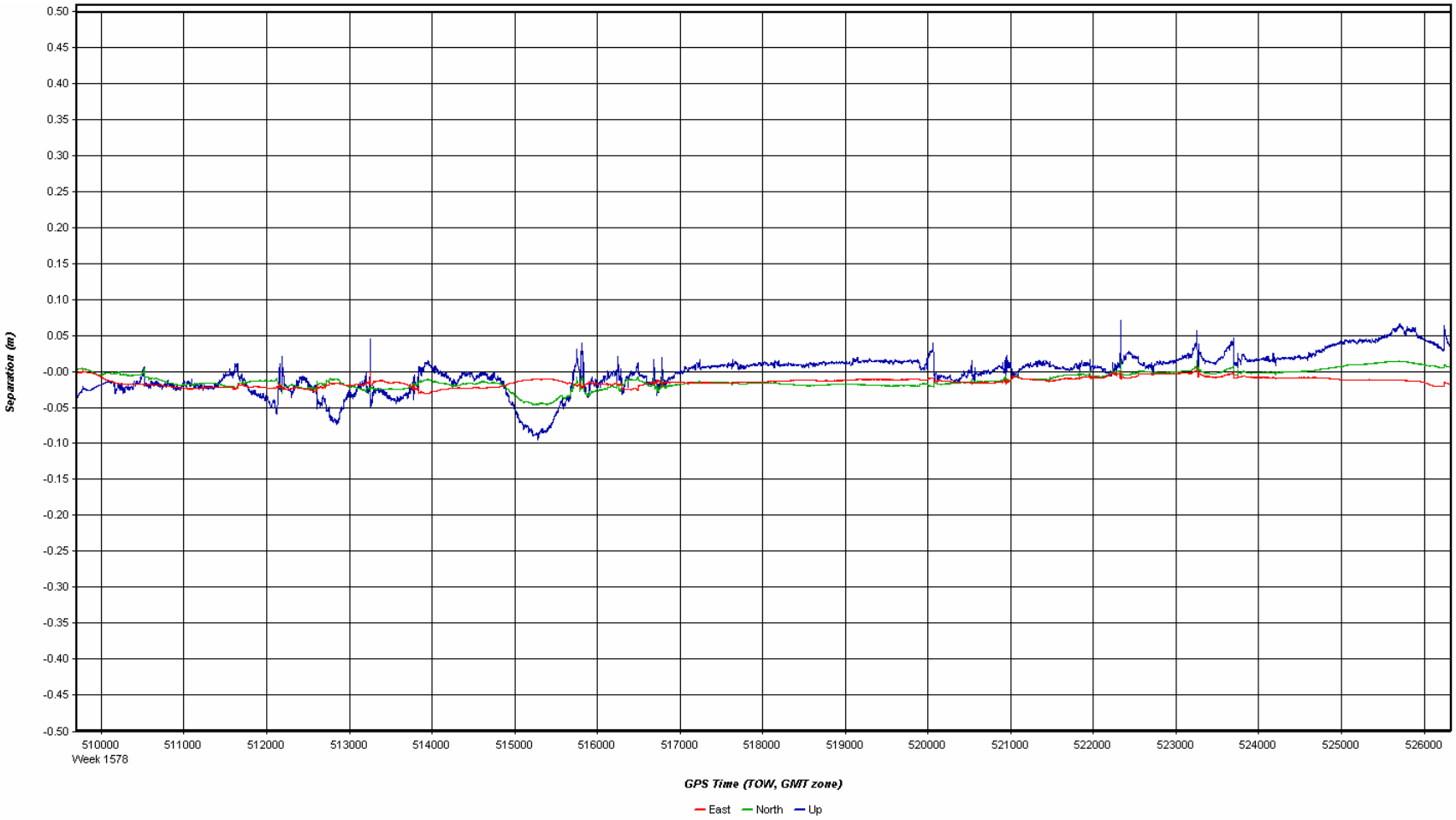
M040910A



N3443Q_M040910A_Sep_101_102_KYTB-Cmb.doc

Separation Plot

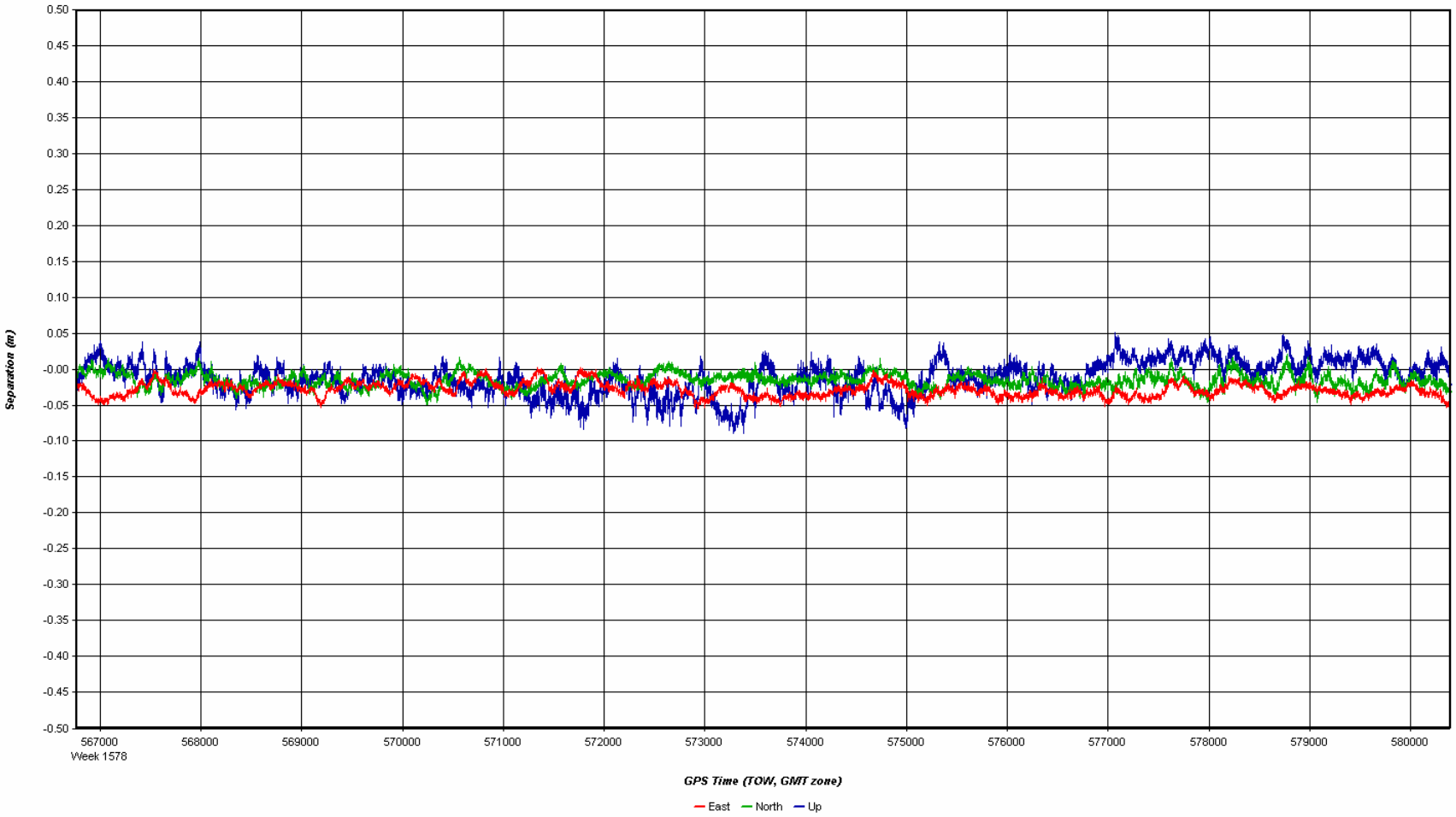
M040910B



N3443Q_M040910B_Sep_101_102_KYTB-Cmb.doc

Separation Plot

M041010A



N3443Q_M041010A_Sep_102_KYTB-Cmb.doc

R:\1100328\Lidar\QAQC\Illinois_checkpoints_stripped.txt

Number	Easting	Northing	Known Z	Laser Z	Dz
1	263748.362	4322633.244	193.391	193.410	+0.019
2	269617.221	4323164.447	191.922	191.990	+0.068
3	271365.474	4325619.405	182.459	182.450	-0.009
4	268470.980	4327458.011	192.823	192.870	+0.047
5	261991.612	4326763.381	199.763	199.730	-0.033
6	263720.889	4330398.699	203.789	203.780	-0.009
7	268574.833	4330620.407	202.486	202.520	+0.034
8	271483.609	4330373.550	186.887	186.870	-0.017
9	271578.040	4334697.595	198.172	198.190	+0.018
10	267832.189	4334021.702	208.310	208.350	+0.040
11	262788.467	4334568.710	202.610	202.600	-0.010
12	265114.882	4338011.184	202.290	202.310	+0.020
13	268968.137	4340015.747	205.942	206.020	+0.078
14	270770.129	4339435.241	209.964	209.970	+0.006
15	271436.480	4341994.826	207.286	207.230	-0.056
16	272244.294	4345968.099	201.876	201.870	-0.006
