

March 25, 2004

Keystone Aerial Surveys, Inc.  
Northeast Philadelphia Airport  
Philadelphia, Pennsylvania 19114

Attn: Mike Rambo

Re: Measurement Report

GEOD Corporation was retained by Keystone Aerial Surveys, Inc. to determine the horizontal and vertical offset of the GPS antenna mounted on the exterior of aircraft No. N4189T from the film plane of the Leica RC30 photogrammetric camera (Serial Number 5063) mounted within. The purpose of this report is to document the procedures used and present the final results of the combined measurements.

Upon arrival at Keystone's hangar, GEOD personnel determined the best orientation of the aircraft to facilitate the measurements. Keystone personnel then jacked the aircraft into the predetermined normal flight attitude. Measurement points were marked and numbered on the exterior of the aircraft. A point in the center of the nose (point number 400) and a point on top of a fin at the base of the rudder (point number 403) were selected to define the Y measurement axis. A screw in a similar position on each wing tank (point number 402 starboard side and point number 401 port side) was selected to define the X measurement axis. The screws securing the GPS antenna to the exterior of the plane (point numbers 404 through 407) were numbered beginning with the forward side screw and proceeding clockwise. On the camera inside the aircraft, the four holes through which the center fiducial marks are projected (points 408 through 411) were numbered beginning with the forward hole and proceeding clockwise.

The first measurements made were between the camera fiducial marks. Using an Alvin engineers scale graduated to a half millimeter, the distance between adjacent and opposite fiducial marks was measured. The same measurements were made between the screws on the GPS antenna.

Next, three observation points (point numbers 1 through 3) were set up around the aircraft to collect the measurements that would determine the relative horizontal position of the aircraft, the camera, and the GPS antenna. All the points on the camera could be observed from both points 1 and 2. All the exterior points could be observed from points 2 and 3, while observation point 1 could see the starboard wing point, the tail point and the GPS points. These measurements were made using a Topcon GTS-300 total station. This instrument's angular accuracy is specified at "1 second standard deviation based on DIN18723" and its distance accuracy is specified at "+/- 2 mm + 2 ppm". All distance measurements were made using the instruments internal EDM to a mini-prism assembly placed on the measurement point.

Finally, measurements were made to determine the vertical offset of the GPS antenna from the camera film plane. First, a spot on the hangar floor near the location of the GPS antenna was

marked. Using a carpenters level and a Lufkin steel rule graduated in millimeters, the distance from the top of the dome of the antenna to the mark on the hangar floor was measured. A Zeiss NI-2 automatic level was then employed to level from the mark on the hangar floor to each of the camera fiducial marks. An engineers scale was then used to measure from the top dome of the GPS antenna to each of the screws.

All of these physical measurements were then combined into a least squares adjustment. The point on the tail (point number 403) was assigned the horizontal coordinate of (0,0). The starboard fiducial mark (point number 409) was assigned the elevation of 0. The direction from the tail point to the nose point (point number 400) was set as the positive Y axis. Additionally, the angles between adjacent fiducial marks and GPS antenna screws were constrained to be close to 90 degrees. The adjustment resulted in standard deviations for the camera and antenna points of approximately 1.5 mm. The full results can be viewed in the included copy of the adjustment output listing.

The final horizontal position of the center of the film plane (point number 500) and the center of the GPS antenna (point number 501) were computed by mathematically intersecting the opposite measurement points on each. The final vertical position of the film plane was computed by averaging the vertical position of each fiducial mark. The final vertical position of the top of the dome of the antenna was taken from the level adjustment.

Based on these observations, the center of the film plane is 0.0014 M to port, 0.0000 M aft/starboard, and 0.8641 M below the top center of the dome of the GPS antenna.

Please note that the final position of the camera film plane (point 400) is the mathematical intersection of the holes through which the center fiducial marks are projected. The user of these observations should consult with the manufacturer's published camera geometry to relate these observation locations to camera geometry such as the "entrance node" and/or the "rear node" needed for airborne GPS computations. Also, the final position of the GPS antenna (point 401) is the center of the antenna at the top of the dome. The L1 & L2 phase center relationship to this point is to be determined by separate observations.

Sincerely,

GEOD Corporation

Paul J. Emilius Jr., PLS  
Vice President Surveying

Summary of Files Used and Option Settings

Project Folder and Data Files

Project Name N4189T  
Project Folder G:\1608\AIRCRAFT #N4189T-01-30-04\STARNET  
Data File List N4189T.dat

Project Option Settings

STAR\*NET Run Mode : Adjust with Error Propagation  
Type of Adjustment : 3D  
Project Units : Meters; DMS  
Coordinate System : LOCAL  
Apply Average Scale Factor : 1.0000000000  
Input/Output Coordinate Order : North-East  
Angle Data Station Order : At-From-To  
Distance/Vertical Data Type : Slope/Zenith  
Convergence Limit; Max Iterations : 0.010000; 50  
Default Coefficient of Refraction : 0.070000  
Earth Radius : 6372000.00 Meters  
Create Coordinate File : Yes  
Create Ground Scale Coordinate File : No  
Create Dump File : No

Instrument Standard Error Settings

Project Default Instrument  
Distances (Constant) : 0.002000 Meters  
Distances (PPM) : 2.000000  
Angles : 5.000000 Seconds  
Directions : 5.000000 Seconds  
Azimuths & Bearings : 5.000000 Seconds  
Zeniths : 5.000000 Seconds  
Elevation Differences (Constant) : 0.002000 Meters  
Elevation Differences (PPM) : 0.000000  
Differential Levels : 0.002403 Meters / Km  
Centering Error Instrument : 0.000000 Meters  
Centering Error Target : 0.002000 Meters  
Centering Error Vertical : 0.002000 Meters

Project Library Instrument Sideshots

Note: n/a  
Distances (Constant) : 0.002000 Meters  
Distances (PPM) : 2.000000  
Angles : 5.000000 Seconds  
Directions : 5.000000 Seconds  
Azimuths & Bearings : 5.000000 Seconds  
Zeniths : 5.000000 Seconds  
Elevation Differences (Constant) : 0.002000 Meters  
Elevation Differences (PPM) : 0.000000  
Differential Levels : 0.002403 Meters / Km  
Centering Error Instrument : 0.000000 Meters  
Centering Error Target : 0.002000 Meters  
Centering Error Vertical : 0.002000 Meters

Project Library Instrument Traverse

Note: n/a  
Distances (Constant) : 0.002000 Meters

Distances (PPM)	:	2.000000
Angles	:	5.000000 Seconds
Directions	:	5.000000 Seconds
Azimuths & Bearings	:	5.000000 Seconds
Zeniths	:	5.000000 Seconds
Elevation Differences (Constant)	:	0.002000 Meters
Elevation Differences (PPM)	:	0.000000
Differential Levels	:	0.002403 Meters / Km
Centering Error Instrument	:	0.000000 Meters
Centering Error Target	:	0.000000 Meters
Centering Error Vertical	:	0.000000 Meters

