Orthorectification of Historic Imagery for the Nabesna Area of Wrangell- St. Elias Park and Preserve

Pacific Northwest CESU Task Agreement #J8W07080010

GeoSpatialServices

Saint Mary's University
OF MINNESOTA

Wrangell-St. Elias Orthorectification

Background:

The GIS Team of the National Park Service Alaska Regional Office is using remote sensing techniques to describe long term, landscape scale changes in its constituent parks. This remotely sensed imagery is also being used as a back drop for mapping projects that require reference imagery to provide context for other mapped features. One such project is the description of human impacts on park lands due to the use of Off-Highway Vehicles (OHV) for subsistence access in Wrangell Saint Elias National Park and Preserve (WRST).

The NPS Alaska Landcover Mapping Program has developed high-resolution IKONOS satellite orthoimage products for the Nabesna area within WRST. These products provide an up to date (2004 acquisition) base cartographic reference for the park and, more importantly, provide a digital terrain data that can be used for the orthorectification of historic aerial photography that has been flown over the coverage area of the IKONOS digital elevation model (DEM).

In WRST, there is an historical record of vegetation, landform, snow and ice and other surficial conditions that exist as point in time snapshots in the form of hardcopy aerial photographs. With advances in image scanning capabilities, georeferencing and orthorectification techniques, it is now possible to have these historic images converted to digital form. Once converted, these images can be compared and contrasted with current imagery in order to derive assessments of human impacts that affect landscapes across project study areas.

For this particular project, the NPS GIS Team worked cooperatively with Saint Mary's University of Minnesota (SMUMN) to complete orthorectification of hardcopy Alaska High Altitude (AHAP) aerial photographs from the early 1980's. The various photo years and emulsions are included in Table 1.

Table 1: Alaska High Altitude Aerial Photography (AHAP) used in orthorectification

Year	Emulsion	Scale	# of Photos	Scan Resolution
Aug. 05, 1980	CIR	1:60K	9	1800 dpi
Aug. 24, 1981	CIR	1:65K	39	1800 dpi
July 27, 1982	CIR	1:65K	3	1200 dpi

Orthorectified IKONOS satellite imagery and an associated digital elevation model were used as the input data for the georeference and orthorectification process.

Mapping Product Overview

The Regional Office GIS Team provided SMUMN with scanned versions of the hardcopy photos as well as base imagery and elevation data in order to complete orthorectification. In return, SMUMN provided the NPS with fully orthorectified aerial imagery in georeferenced digital format; complete with metadata.

The NPS has previously collaborated with SMUMN to develop a method for digital data conversion and orthorectification of aerial photography. The method makes use of a Digital Elevation Model (DEM), camera calibration reports, and control points taken from existing orthoimagery. SMUMN has produced images that were corrected using this approach, and they have shown a horizontal error of approximately ±20-30m when compared to the control orthoimagery, thus meeting the National Map Accuracy Standard (NMAS) of 1:63,360 (±32m). Registration of the WRST photo series (1980-1982) to IKONOS imagery as part of this Task Agreement required additional control due to the mountainous terrain. NPS worked cooperatively with SMUMN to identify and resolve problems associated with processing over the course of the project.

Study Area and Mapping Program:

Wrangell- St. Elias National Park and Preserve has been called the "mountain kingdom of North America". Eight of the United States 16 tallest mountains can be found here including Mount St. Elias, the second highest mountain in the United States behind Mount McKinley. The Park is a vast area of land covering more than 13 million acres; six times larger than Yellowstone. The Park spans three different climatic zones. It contains a wide variety of flora and wildlife. Due to the vast expanse of the Park, it contains the most diverse groups of plant life in the Alaska Park system. Wildlife ranges from Dall sheep, grizzly bears and bison to shrews and bats.