17	268542.027	4346260.478	202.120	202.130	+0.010
18	263678.760	4346385.253	202.415	202.380	-0.035
19	262728.142	4343108.262	204.171	204.190	+0.019
20	266791.853	4343028.206	203.763	203.800	+0.037
21	262633.579	4339810.027	203.967	203.950	-0.017
101	265073.175	4336917.561	204.948	205.020	+0.072
GINN_AZ_MK	269332.733	4336437.724	207.631	207.700	+0.069
Q_218	269331.221	4378314.084	193.970	outside	*
RENT	262738.640	4323474.184	195.787	195.840	+0.053
T_93	284521.146	4337367.101	191.979	outside	*

Average dz	+0.017
Minimum dz	-0.056
Maximum dz	+0.078
Average magnitude	0.033
Root mean square	0.040
Std deviation	0.037

Run by Dave Irwin on May 27 2010 using class 2 ground, 20 max triangle, 45 degree slope and 2 ft values.

R:\1100328\Lidar\QAQC\Kentucky_checkpoints_stripped.txt

Number	Easting	Northing	Known Z	Laser Z	Dz
1	452408.361	4080742.082	168.934	168.930	-0.004
2	452655.123	4077404.205	161.855	161.840	-0.015
3	454955.806	4074886.924	156.712	156.670	-0.042
4	457809.813	4073427.716	168.498	168.580	+0.082
5	461423.471	4074694.678	185.182	185.220	+0.038
6	461614.586	4077705.060	168.825	168.830	+0.005
7	466727.602	4076635.685	183.351	183.310	-0.041