Summary of Unadjusted Input Observations

Number of Entered Stations (Meters) = 15

Partially Fixed	N	E	Elev	Description
	StdErr	StdErr	StdErr	
409	4.3589	-0.2999	0.0000	CAMERA
	FREE	FREE	FIXED	
408	4.4561	-0.4214	0.0010	CAMERA
	FREE	FREE	0.0005	
410	4.2373	-0.3973	0.0000	CAMERA
	FREE	FREE	0.0005	
411	4.3340	-0.5185	0.0005	CAMERA
	FREE	FREE	0.0005	
404	4.3791	-0.4064	0.8554	GPS
	FREE	FREE	0.0005	
405	4.3484	-0.3694	0.8559	GPS
	FREE	FREE	0.0005	
406	4.3112	-0.3998	0.8644	GPS
	FREE	FREE	0.0005	
407	4.3418	-0.4370	0.8644	GPS
	FREE	FREE	0.0005	
403	0.0000	0.0000	0.5950	TAIL
	FIXED	FIXED	FREE	

Free Stations	N	E	Elev	Description
1	3.8460	4.0172	-1.5134	TR_XCT
2	14.8007	4.9325	-1.5312	TR_XCT
400	8.0976	0.0000	-0.2136	NOSE
3	12.1001	-3.7054	-1.5445	TR_XCT
402	7.2529	5.0235	0.2298	WING
401	6.1421	-5.7854	0.2421	WING

Number of Angle Observations (DMS) = 74

At	From	To	Angle	StdErr
408	409	411	90-00-00.00	FIXED
411	408	410	90-00-00.00	FIXED
410	411	409	90-00-00.00	FIXED
409	410	408	90-00-00.00	FIXED
404	405	407	90-00-00.00	0.00
407	404	406	90-00-00.00	0.00
406	407	405	90-00-00.00	0.00
405	406	404	90-00-00.00	0.00
1	2	3	312-07-15.20	5.00
1	3	2	47-52-46.80	5.00
2	1	3	67-51-25.00	5.00
2	3	1	292-08-35.20	5.00
3	1	2	295-44-32.50	5.00
3	2	1	64-15-27.20	5.00
1	2	402	11-37-14.00	122.14
1	2	403	220-08-07.00	83.28
1	2	404	272-10-53.00	100.03
1	2	405	271-50-42.50	100.81
1	2	406	271-19-27.50	100.30
1	2	407	271-39-41.00	99.53
1	2	408	273-07-12.50	99.56
1	2	409	272-04-19.00	102.16
1	2	410	270-21-27.00	100.49
1	2	411	271-25-59.50	98.04
1	3	402	59-30-00.50	121.83
1	3	403	268-01-09.50	82.82
1	3	404	320-03-38.50	99.65
1	3	405	319-43-31.50	100.43

1	3	406	319-12-15.50	99.92
1	3	407	319-32-38.50	99.15
1	3	408	321-00-20.50	99.17
1	3	409	319-57-14.00	101.79
1	3	410	318-14-54.50	100.11
1	3	411	319-19-00.50	97.64
2	1	400	34-35-29.00	62.37
2	1	401	46-18-02.00	48.27
2	1	402	354-33-47.50	66.48
2	1	403	12-44-14.00	46.18
2	1	404	22-21-25.00	51.71
2	1	405	22-07-38.00	51.69
2	1	406	22-10-36.00	51.60
2	1	407	22-24-15.50	51.62
2	1	408	22-34-18.00	51.84
2	1	409	21-49-18.00	51.78
2	1	410	21-58-45.00	51.47
2	1	411	22-43-06.00	51.53
2	3	400	326-43-52.00	67.53
2	3	401	338-26-33.00	54.76
2	3	402	286-42-12.00	71.34
2	3	403	304-52-36.50	52.93
2	3	404	314-29-46.50	57.83
2	3	405	314-16-11.00	57.81
2	3	406	314-19-08.50	57.72
2	3	407	314-32-53.00	57.74
2	3	408	314-42-46.00	57.94
2	3	409	313-57-55.00	57.88
2	3	410	314-07-23.50	57.61
2	3	411	314-51-30.50	57.66
3	1	400	4-14-35.00	84.13
3	1	401	62-18-23.50	75.03
3	1	402	342-07-40.00	55.35
3	1	403	24-36-47.50	49.19
3	1	404	19-55-43.50	61.41
3	1	405	19-46-52.50	61.21
3	1	406	20-04-09.50	61.11
3	1	407	20-13-16.50	61.30
3	2	400	68-30-16.00	88.45
3	2	401	126-33-59.00	79.85
3	2	402	46-23-11.00	61.72
3	2	403	88-52-53.00	56.26
3	2	404	84-11-08.50	67.21
3	2	405	84-02-11.50	67.02
3	2	406	84-19-40.00	66.93
3	2	407	84-28-46.00	67.11

Number of Distance Observations (Meters) = 90

From	To	Distance	StdErr	HI	HT	Type
408	409	0.1555	0.0005	0.000	0.000	S
409	410	0.1555	0.0005	0.000	0.000	S
410	411	0.1555	0.0005	0.000	0.000	S
411	408	0.1555	0.0005	0.000	0.000	S
408	410	0.2195	0.0005	0.000	0.000	S
409	411	0.2195	0.0005	0.000	0.000	S
404	405	0.0485	0.0005	0.000	0.000	S
405	406	0.0485	0.0005	0.000	0.000	S
406	407	0.0485	0.0005	0.000	0.000	S
407	404	0.0485	0.0005	0.000	0.000	S
404	406	0.0685	0.0005	0.000	0.000	S
405	407	0.0685	0.0005	0.000	0.000	S
1	2	11.0082	0.0020	0.000	0.000	S
1	3	11.3195	0.0020	0.000	0.000	S
1	2	11.0087	0.0020	0.000	0.000	S
1	3	11.3192	0.0020	0.000	0.000	S