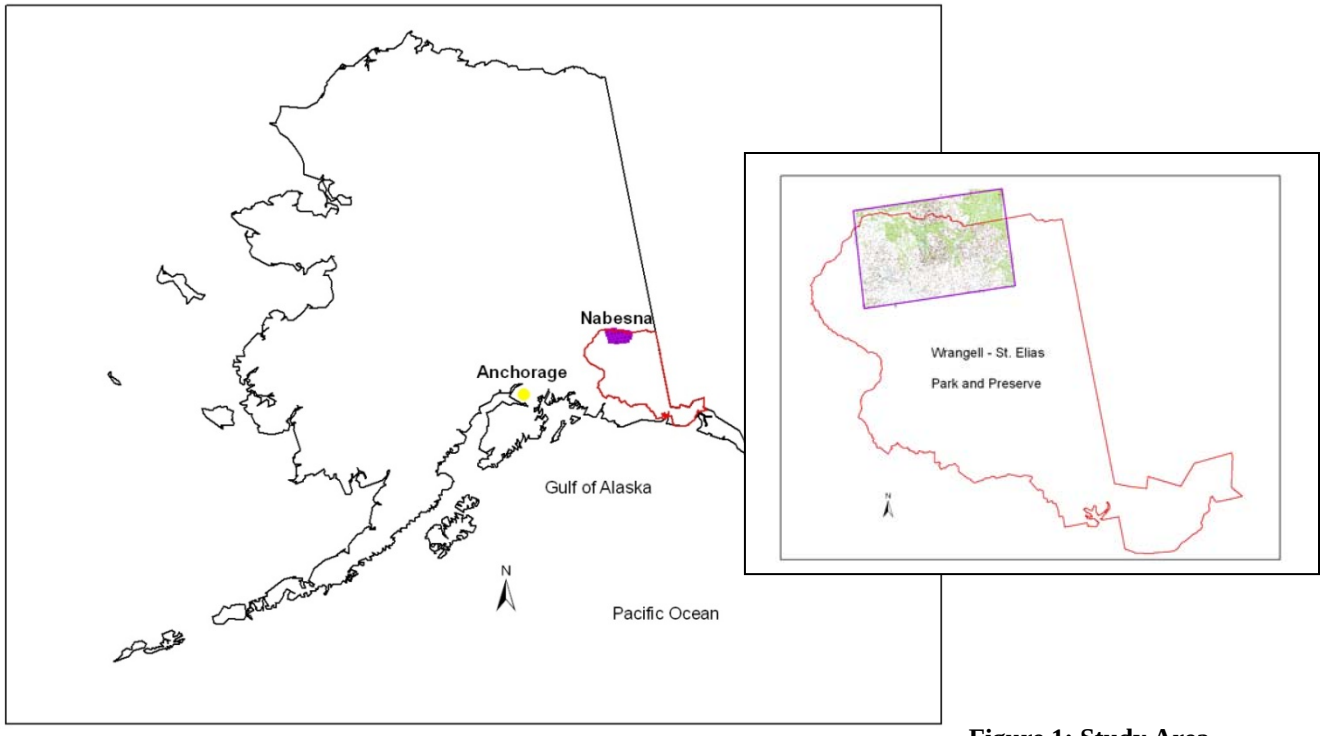


Figure 1: Study Area

Historical aerial photography provides an image record of conditions in the park throughout time. These photos provide a valuable source of vegetation and landform condition information that can be assessed against current imagery in order to examine processes that are impacting the landscape. There are a variety of ways in which these historic aerial images might be used once they are in digital, georeferenced form. These include:

1. Local and regional vegetation gain/loss studies;
2. Glacial advance and retreat;
3. Ice condition assessment;
4. Assessment of land use impacts;
5. Identification of landform change processes; and,
6. Climate change studies.

Digital Georeferencing and Orthorectification:

Conversion consisted of the orthorectification of scanned hard copy AHAP aerial photos from 1980, 1981 and 1982. Where available, IKONOS imagery was used for the selection of ground control points (minimum 5 per photo) and IKONOS DEM was used for orthorectification.

Best results came from the use of IKONOS base imagery and IKONOS DEM. However, because the IKONOS base imagery and DEM was subset to the park boundary and some of the AHAP photos for the project extended beyond this boundary, other forms of DEM and base layer imagery were required for orthorectification. In consultations between NPS and SMUMN, it was determined that the USGS 1:63,360 digital raster graphics (DRG) would be used for georeferencing these areas and the Alaska 60 meter resolution National Elevation Dataset (NED) would be used for orthorectification.

Aerial Photo and Camera Specifications

The 1980 camera type was a Zeiss RMK A 30/23 equipped with a Zeiss Topar A lens (calibrated focal length of 305.279 mm). The 1981 and 1982 camera type was a Wild Heerbrugg RC10 equipped with a Wild Aviotar II lens (calibrated focal length of 304.960 mm). The products from the cameras were color infra-red aerial photographs for the Park.

Camera calibration reports were an important aid in achieving accuracy of the orthorectified imagery. Reports created by the United States Geological Survey (USGS) contained correction information that was used in the orthorectification software to better remove camera distortion problems. Camera reports contained distortion correction information such as focal length, principal point of symmetry, and X/Y coordinates for the fiducial marks.

Photo Scanning

Scanning of the 1980's AHAP photos was completed by the United States Geological Service (USGS). All scanned images were provided to SMUMN by NPS in TIFF format and at various levels of resolution. Data was provided on DVD's which were produced by USGS EROS Data Center. Some photos were scanned at 1200 dpi (21 microns) and others at 1800 dpi (14 microns). The notable distinction between the 1200 and 1800 dpi scans was the file size.

Table 2: Specifications for the scanned photography provided by NPS

Scan resolution:	14 or 21 microns (1200 or 1800 dpi)
Pixel Depth:	8 bit
File Format:	TIFF
Bands:	Multi-band (red-green-blue), where applicable

Georeferencing and Orthorectification:

Georeferencing or photogrammetric control is the process by which known ground control points are used to provide geographic reference to a scanned aerial image and/or graphic. Orthorectification is the process by which a digital elevation model and a camera calibration report are used to correct image displacement caused by terrain variation and camera lens aberrations. Georeferencing of AHAP photos in this project included picking photo-identifiable points (e.g. rock outcrops, roads or trails, islands etc.) on the scanned AHAP photos and the corresponding visible, identifiable feature on the IKONOS orthophoto in order to adjust the photos to the IKONOS reference image. The software package used for georeferencing and orthorectification on the Nabesna project was OrthoMapper rev. 4.75 from Image Processing Software Inc.