8	472286.896	4078108.610	207.877	207.950	+0.073
9	469891.802	4081819.773	184.725	184.730	+0.005
10	467090.805	4084396.052	208.413	208.420	+0.007
11	463007.246	4084451.060	185.968	185.820	-0.148
12	464706.777	4081114.620	183.920	183.870	-0.050
13	460928.446	4085641.511	185.132	185.020	-0.112
14	458698.770	4083045.182	184.109	184.140	+0.031
15	456740.182	4085946.317	173.571	173.490	-0.081
16	454253.912	4083282.900	186.274	186.290	+0.016
17	453807.446	4079488.250	158.050	158.050	+0.000
18	455504.216	4077295.525	172.735	172.690	-0.045
19	456389.236	4080591.054	161.519	161.520	+0.001
20	457255.649	4079338.800	179.880	179.910	+0.030
21	458938.692	4080177.333	188.751	188.820	+0.069
101	460370.945	4076690.201	180.340	removed	*
102	464568.328	4078935.667	198.666	removed	*
B_22	427561.729	4080474.718	152.720	outside	*
KYTB	456006.042	4134172.817	165.367	outside	*
KYTC	546763.886	4093798.919	147.297	outside	*
M_133	459357.875	4063986.966	178.635	outside	*
R_392	476594.500	4077437.740	182.871	outside	*
TN48	383577.812	4017564.656	138.220	outside	*

Average dz	-0.009
Minimum dz	-0.148
Maximum dz	+0.082
Average magnitude	0.043
Root mean square	0.058
Std deviation	0.058