1	2	11.0085	0.0020	0.000	0.000	S
1	3	11.3185	0.0020	0.000	0.000	S
2	1	11.0087	0.0020	0.000	0.000	S
2	3	9.0658	0.0020	0.000	0.000	S
2	1	11.0089	0.0020	0.000	0.000	S
2	3	9.0655	0.0020	0.000	0.000	S
2	1	11.0084	0.0020	0.000	0.000	S
2	3	9.0655	0.0020	0.000	0.000	S
3	1	11.3197	0.0020	0.000	0.000	S
3	2	9.0650	0.0020	0.000	0.000	S
3	1	11.3192	0.0020	0.000	0.000	S
3	2	9.0653	0.0020	0.000	0.000	S
3	1	11.3195	0.0020	0.000	0.000	S
3	2	9.0650	0.0020	0.000	0.000	S
1	402	3.9631	0.0030	0.000	0.000	S
1	403	5.6580	0.0029	0.000	0.000	S
1	404	5.0520	0.0030	0.000	0.000	S
1	405	5.0163	0.0030	0.000	0.000	S
1	406	5.0396	0.0030	0.000	0.000	S
1	407	5.0749	0.0030	0.000	0.000	S
1	408	4.7276	0.0029	0.000	0.000	S
1	409	4.6019	0.0029	0.000	0.000	S
1	410	4.6814	0.0029	0.000	0.000	S
1	411	4.8048	0.0029	0.000	0.000	S
1	402	3.9642	0.0030	0.000	0.000	S
1	403	5.6591	0.0029	0.000	0.000	S
1	404	5.0521	0.0030	0.000	0.000	S
1	405	5.0162	0.0030	0.000	0.000	S
1	406	5.0395	0.0030	0.000	0.000	S
1	407	5.0748	0.0030	0.000	0.000	S
1	408	4.7284	0.0029	0.000	0.000	S
1	409	4.6023	0.0029	0.000	0.000	S
1	410	4.6819	0.0029	0.000	0.000	S
1	411	4.8053	0.0029	0.000	0.000	S
2	400	8.7153	0.0029	0.000	0.000	S
2	401	13.9000	0.0029	0.000	0.000	S
2	402	7.7578	0.0029	0.000	0.000	S
2	403	15.5581	0.0029	0.000	0.000	S
2	404	11.9616	0.0029	0.000	0.000	S
2	405	11.9718	0.0029	0.000	0.000	S
2	406	12.0185	0.0029	0.000	0.000	S
2	407	12.0082	0.0029	0.000	0.000	S
2	408	11.7586	0.0029	0.000	0.000	S
2	409	11.7898	0.0029	0.000	0.000	S
2	410	11.9405	0.0029	0.000	0.000	S
2	411	11.9098	0.0029	0.000	0.000	S
2	400	8.7154	0.0029	0.000	0.000	S
2	401	13.8999	0.0029	0.000	0.000	S
2	402	7.7575	0.0029	0.000	0.000	S
2	403	15.5586	0.0029	0.000	0.000	S
2	404	11.9616	0.0029	0.000	0.000	S
2	405	11.9713	0.0029	0.000	0.000	S
2	406	12.0175	0.0029	0.000	0.000	S
2	407	12.0082	0.0029	0.000	0.000	S
2	408	11.7586	0.0029	0.000	0.000	S
2	409	11.7893	0.0029	0.000	0.000	S
2	410	11.9410	0.0029	0.000	0.000	S
2	411	11.9103	0.0029	0.000	0.000	S
3	400	5.2505	0.0029	0.000	0.000	S
3	401	6.5528	0.0029	0.000	0.000	S
3	402	10.1498	0.0029	0.000	0.000	S
3	403	12.8224	0.0029	0.000	0.000	S
3	404	8.7411	0.0029	0.000	0.000	S
3	405	8.7821	0.0029	0.000	0.000	S
3	406	8.8034	0.0029	0.000	0.000	S
3	407	8.7614	0.0029	0.000	0.000	S

3	400	5.2510	0.0029	0.000	0.000	S
3	401	6.5534	0.0029	0.000	0.000	S
3	402	10.1497	0.0029	0.000	0.000	S
3	403	12.8220	0.0029	0.000	0.000	S
3	404	8.7402	0.0029	0.000	0.000	S
3	405	8.7816	0.0029	0.000	0.000	S
3	406	8.8028	0.0029	0.000	0.000	S
3	407	8.7623	0.0029	0.000	0.000	S

Number of Zenith Observations (DMS) = 78

From	To	Zenith	StdErr	HI	HT
1	2	90-05-28.80	5.00	0.000	0.000
1	3	90-09-33.20	5.00	0.000	0.000
1	2	90-05-28.30	5.00	0.000	0.000
1	3	90-09-34.40	5.00	0.000	0.000
1	2	90-05-29.50	5.00	0.000	0.000
1	3	90-09-33.40	5.00	0.000	0.000
2	1	89-54-11.50	5.00	0.000	0.000
2	3	90-05-05.00	5.00	0.000	0.000
2	1	89-54-15.70	5.00	0.000	0.000
2	3	90-05-05.80	5.00	0.000	0.000
2	1	89-54-16.00	5.00	0.000	0.000
2	3	90-05-06.00	5.00	0.000	0.000
3	1	89-50-27.10	5.00	0.000	0.000
3	2	89-54-56.70	5.00	0.000	0.000
3	1	89-50-28.30	5.00	0.000	0.000
3	2	89-54-59.50	5.00	0.000	0.000
3	1	89-50-23.60	5.00	0.000	0.000
3	2	89-54-54.40	5.00	0.000	0.000
1	402	63-55-24.60	140.19	0.000	0.000
1	403	68-42-47.60	95.09	0.000	0.000
1	404	61-57-59.50	109.17	0.000	0.000
1	405	61-45-00.60	109.84	0.000	0.000
1	406	61-53-19.80	109.28	0.000	0.000
1	407	62-06-05.10	108.61	0.000	0.000
1	408	71-19-49.20	120.26	0.000	0.000
1	409	70-48-36.10	123.36	0.000	0.000
1	410	71-08-46.90	121.38	0.000	0.000
1	411	71-38-38.70	118.43	0.000	0.000
1	402	63-54-23.30	140.19	0.000	0.000
1	403	68-42-35.10	95.09	0.000	0.000
1	404	61-57-46.00	109.17	0.000	0.000
1	405	61-45-06.10	109.84	0.000	0.000
1	406	61-53-25.20	109.28	0.000	0.000
1	407	62-06-10.60	108.61	0.000	0.000
1	408	71-20-14.30	120.26	0.000	0.000
1	409	70-48-47.80	123.36	0.000	0.000
1	410	71-08-54.30	121.38	0.000	0.000
1	411	71-38-49.30	118.43	0.000	0.000
2	400	81-17-50.50	69.00	0.000	0.000
2	401	82-40-09.20	42.12	0.000	0.000
2	402	76-52-25.80	74.46	0.000	0.000
2	403	82-20-41.60	37.22	0.000	0.000
2	404	78-28-10.90	48.59	0.000	0.000
2	405	78-28-51.20	48.55	0.000	0.000
2	406	78-31-33.40	48.36	0.000	0.000
2	407	78-30-49.90	48.40	0.000	0.000
2	408	82-30-54.90	49.70	0.000	0.000
2	409	82-32-16.10	49.57	0.000	0.000
2	410	82-37-53.60	48.95	0.000	0.000
2	411	82-36-46.40	49.08	0.000	0.000
2	400	81-17-37.40	69.00	0.000	0.000
2	401	82-40-16.60	42.12	0.000	0.000
2	402	76-52-55.80	74.46	0.000	0.000
2	403	82-20-46.80	37.22	0.000	0.000



2	404	78-28-11.30	48.59	0.000	0.000
2	405	78-28-57.30	48.55	0.000	0.000
2	406	78-31-31.10	48.36	0.000	0.000
2	407	78-30-54.20	48.40	0.000	0.000
2	408	82-30-54.40	49.70	0.000	0.000
2	409	82-32-12.40	49.57	0.000	0.000
2	410	82-38-03.20	48.95	0.000	0.000
2	411	82-36-42.70	49.08	0.000	0.000
3	400	75-18-19.60	102.56	0.000	0.000
3	401	74-10-52.20	87.43	0.000	0.000
3	402	79-55-31.30	57.31	0.000	0.000
3	403	80-38-20.30	45.42	0.000	0.000
3	404	74-01-48.40	65.72	0.000	0.000
3	405	74-06-34.10	65.43	0.000	0.000
3	406	74-08-49.40	65.25	0.000	0.000
3	407	74-04-05.40	65.54	0.000	0.000
3	400	75-18-19.80	102.56	0.000	0.000
3	401	74-10-41.80	87.43	0.000	0.000
3	402	79-55-40.10	57.31	0.000	0.000
3	403	80-38-16.30	45.42	0.000	0.000
3	404	74-01-41.60	65.72	0.000	0.000
3	405	74-06-32.90	65.43	0.000	0.000
3	406	74-08-54.30	65.25	0.000	0.000
3	407	74-04-13.20	65.54	0.000	0.000