The aerial photography for Nabesna was georeferenced using two different data sources. For much of the park area (approximately 80%), NPS provided IKONOS imagery which was used for the selection of high quality control points (Figure 2). For areas of the park where this imagery was not available, ground control points were selected from 1:63,360 scale DRG's.

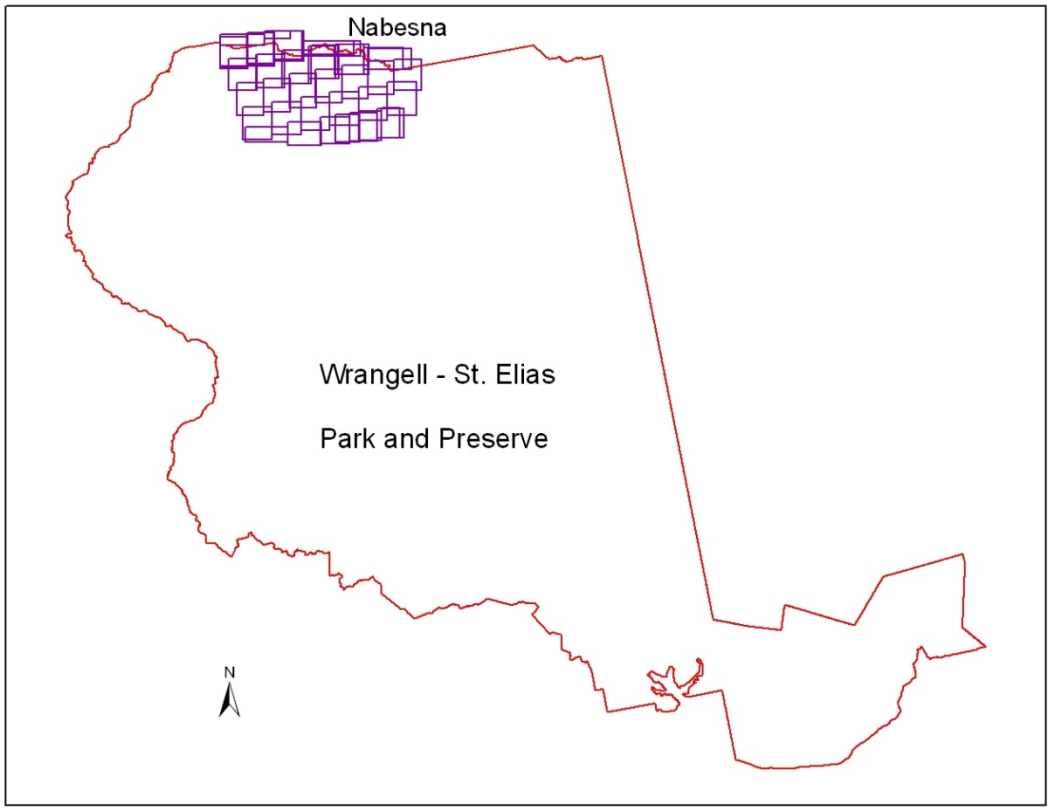
A minimum of 5 georeference control points were required for every photo, however, in most cases between 15 and 20 points were used in order to improve the accuracy of the referencing process (see Appendix 2). Issues with finding a number of quality control points were encountered in icefields, areas dominated by mountains, and water. For every photo, a text file was generated in order to document the approximate error of the georeferencing process. Typical Root Mean Square (RMS) error for areas georeferenced to the IKONOS imagery was between 6 and 12 meters (Appendix 2). Areas that were georeferenced using the USGS DRG's in conjunction with IKONOS typically had RMS errors of between 15 and 20 Appendix 2). Note that the RMS errors reported during the georeferencing process represent the errors recorded by the processing software. These errors do not correlate to on-the-ground accuracy, but are typical errors associated with: selecting un-changed ground control points; camera calibration errors; and software.

All aerial photographs were georeferenced to Alaska Albers Projection:

```
PROJCS["Alaska_Albers_Equal_Area_Conic",
GEOGCS["GCS_North_American_1983",
DATUM["D_North_American_1983",
SPHEROID["GRS_1980",6378137,298.257222101]],
PRIMEM["Greenwich",0],
```

```
UNIT["Degree",0.0174532925199432955]],
PROJECTION["Albers"],
PARAMETER["False_Easting",0],
PARAMETER["False_Northing",0],
PARAMETER["Central_Meridian",-154],
PARAMETER["Standard_Parallel_1",55],
PARAMETER["Standard_Parallel_2",65],
PARAMETER["Latitude_Of_Origin",50],
UNIT["Meter",1]]
```

Figure 2: NPS Supplied IKONOS Imagery Coverage for Nabesna



Orthorectification of the scanned products for Nabesna was completed using two different Digital Elevation Models. For areas where there was IKONOS imagery provided by NPS, there was also an IKONOS DEM (Figure 3) that was built for the orthorectification of the IKONOS imagery referenced above. The IKONOS DEM was limited on its coverage of the Nabesna project area. To resolve missing DEM coverage issues, SMUMN used a NED DEM and merged it with the IKONOS DEM. Processing of the DEM's in their native GRID format was needed to merge the IKONOS DEM to the NED and eliminate problems in the overlap regions. All GRID calculations were conducted using ESRI's ArcGIS 9.2 with the Spatial Analyst extension. These DEM files were converted to TIFF format and then converted to a .dem format for use in the orthorectification software. Shuttle Radar Topography Mission (SRTM) DEM data from NASA would have provided a more accurate alternative DEM, however, this data was not available for the Nabesna area of WRST.