Number of Azimuth/Bearing Observations (DMS) = 1

From	To	Bearing	StdErr
403	400	N00-00-00.00E	FIXED



Adjustment Statistical Summary

=====

Convergence Iterations = 8  
 Number of Stations = 15  
 Number of Observations = 250  
 Number of Unknowns = 42  
 Number of Redundant Obs = 208

Observation	Count	Sum Squares of StdRes	Error Factor
Coordinates	7	8.147	1.183
Angles	74	16.036	0.510
Distances	90	9.634	0.359
Az/Bearings	1	0.000	0.000
Zeniths	78	60.595	0.966
Total	250	94.411	0.674

Warning: The Chi-Square Test at 5.00% Level Exceeded Lower Bound  
 Lower/Upper Bounds (0.904/1.096)

Adjusted Coordinates (Meters)

Station	N	E	Elev	Description
1	3.3348	4.0847	-1.5132	TR_XCT
2	14.1541	6.1160	-1.5313	TR_XCT
409	4.2906	-0.1565	0.0000	CAMERA
408	4.3994	-0.2674	0.0009	CAMERA
410	4.1797	-0.2653	-0.0000	CAMERA
411	4.2885	-0.3762	0.0004	CAMERA
404	4.3236	-0.2649	0.8562	GPS
405	4.2891	-0.2309	0.8566	GPS
406	4.2555	-0.2650	0.8637	GPS
407	4.2899	-0.2990	0.8638	GPS
403	0.0000	0.0000	0.5411	TAIL
400	8.0862	-0.0000	-0.2125	NOSE
3	12.3456	-2.7669	-1.5447	TR_XCT
402	6.6301	5.4321	0.2301	WING
401	6.6333	-5.4375	0.2420	WING

Adjusted Observations and Residuals

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Adjusted Coordinate Observations (Meters)  
(Stations with Partially Fixed Coordinate Components)

Station	Component	Adj Coordinate	Residual	StdErr	StdRes
408	Elev	0.0009	-0.0001	0.0005	0.2
410	Elev	-0.0000	-0.0000	0.0005	0.1
411	Elev	0.0004	-0.0001	0.0005	0.1
404	Elev	0.8562	0.0008	0.0005	1.7
405	Elev	0.8566	0.0007	0.0005	1.4
406	Elev	0.8637	-0.0007	0.0005	1.3
407	Elev	0.8638	-0.0006	0.0005	1.3

Adjusted Angle Observations (DMS)

At	From	To	Angle	Residual	StdErr	StdRes
408	409	411	90-00-00.00	-0-00-00.00	FIXED	0.0
411	408	410	90-00-00.00	0-00-00.00	FIXED	0.0
410	411	409	90-00-00.00	-0-00-00.00	FIXED	0.0
409	410	408	90-00-00.00	0-00-00.00	FIXED	0.0
404	405	407	90-00-00.00	-0-00-00.00	0.00	0.0
407	404	406	90-00-00.00	0-00-00.00	0.00	0.0
406	407	405	90-00-00.00	-0-00-00.00	0.00	0.0
405	406	404	90-00-00.00	0-00-00.00	0.00	0.0
1	2	3	312-07-06.57	-0-00-08.63	5.00	1.7
1	3	2	47-52-53.43	0-00-06.63	5.00	1.3
2	1	3	67-51-31.32	0-00-06.32	5.00	1.3
2	3	1	292-08-28.68	-0-00-06.52	5.00	1.3
3	1	2	295-44-24.75	-0-00-07.75	5.00	1.6
3	2	1	64-15-35.25	0-00-08.05	5.00	1.6
1	2	402	11-36-21.45	-0-00-52.55	122.14	0.4
1	2	403	220-08-16.99	0-00-09.99	83.28	0.1
1	2	404	272-10-29.26	-0-00-23.74	100.03	0.2
1	2	405	271-50-12.69	-0-00-29.81	100.81	0.3
1	2	406	271-19-04.73	-0-00-22.77	100.30	0.2
1	2	407	271-39-31.13	-0-00-09.87	99.53	0.1
1	2	408	273-06-45.88	-0-00-26.62	99.56	0.3
1	2	409	272-04-03.59	-0-00-15.41	102.16	0.2
1	2	410	270-21-31.64	0-00-04.64	100.49	0.0
1	2	411	271-26-03.44	0-00-03.94	98.04	0.0
1	3	402	59-29-14.87	-0-00-45.63	121.83	0.4
1	3	403	268-01-10.41	0-00-00.91	82.82	0.0
1	3	404	320-03-22.69	-0-00-15.81	99.65	0.2
1	3	405	319-43-06.12	-0-00-25.38	100.43	0.3
1	3	406	319-11-58.16	-0-00-17.34	99.92	0.2
1	3	407	319-32-24.56	-0-00-13.94	99.15	0.1
1	3	408	320-59-39.31	-0-00-41.19	99.17	0.4
1	3	409	319-56-57.01	-0-00-16.99	101.79	0.2
1	3	410	318-14-25.07	-0-00-29.43	100.11	0.3
1	3	411	319-18-56.86	-0-00-03.64	97.64	0.0
2	1	400	34-35-33.00	0-00-04.00	62.37	0.1
2	1	401	46-18-15.55	0-00-13.55	48.27	0.3
2	1	402	354-33-36.03	-0-00-11.47	66.48	0.2
2	1	403	12-44-08.67	-0-00-05.33	46.18	0.1
2	1	404	22-21-13.24	-0-00-11.76	51.71	0.2
2	1	405	22-07-21.47	-0-00-16.53	51.69	0.3
2	1	406	22-10-24.94	-0-00-11.06	51.60	0.2
2	1	407	22-24-13.57	-0-00-01.93	51.62	0.0
2	1	408	22-34-00.57	-0-00-17.43	51.84	0.3
2	1	409	21-49-11.81	-0-00-06.19	51.78	0.1
2	1	410	21-58-33.89	-0-00-11.11	51.47	0.2
2	1	411	22-42-49.48	-0-00-16.52	51.53	0.3
2	3	400	326-44-01.68	0-00-09.68	67.53	0.1

2	3	401	338-26-44.23	0-00-11.23	54.76	0.2
2	3	402	286-42-04.71	-0-00-07.29	71.34	0.1
2	3	403	304-52-37.35	0-00-00.85	52.93	0.0
2	3	404	314-29-41.92	-0-00-04.58	57.83	0.1
2	3	405	314-15-50.15	-0-00-20.85	57.81	0.4
2	3	406	314-18-53.62	-0-00-14.88	57.72	0.3
2	3	407	314-32-42.25	-0-00-10.75	57.74	0.2
2	3	408	314-42-29.25	-0-00-16.75	57.94	0.3
2	3	409	313-57-40.49	-0-00-14.51	57.88	0.3
2	3	410	314-07-02.57	-0-00-20.93	57.61	0.4
2	3	411	314-51-18.16	-0-00-12.34	57.66	0.2
3	1	400	4-14-26.99	-0-00-08.01	84.13	0.1
3	1	401	62-18-20.04	-0-00-03.46	75.03	0.0
3	1	402	342-07-42.02	0-00-02.02	55.35	0.0
3	1	403	24-36-57.15	0-00-09.65	49.19	0.2
3	1	404	19-55-33.03	-0-00-10.47	61.41	0.2
3	1	405	19-46-30.50	-0-00-22.00	61.21	0.4
3	1	406	20-03-49.86	-0-00-19.64	61.11	0.3
3	1	407	20-12-56.27	-0-00-20.23	61.30	0.3
3	2	400	68-30-02.24	-0-00-13.76	88.45	0.2
3	2	401	126-33-55.29	-0-00-03.71	79.85	0.0
3	2	402	46-23-17.27	0-00-06.27	61.72	0.1
3	2	403	88-52-32.41	-0-00-20.59	56.26	0.4
3	2	404	84-11-08.28	-0-00-00.22	67.21	0.0
3	2	405	84-02-05.75	-0-00-05.75	67.02	0.1
3	2	406	84-19-25.11	-0-00-14.89	66.93	0.2
3	2	407	84-28-31.53	-0-00-14.47	67.11	0.2

Adjusted Distance Observations (Meters)

From	To	Distance	Residual	StdErr	StdRes
408	409	0.1553	-0.0002	0.0005	0.3
409	410	0.1554	-0.0001	0.0005	0.2
410	411	0.1553	-0.0002	0.0005	0.3
411	408	0.1554	-0.0001	0.0005	0.2
408	410	0.2197	0.0002	0.0005	0.4
409	411	0.2197	0.0002	0.0005	0.4
404	405	0.0484	-0.0001	0.0005	0.1
405	406	0.0485	-0.0000	0.0005	0.0
406	407	0.0484	-0.0001	0.0005	0.1
407	404	0.0485	0.0000	0.0005	0.1
404	406	0.0686	0.0001	0.0005	0.1
405	407	0.0685	0.0000	0.0005	0.1
1	2	11.0084	0.0002	0.0020	0.1
1	3	11.3199	0.0004	0.0020	0.2
1	2	11.0084	-0.0003	0.0020	0.1
1	3	11.3199	0.0007	0.0020	0.3
1	2	11.0084	-0.0000	0.0020	0.0
1	3	11.3199	0.0014	0.0020	0.7
2	1	11.0084	-0.0003	0.0020	0.1
2	3	9.0651	-0.0007	0.0020	0.3
2	1	11.0084	-0.0005	0.0020	0.3
2	3	9.0651	-0.0004	0.0020	0.2
2	1	11.0084	-0.0000	0.0020	0.0
2	3	9.0651	-0.0004	0.0020	0.2
3	1	11.3199	0.0002	0.0020	0.1
3	2	9.0651	0.0001	0.0020	0.0
3	1	11.3199	0.0007	0.0020	0.3
3	2	9.0651	-0.0002	0.0020	0.1
3	1	11.3199	0.0004	0.0020	0.2
3	2	9.0651	0.0001	0.0020	0.0
1	402	3.9641	0.0010	0.0030	0.4
1	403	5.6591	0.0012	0.0029	0.4
1	404	5.0508	-0.0012	0.0030	0.4
1	405	5.0150	-0.0012	0.0030	0.4
1	406	5.0415	0.0020	0.0030	0.7

1	407	5.0773	0.0024	0.0030	0.8
1	408	4.7293	0.0018	0.0029	0.6
1	409	4.6033	0.0014	0.0029	0.5
1	410	4.6825	0.0011	0.0029	0.4
1	411	4.8062	0.0014	0.0029	0.5
1	402	3.9641	-0.0001	0.0030	0.0
1	403	5.6591	0.0000	0.0029	0.0
1	404	5.0508	-0.0013	0.0030	0.4
1	405	5.0150	-0.0012	0.0030	0.4
1	406	5.0415	0.0020	0.0030	0.7
1	407	5.0773	0.0025	0.0030	0.8
1	408	4.7293	0.0009	0.0029	0.3
1	409	4.6033	0.0010	0.0029	0.3
1	410	4.6825	0.0006	0.0029	0.2
1	411	4.8062	0.0010	0.0029	0.3
2	400	8.7157	0.0004	0.0029	0.2
2	401	13.8993	-0.0007	0.0029	0.2
2	402	7.7576	-0.0001	0.0029	0.1
2	403	15.5576	-0.0005	0.0029	0.2
2	404	11.9605	-0.0010	0.0029	0.3
2	405	11.9709	-0.0009	0.0029	0.3
2	406	12.0182	-0.0003	0.0029	0.1
2	407	12.0080	-0.0003	0.0029	0.1
2	408	11.7580	-0.0006	0.0029	0.2
2	409	11.7889	-0.0009	0.0029	0.3
2	410	11.9396	-0.0009	0.0029	0.3
2	411	11.9091	-0.0007	0.0029	0.2
2	400	8.7157	0.0003	0.0029	0.1
2	401	13.8993	-0.0006	0.0029	0.2
2	402	7.7576	0.0001	0.0029	0.0
2	403	15.5576	-0.0009	0.0029	0.3
2	404	11.9605	-0.0010	0.0029	0.3
2	405	11.9709	-0.0004	0.0029	0.1
2	406	12.0182	0.0007	0.0029	0.2
2	407	12.0080	-0.0002	0.0029	0.1
2	408	11.7580	-0.0006	0.0029	0.2
2	409	11.7889	-0.0004	0.0029	0.2
2	410	11.9396	-0.0013	0.0029	0.5
2	411	11.9091	-0.0012	0.0029	0.4
3	400	5.2510	0.0005	0.0029	0.2
3	401	6.5540	0.0012	0.0029	0.4
3	402	10.1509	0.0011	0.0029	0.4
3	403	12.8227	0.0002	0.0029	0.1
3	404	8.7394	-0.0017	0.0029	0.6
3	405	8.7809	-0.0012	0.0029	0.4
3	406	8.8040	0.0006	0.0029	0.2
3	407	8.7627	0.0013	0.0029	0.5
3	400	5.2510	0.0000	0.0029	0.0
3	401	6.5540	0.0006	0.0029	0.2
3	402	10.1509	0.0011	0.0029	0.4
3	403	12.8227	0.0007	0.0029	0.2
3	404	8.7394	-0.0008	0.0029	0.3
3	405	8.7809	-0.0007	0.0029	0.2
3	406	8.8040	0.0012	0.0029	0.4
3	407	8.7627	0.0004	0.0029	0.1

Adjusted Zenith Observations (DMS)

From	To	Zenith	Residual	StdErr	StdRes
1	2	90-05-38.04	0-00-09.24	5.00	1.8
1	3	90-09-33.01	-0-00-00.19	5.00	0.0
1	2	90-05-38.04	0-00-09.74	5.00	1.9
1	3	90-09-33.01	-0-00-01.39	5.00	0.3
1	2	90-05-38.04	0-00-08.54	5.00	1.7
1	3	90-09-33.01	-0-00-00.39	5.00	0.1
2	1	89-54-22.27	0-00-10.77	5.00	2.2