The purpose of extending the DEM coverage using the NED elevation model was to accommodate the orthorectification of photos that were required as part of the project but extended beyond the IKONOS DEM boundary. When orthorectifying a photo that goes beyond the edge of the DEM, OrthoMapper simply clips the photo at the DEM edge. Obviously, this was not suitable for a photo mosaicing project where complete photo coverage is essential. As a result, even though the incorporation of NED DEM and DRG processing lowered the overall accuracy of the orthorectification process, errors were still within the tolerance (National Map Accuracy Standard for 1:63,360 mapping) established for the project.

Figure 3: AHAP Photo Centers Overlaid on Available IKONOS Image Footprints

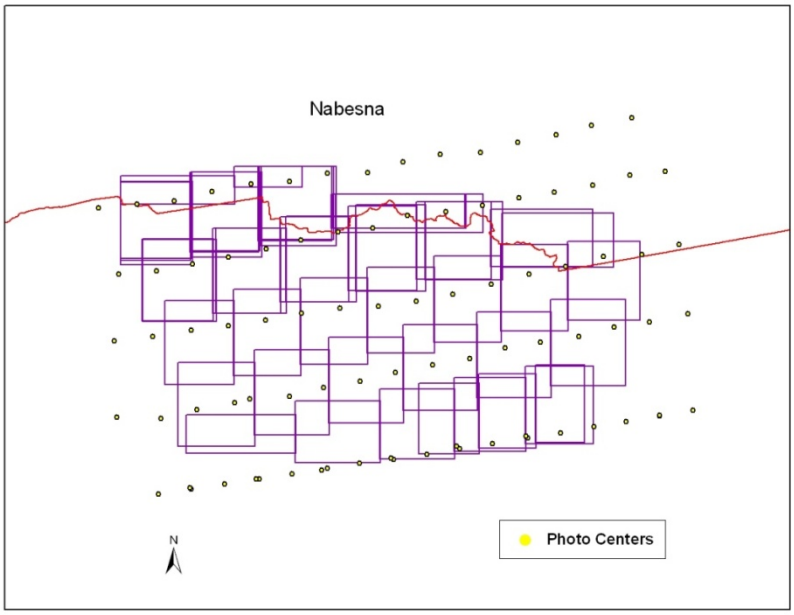


Figure 4: Coverage of NPS Supplied IKONOS DEM and IKONOS Image Footprints

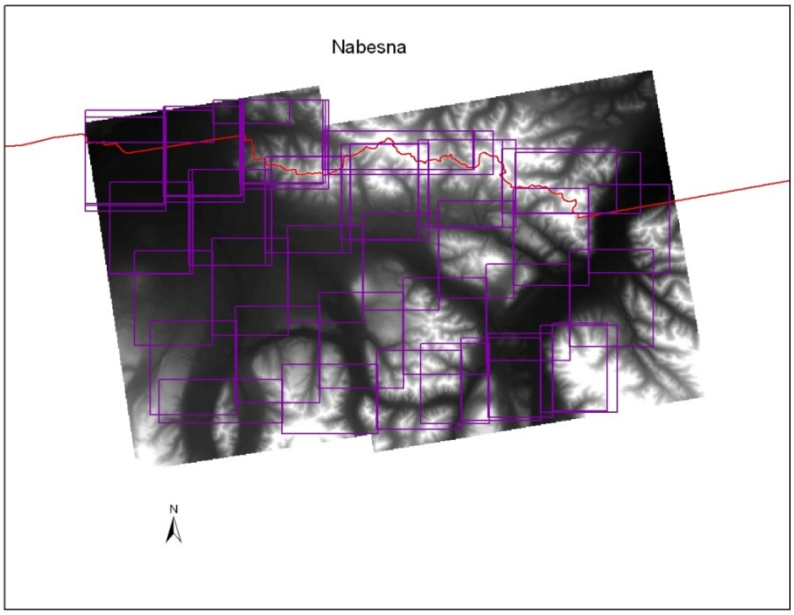


Figure 5: Sample AHAP Photo – Frame # 4271

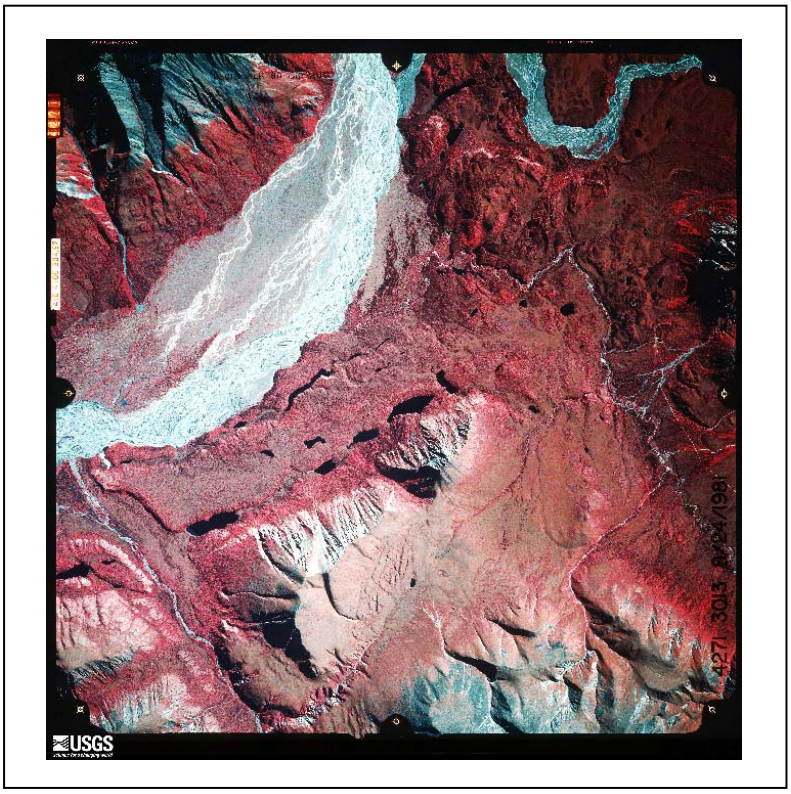


Figure 6: Sample AHAP Photo – Frame # 4128