2	3	90-05-05.15	0-00-00.15	5.00	0.0
2	1	89-54-22.27	0-00-06.57	5.00	1.3
2	3	90-05-05.15	-0-00-00.65	5.00	0.1
2	1	89-54-22.27	0-00-06.27	5.00	1.3
2	3	90-05-05.15	-0-00-00.85	5.00	0.2
3	1	89-50-27.30	0-00-00.20	5.00	0.0
3	2	89-54-55.10	-0-00-01.60	5.00	0.3
3	1	89-50-27.30	-0-00-01.00	5.00	0.2
3	2	89-54-55.10	-0-00-04.40	5.00	0.9
3	1	89-50-27.30	0-00-03.70	5.00	0.7
3	2	89-54-55.10	0-00-00.70	5.00	0.1
1	402	63-54-39.70	-0-00-44.90	140.19	0.3
1	403	68-42-51.91	0-00-04.31	95.09	0.0
1	404	62-01-21.09	0-03-21.59	109.17	1.8
1	405	61-48-02.72	0-03-02.12	109.84	1.7
1	406	61-52-12.10	-0-01-07.70	109.28	0.6
1	407	62-05-06.67	-0-00-58.43	108.61	0.5
1	408	71-19-38.83	-0-00-10.37	120.26	0.1
1	409	70-48-31.65	-0-00-04.45	123.36	0.0
1	410	71-08-44.97	-0-00-01.93	121.38	0.0
1	411	71-38-34.53	-0-00-04.17	118.43	0.0
1	402	63-54-39.70	0-00-16.40	140.19	0.1
1	403	68-42-51.91	0-00-16.81	95.09	0.2
1	404	62-01-21.09	0-03-35.09	109.17	2.0
1	405	61-48-02.72	0-02-56.62	109.84	1.6
1	406	61-52-12.10	-0-01-13.10	109.28	0.7
1	407	62-05-06.67	-0-01-03.93	108.61	0.6
1	408	71-19-38.83	-0-00-35.47	120.26	0.3
1	409	70-48-31.65	-0-00-16.15	123.36	0.1
1	410	71-08-44.97	-0-00-09.33	121.38	0.1
1	411	71-38-34.53	-0-00-14.77	118.43	0.1
2	400	81-17-51.11	0-00-00.61	69.00	0.0
2	401	82-40-13.42	0-00-04.22	42.12	0.1
2	402	76-52-37.24	0-00-11.44	74.46	0.2
2	403	82-20-42.31	0-00-00.71	37.22	0.0
2	404	78-29-08.35	0-00-57.45	48.59	1.2
2	405	78-29-38.68	0-00-47.48	48.55	1.0
2	406	78-30-18.67	-0-01-14.73	48.36	1.5
2	407	78-29-42.38	-0-01-07.52	48.40	1.4
2	408	82-30-45.37	-0-00-09.53	49.70	0.2
2	409	82-32-12.53	-0-00-03.57	49.57	0.1
2	410	82-37-54.19	0-00-00.59	48.95	0.0
2	411	82-36-37.46	-0-00-08.94	49.08	0.2
2	400	81-17-51.11	0-00-13.71	69.00	0.2
2	401	82-40-13.42	-0-00-03.18	42.12	0.1
2	402	76-52-37.24	-0-00-18.56	74.46	0.2
2	403	82-20-42.31	-0-00-04.49	37.22	0.1
2	404	78-29-08.35	0-00-57.05	48.59	1.2
2	405	78-29-38.68	0-00-41.38	48.55	0.9
2	406	78-30-18.67	-0-01-12.43	48.36	1.5
2	407	78-29-42.38	-0-01-11.82	48.40	1.5
2	408	82-30-45.37	-0-00-09.03	49.70	0.2
2	409	82-32-12.53	0-00-00.13	49.57	0.0
2	410	82-37-54.19	-0-00-09.01	48.95	0.2
2	411	82-36-37.46	-0-00-05.24	49.08	0.1
3	400	75-18-14.23	-0-00-05.37	102.56	0.1
3	401	74-10-50.51	-0-00-01.69	87.43	0.0
3	402	79-55-51.78	0-00-20.48	57.31	0.4
3	403	80-38-18.38	-0-00-01.92	45.42	0.0
3	404	74-03-16.58	0-01-28.18	65.72	1.3
3	405	74-07-46.82	0-01-12.72	65.43	1.1
3	406	74-07-26.61	-0-01-22.79	65.25	1.3
3	407	74-02-49.30	-0-01-16.10	65.54	1.2
3	400	75-18-14.23	-0-00-05.57	102.56	0.1
3	401	74-10-50.51	0-00-08.71	87.43	0.1
3	402	79-55-51.78	0-00-11.68	57.31	0.2



3	403	80-38-18.38	0-00-02.08	45.42	0.0
3	404	74-03-16.58	0-01-34.98	65.72	1.4
3	405	74-07-46.82	0-01-13.92	65.43	1.1
3	406	74-07-26.61	-0-01-27.69	65.25	1.3
3	407	74-02-49.30	-0-01-23.90	65.54	1.3

Adjusted Azimuth/Bearing Observations (DMS)

From	To	Bearing	Residual	StdErr	StdRes
403	400	N00-00-00.00W	-0-00-00.00	FIXED	0.0

## Adjusted Bearings (DMS) and Horizontal Distances (Meters)

(Relative Confidence of Bearing is in Seconds)

From	To	Bearing	Distance	95% RelConfidence		
				Brg	Dist	PPM
1	2	N10-37-59.99E	11.0084	109.58	0.0010	89.2915
1	3	N37-14-53.44W	11.3199	109.58	0.0010	89.0819
1	402	N22-14-21.43E	3.5602	179.10	0.0029	814.3734
1	403	S50-46-16.98W	5.2731	116.11	0.0031	586.9401
1	404	N77-11-30.75W	4.4605	128.65	0.0020	453.1928
1	405	N77-31-47.32W	4.4198	142.59	0.0015	345.3118
1	406	N78-02-55.28W	4.4460	128.70	0.0020	454.7127
1	407	N77-42-28.88W	4.4865	141.77	0.0015	339.5504
1	408	N76-15-14.13W	4.4804	133.04	0.0025	566.2348
1	409	N77-17-56.43W	4.3475	154.89	0.0020	453.2104
1	410	N79-00-28.37W	4.4312	133.38	0.0026	586.1249
1	411	N77-55-56.57W	4.5617	149.46	0.0020	434.6276
2	3	S78-29-31.31W	9.0651	109.68	0.0008	92.7658
2	400	S45-13-32.99W	8.6154	168.62	0.0031	356.3013
2	401	S56-56-15.54W	13.7857	121.67	0.0034	249.7951
2	402	S05-11-36.02W	7.5550	128.97	0.0029	380.0968
2	403	S23-22-08.66W	15.4190	90.79	0.0029	188.4726
2	404	S32-59-13.23W	11.7198	114.50	0.0016	139.7055
2	405	S32-45-21.46W	11.7303	113.37	0.0019	158.4169
2	406	S32-48-24.93W	11.7771	114.46	0.0016	138.8600
2	407	S33-02-13.56W	11.7667	113.35	0.0019	157.7393
2	408	S33-12-00.56W	11.6577	116.79	0.0019	163.3069
2	409	S32-27-11.80W	11.6890	115.15	0.0022	189.4186
2	410	S32-36-33.88W	11.8410	116.74	0.0019	163.9855
2	411	S33-20-49.47W	11.8102	115.13	0.0021	181.4388
3	400	S33-00-26.45E	5.0792	205.93	0.0035	682.3253
3	401	S25-03-26.60W	6.3058	153.90	0.0036	572.2891
3	402	S55-07-11.42E	9.9945	124.02	0.0026	255.1431
3	403	S12-37-56.29E	12.6519	85.54	0.0026	208.3973
3	404	S17-19-20.41E	8.4031	119.25	0.0015	179.4220
3	405	S17-28-22.94E	8.4462	115.15	0.0019	230.5221
3	406	S17-11-03.58E	8.4682	119.12	0.0015	177.8348
3	407	S17-01-57.17E	8.4252	115.16	0.0019	231.0840
400	403	S00-00-00.00E	8.0862	0.00	0.0042	525.5460
404	405	S44-37-35.07E	0.0484	8157.32	0.0007	14901.3806
404	406	S00-05-30.15W	0.0682	8602.04	0.0006	8960.7705
404	407	S45-22-24.93W	0.0480	8157.31	0.0007	15468.4834
405	406	S45-22-24.93W	0.0480	8157.31	0.0007	15468.4834
405	407	N89-20-40.29W	0.0682	8477.97	0.0006	8960.7702
406	407	N44-37-35.07W	0.0484	8157.32	0.0007	14901.3806
408	409	S45-33-39.09E	0.1553	3141.36	0.0007	4720.0131
408	410	S00-33-17.51E	0.2197	3285.66	0.0006	2743.5763
408	411	S44-26-20.91W	0.1554	3141.36	0.0007	4687.4835
409	410	S44-26-20.91W	0.1554	3141.36	0.0007	4687.4835
409	411	S89-25-59.33W	0.2197	3191.07	0.0006	2743.5759
410	411	N45-33-39.09W	0.1553	3141.36	0.0007	4720.0131