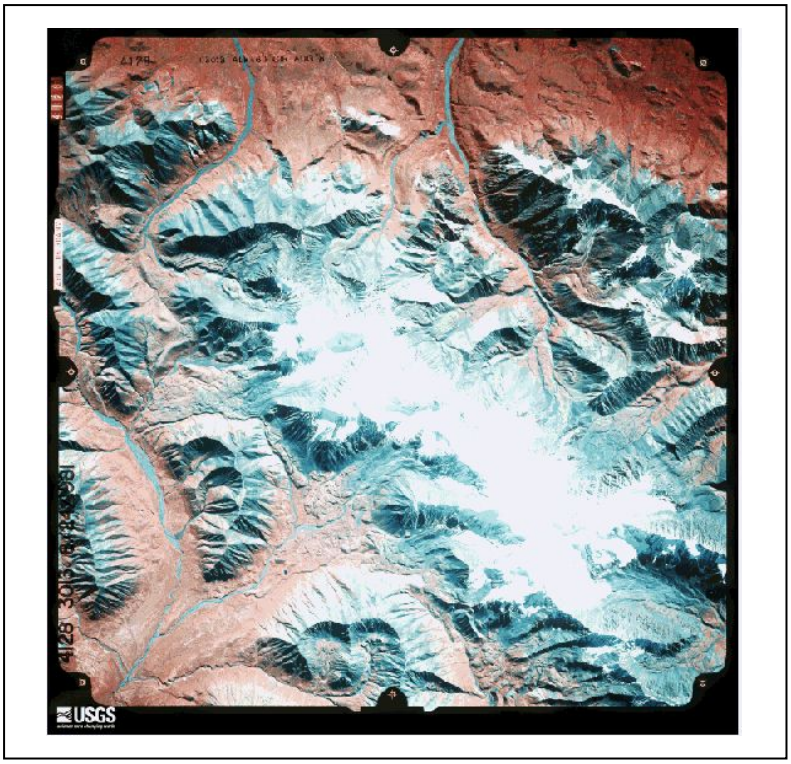


Figure 7: Individual Orthorectified Image – Frame # 4271

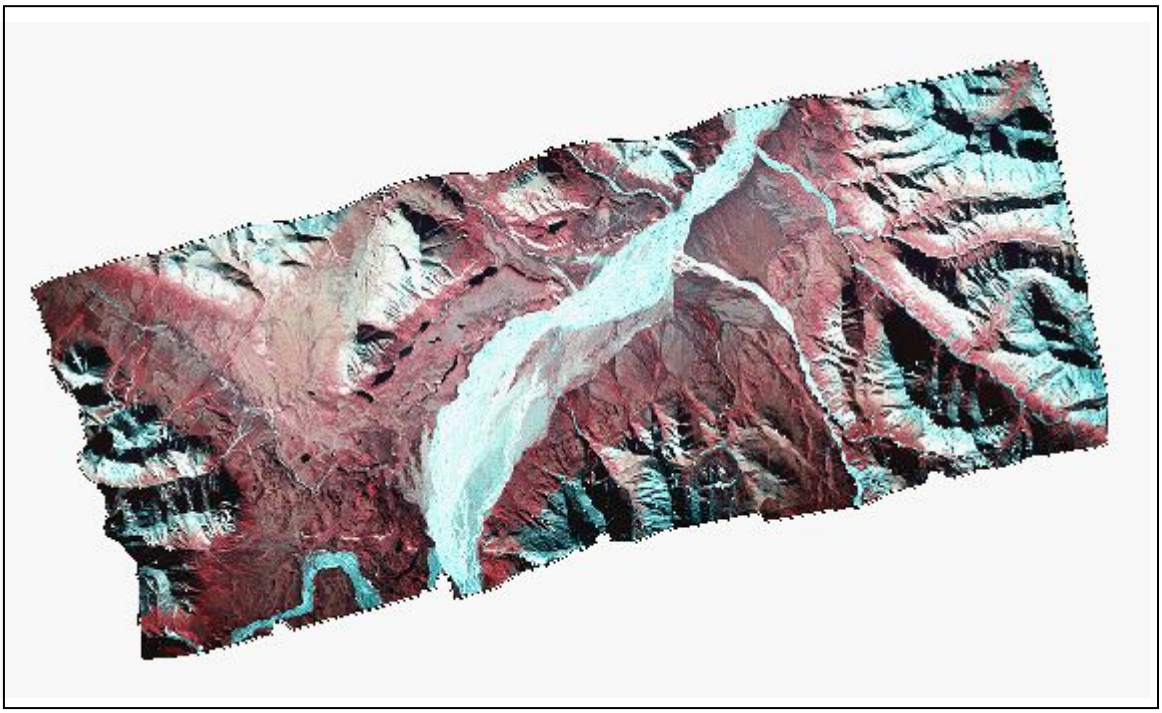
Quality Control:

Quality control of the final product was managed in several different ways. During the orthorectification phase, the amount of error associated with the selection of individual georeferencing control points was monitored and points that had too much error were eliminated from the final rectification. The use of the merged DEM and DRG's was limited to only those photos that extended beyond the boundaries of the IKONOS DEM and imagery. An average of 14 control points were chosen per photo in order to ensure that spatial correlation was the best possible. The minimum number of control points used for an individual photo was 6 and the maximum was 24 (Appendix 2). Final georeferencing and orthorectification had an average RMS error of 9.66 meters with a minimum of 6.59 meters and a maximum of 19.80 meters for 51 photos (Appendix 2).

Preparation of the Photo Mosaic:

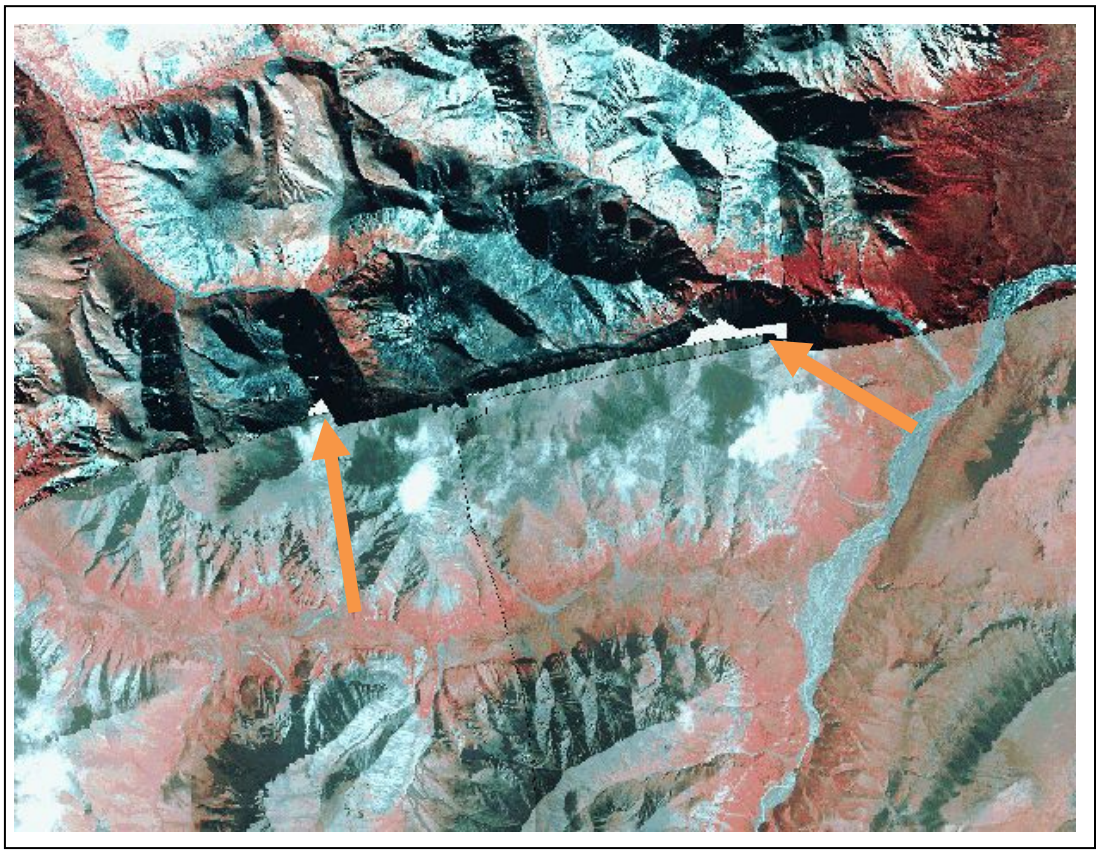
The primary product of this orthorectification project was the preparation of a mosaic of the orthorectified images that covered the Nabesna area of Wrangell-St. Elias National Park. Initially, the intention was to create a single mosaic of up to 60 input aerial photos covering the Nabesna area. This quickly became infeasible due to the size of the individual orthorectified images that would be mosaiced together. Unfortunately, the TIFF file format, which was specified as the delivery format required b the Park Service, had a maximum size limitation of 4 Gigabytes (Gb). In the case of this project, each of the individual orthorectified photos was up to 600 Mb; in size meaning that a maximum of 5 photos could be moasiced together without exceeding the TIFF file size limitation. The alternative approach was to mosaic as many ortho images together as possible without exceeding the maximum size of the output file. In most cases, for this project, this was 4 or 5 images. As a result, the final product for this project ended up being a series of 12 mosaics that covered the project area.