Error Propagation

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Station Coordinate Standard Deviations (Meters)

Station	N	E	Elev
1	0.001468	0.000956	0.000476
2	0.001773	0.002440	0.000475
409	0.001442	0.001309	0.000000
408	0.001234	0.001467	0.000474
410	0.001230	0.001508	0.000474
411	0.001374	0.001311	0.000474
404	0.001220	0.001257	0.000460
405	0.001342	0.001121	0.000461
406	0.001220	0.001254	0.000461
407	0.001341	0.001119	0.000461
403	0.000000	0.000000	0.001221
400	0.001736	0.000000	0.001459
3	0.001216	0.002068	0.000477
402	0.002016	0.001514	0.001233
401	0.002158	0.001744	0.001484

Station Coordinate Error Ellipses (Meters)

Confidence Region = 95%

Station	Semi-Major Axis	Semi-Minor Axis	Azimuth of Major Axis	Elev
1	0.003617	0.002303	8-36	0.000932
2	0.006858	0.002733	122-24	0.000932
409	0.003546	0.003187	12-10	0.000000
408	0.003591	0.003020	88-12	0.000929
410	0.003703	0.002994	81-58	0.000929
411	0.003367	0.003205	9-42	0.000929
404	0.003123	0.002939	59-45	0.000902
405	0.003297	0.002729	8-33	0.000903
406	0.003117	0.002935	58-26	0.000903
407	0.003296	0.002725	8-54	0.000903
403	0.000000	0.000000	0-00	0.002393
400	0.004250	0.000000	0-00	0.002860
3	0.005269	0.002593	71-23	0.000935
402	0.005029	0.003578	164-12	0.002417
401	0.005469	0.004027	22-32	0.002909

Relative Error Ellipses (Meters)

Confidence Region = 95%

Stations From	To	Semi-Major Axis	Semi-Minor Axis	Azimuth of Major Axis	Vertical
1	2	0.005849	0.000981	100-04	0.000169
1	3	0.006014	0.001006	52-08	0.000171
1	402	0.003099	0.002891	123-48	0.002234
1	403	0.003617	0.002303	8-36	0.002208
1	404	0.002784	0.002019	15-43	0.001185
1	405	0.003064	0.001509	7-35	0.001185
1	406	0.002775	0.002020	14-25	0.001185
1	407	0.003092	0.001507	7-34	0.001185
1	408	0.002932	0.002488	32-22	0.001240
1	409	0.003270	0.001961	8-27	0.000932
1	410	0.002916	0.002540	33-11	0.001240
1	411	0.003312	0.001972	7-37	0.001240
2	3	0.004821	0.000839	167-53	0.000152
2	400	0.007112	0.002907	126-29	0.002706
2	401	0.008133	0.003441	147-57	0.002757
2	402	0.004727	0.002867	92-37	0.002233
2	403	0.006858	0.002733	122-24	0.002208

2	404	0.006509	0.001626	121-15	0.001185
2	405	0.006448	0.001856	123-31	0.001185
2	406	0.006538	0.001624	121-05	0.001185
2	407	0.006467	0.001854	123-48	0.001185
2	408	0.006607	0.001883	120-41	0.001240
2	409	0.006527	0.002210	123-43	0.000932
2	410	0.006708	0.001918	119-56	0.001240
2	411	0.006593	0.002139	124-29	0.001240
3	400	0.005194	0.003279	73-11	0.002705
3	401	0.004712	0.003600	119-48	0.002757
3	402	0.006011	0.002546	33-26	0.002234
3	403	0.005269	0.002593	71-23	0.002208
3	404	0.004861	0.001499	74-43	0.001186
3	405	0.004716	0.001945	71-28	0.001187
3	406	0.004893	0.001497	74-49	0.001187
3	407	0.004705	0.001945	71-56	0.001187
400	403	0.004250	0.000000	0-00	0.003490
404	405	0.001915	0.000721	45-54	0.001251
404	406	0.002842	0.000611	90-00	0.001261
404	407	0.001897	0.000742	134-50	0.001254
405	406	0.001897	0.000742	134-50	0.001256
405	407	0.002801	0.000611	0-46	0.001261
406	407	0.001915	0.000721	45-54	0.001251
408	409	0.002366	0.000732	45-30	0.000929
408	410	0.003500	0.000603	89-31	0.001305
408	411	0.002367	0.000727	133-32	0.001305
409	410	0.002367	0.000727	133-32	0.000929
409	411	0.003399	0.000603	179-29	0.000929
410	411	0.002366	0.000732	45-30	0.001305

Elapsed Time = 00:00:04

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01 00000000 Top of File  
01 00000006 Summary of Files Used and Option Settings  
02 00000009 Project Folder and Data Files  
02 00000015 Project Option Settings  
02 00000032 Instrument Standard Error Settings  
03 00000034 Project Default Instrument  
03 00000048 Project Library Instrument Sideshots  
03 00000063 Project Library Instrument Traverse  
01 00000078 Summary of Unadjusted Input Observations  
02 00000081 Entered Stations  
03 00000083 Partially Fixed Coordinates  
03 00000104 Free Coordinates  
02 00000112 Angle Observations  
02 00000190 Distance Observations  
02 00000284 Zenith Observations  
02 00000366 Azimuth/Bearing Observations  
01 00000371 Adjustment Statistical Summary  
01 00000395 Adjusted Coordinates  
01 00000415 Adjusted Observations and Residuals  
02 00000418 Adjusted Coordinate Observations  
02 00000430 Adjusted Angle Observations  
02 00000508 Adjusted Distance Observations  
02 00000602 Adjusted Zenith Observations  
02 00000684 Adjusted Azimuth/Bearing Observations  
01 00000689 Adjusted Bearings and Horizontal Distances  
01 00000742 Error Propagation  
02 00000745 Station Coordinate Standard Deviations  
02 00000764 Station Coordinate Error Ellipses  
02 00000785 Relative Error Ellipses  
01 00000836 End of File

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STARPLUS

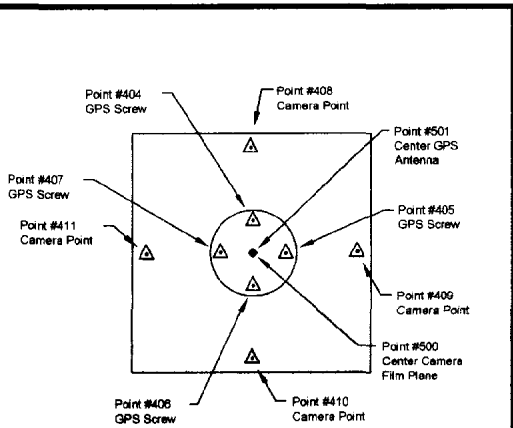
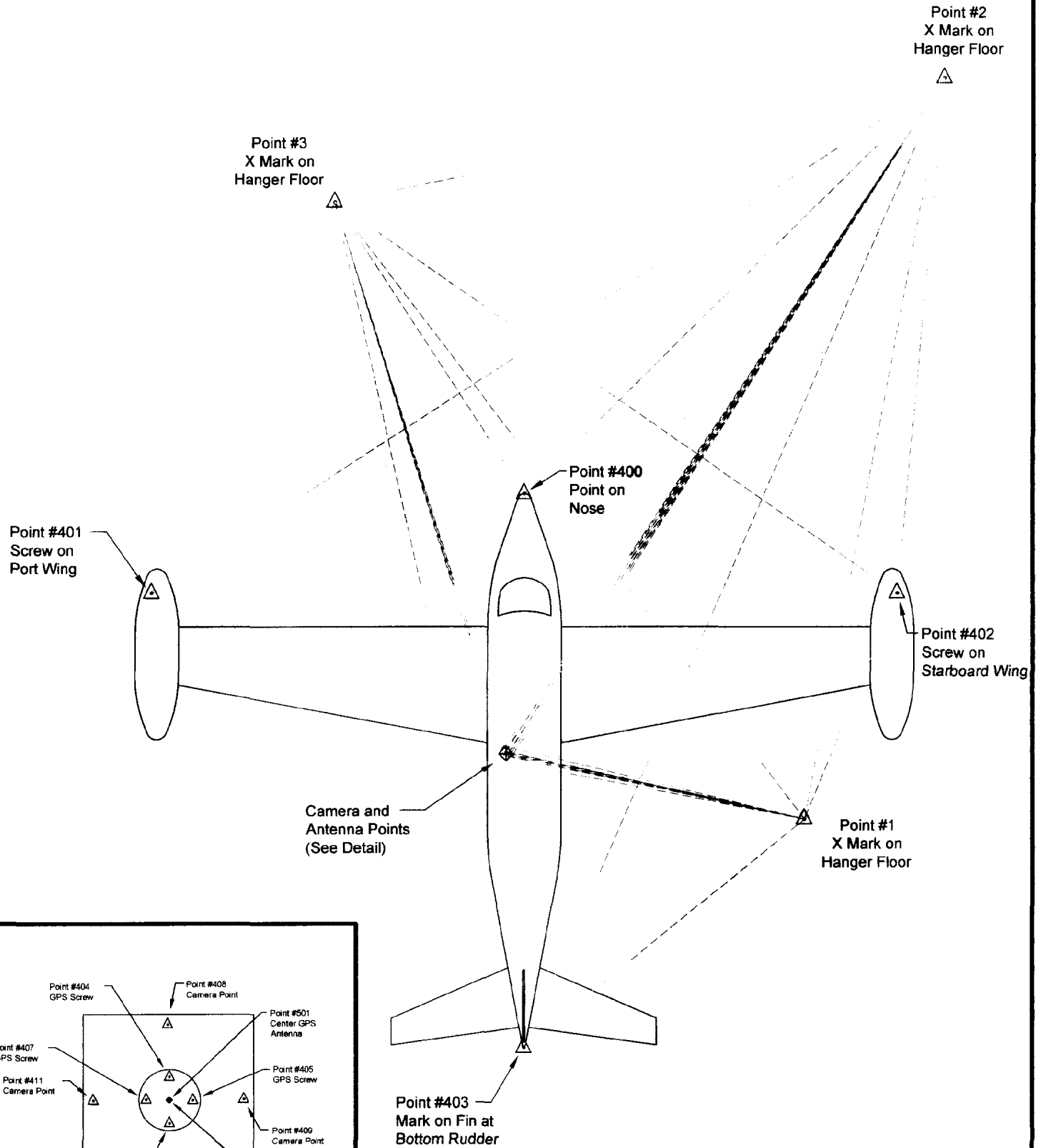
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**GEOD**

SURVEYING & AERIAL MAPPING  
Executive Office

18-24 Kanouse Road, Newfoundland, New Jersey 07435



Camera & Antenna Points

Aircraft No. N4189T

**Final Coordinates**  
**Project: 1608**  
**Client: Keystone Aerial Surveys**  
**Aircraft: N4189T**

**GEOD Corporation**  
**March 22, 2004**

Point	X Coordinate (Meters)	Y Coordinate (Meters)	Elevation (Meters)	Description
1	4.0847	3.3348	-1.5132	TR-XCT
2	6.1160	14.1542	-1.5313	TR-XCT
3	-2.7669	12.3456	-1.5447	TR-XCT
400	0.0000	8.0862	-0.2125	NOSE POINT
401	-5.4375	6.6333	0.2420	WING POINT
402	5.4321	6.6302	0.2301	WING POINT
403	0.0000	0.0000	0.5411	TAIL POINT
404	-0.2649	4.3236	0.8562	GPS SCREW
405	-0.2309	4.2892	0.8566	GPS SCREW
406	-0.2650	4.2555	0.8637	GPS SCREW
407	-0.2990	4.2899	0.8638	GPS SCREW
408	-0.2674	4.3994	0.0009	CAMERA POINT
409	-0.1565	4.2907	0.0000	CAMERA POINT
410	-0.2652	4.1797	0.0000	CAMERA POINT
411	-0.3762	4.2885	0.0005	CAMERA POINT
500	-0.2663	4.2896	0.0003	CENTER FILM PLANE
501	-0.2649	4.2896	0.8644	CENTER GPS ANT @ TOP DOME

**NOTES:**

The calculated centerline of the GPS antenna is 0.14 cm. starboard of the calculated centerline of the camera film plane.

There is not any forward\aft difference between the calculated centerline of the GPS antenna and the calculated centerline of the camera film plane.

The measured elevation of the centerline of the GPS antenna is 86.41 cm. higher than the calculated centerline of the camera film plane.