Figure 8: Example of Orthorectified Mosaic of 4 AHAP Photos – Mosaic # 3



Sub-setting of each image was done to remove the "no data" border around each image. Time was taken to clip around high elevation features and not to go through open water features where ever possible. This made for a cleaner mosaic in the end. Distortion of ortho images due to the elevation made for areas with small "holes" (Figure 9) where there was not sufficient photo overlap to fill the gaps between photos.

Figure 9: Example of Image Holes in Orthophoto Mosaic from Insufficient Photo Overlap



Final Products:

Final products for the Nabesna orthorectification project included the following:

1. 51 individually georeferenced and orthorectified AHAP aerial photos.
2. Orthorectified aerial photos delivered as 8 bit pixel depth, 1 meter pixel resolution, TIFF format files. These files all included OGC compliant metadata created with the ESRI ArcGIS 9.2 metadata editor following the FGDC-STD-001-1998 format. This metadata indicated which base data set and DEM were used to orthorectify each photo.
3. FGDC compliant metadata for orthorectified products. Metadata created with the ESRI ArcCatalog 9.2 metadata editor following the FGDC-STD-001-1998 format.
4. Mosaiced TIFF's (12 in total) in largest tiles permitted by processing software.
5. Text reports for each photo orthorectification summarizing the average horizontal Root Mean Square inherent in the rectification process.

Results and Discussion:

The objectives of this project were successfully met. The primary goal was to produce co-referenced georeferenced and orthorectified AHAP photo products for the Nabesna area meeting approximate 1:63,360 National Mapping Accuracy Specifications. The use of the IKONOS DEM and its relatively higher quality accuracy, as opposed to the statewide 90 meter DEM outside the project area, led to relatively low RMS errors during the orthorectification process. As reported by the software, RMS errors ranged from a minimum of 6.59 meters to a maximum of 19.8 meters with an average of 9.66 meters. The availability of camera calibration reports and high numbers of photo-identifiable ground control points (an average of 14 per photo) produced these acceptable RMS errors.

NPS personnel conducted an independent ground control check on visible identifiable features between 2-5 on-ground GPS points and the final product and found an estimated +/- 9 to +/- 16 meter on-ground error for this product. For areas where the IKONOS DEM and IKONOS imagery were available, the digital product was well within the specifications for the 1:63,360 National Mapping Accuracy Standard of +/- 38 meters (horizontal at 90% CI). For areas where a composite of IKONOS and NED DEM were used, the on-ground errors were higher, however still acceptable to the NPS in the final review of the product (See Appendix 1).

As with any process that is based on sampling and averaging, there is a certain amount of shifting that occurs in the final product as a result of the orthorectification methodology. The amount of this shift is a function of many different elements including:

1. The number of control points used
2. The displacement of the control points over the surface of the image
3. The editor's ability to match control points between AHAP photos and the IKONOS image
4. The resolution of the DEM
5. The extent of the DEM
6. The merging of different DEM formats and associated DEM quality issues
7. The accuracy and quality of the base layer imagery
8. The use of different types of imagery for GCP selection on one photo (IKONOS, DOQQ, DRG)
9. The quality of the aerial photo (e.g. orientation, cloud cover, sun angle, clarity, season)
10. Topographic changes. A photo may have mountain on one half and ocean on the other
11. The ability of the software to perform high end transformations
12. The accuracy and availability of camera calibration reports
13. Anomalies with the photos, such as no fiducials

In areas of the Park where the USGS DRG's were used for georeferencing and anywhere the merged DEM was used for orthorectification, there was horizontal error in the final data. The careful selection of ground control points for georeferencing allowed for a good product, however, horizontal accuracy in many of these areas still ranged between 15 and 30 meters. Unfortunately, it was not possible to achieve better results in areas where the IKONOS DEM was unavailable.

The photos were scanned at various resolutions. They ranged from 1200 dpi to 1800 dpi. An 1800 dpi scanned photo creates an image with a large file size. The larger the file size the more difficult it is for the software to display the data and processing times increase exponentially. A visual comparison of the scans and finished orthorectified photo showed there was no significant visual difference in image quality between 1200 and 1800 dpi products.

The mountainous terrain also induced some shifting in the final ortho product. Even with the highest resolution DEM it becomes difficult to create an accurate, consistent image surface around high peaks with abrupt changes in elevation The flatter valley areas, around and between the mountains, lined up better than the peaks and ridgelines of the mountains.

Appendix 1
Summary E-mail – NPS Product Review and Acceptance

-----Original Message-----
From: Joel_Cusick@nps.gov [mailto:Joel_Cusick@nps.gov]
Sent: Thursday, October 30, 2008 7:09 PM
To: Andy Robertson
Cc: Joni_Piercy@nps.gov
Subject: WRST AHAP Nabesna Area Mosaics review complete

Hi Andy,
Sorry I'm going to miss you while your here. I'll be sure to stay warm in Fairbanks.

To Andy Robertson, SMUMN Project Manager GeoSpatial Services

From: Joel Cusick, Agreement Technical Representative

Re: Project Review Complete and Data Delivery Accepted

PROJECT TITLE: Orthorectification of historic imagery for Nabesna Area, Wrangell-St. Elias National Park and Preserve

COOPERATOR: St. Mary's University of Minnesota TASK AGREEMENT NO. J8W07080010 :

COOPERATIVE AGREEMENT NO.: H8W07060001 EFFECTIVE DATES:06/15/08 – 04/15/09

PROJECT ABSTRACT: This project includes orthorectification and mosaicing of mid-1980's Aerial High Altitude Program Color Infrared photos in the Nabesna, Alaska drainage area that is covered by existing IKONOS 2004 ortho and DEM products.

Andy,

Q. Before you get started, do you want us to mail the Harddive or you pick up next week?

As discussed, I'm slipping in under the deadline for our review of the WRST AHAP Nabesna Area Mosaics. As the NPS Point of contact for this project I am pleased to announce the data meets our needs and we accept the project deliverables as sent on an external hard drive (via Fedex, shipping date 10-16-08) and the earlier data delivery containing DVD's and NPS hard drive containing individually georef/rectified AHAPS. The acceptance of this project will provide regional and park -based managers an easy to use image map product base that utilizes the historic strengths of the AHAP early 1980's time series and color infrared raster-based imagery. The co-referencing to the best available IKONOS DEM and Orthos in area will only enhance its usefulness in GIS.

Data Delivery Summary: All mosaics provided on SMUMN hard drive were valid and meet an estimated horizontal accuracy. Metadata associated with all mosaics meet our requirements.

Horizontal Error summary: Using best available GPS data from 2006 and testing against visible identifiable features (VIF), I ran a test across mosaics that contained GPS data within their borders. 65 test points averaged n error of 12 meters, STD 15meters. Two test points outside the DEM area averaged 20 meters. Given Joel's estimated testing error sources (see below), these test results fall within errors for this product. We look forward to other tests using this dataset.(See attached file:TestofHorzErrors.xls)

Testing background: In order to run an independent horizontal accuracy test (hey, I'm a GPS guy, whaddya know), I used our best available OHV trail centerline GPS data collected from 2006 by experienced GPS mappers (Kevin Meyer and Blain Anderson). I created a line feature (projection in Alaska Albers 83) snapping to closes available line vertex or point and the associated VIF. Summaries were generated in ArcGIS against which mosaic the dataset fell in (in cases of multiple mosaic overlap, mosaic with data closest to center chosen), and the Shape_length attribute. Summaries are compiled in this Excel datasheet.

There are errors in Joel's testing method. Most notably (in order of highest error):

1) Picking a feature that did not move in 20+ years and was occupied by mappers. I kept to tree lined areas, looking for general trail trends, and used 50% of the time stream crossing point features that looked as stable and erosional proof. This is the most difficult error to assess, but from years of personal testing experience, lets say Est. Error +/- 5 meters.

2) GPS Errors: On-ground data collected using Geo3 handhelds and post processed to best available CORS station and exported in NAD83 (CORS96; Epoch 2003) shapefile format. Wrapping all these up with a conservative 95% confidence is fairly straightforward given the quality of gear and mappers. Estimated horizontal error +/- 3 meters in open and +/- 10m (under canopy).

3) Other process errors. We assume the GPS data was not disturbed when placed in our archival dataset (pretty confident). I was constrained to areas of mosaics that had GPS data. I varied monitor viewing scale to
select the feature. Estimate another 1meter for comfort.

Joel’s additive errors in estimating "VIF against Orthos" SUM = +/- 9meters on the low end to +/- 16 meters on the high end. We’re talking a testing routine commensurate with the errors of the product. This data meets the stated specs.

Again, a great product and we hope to use this in mapping efforts around the Nabesna area.

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+61 13' 01.28", -149 53' 10.58"; (NAD83 CORS96)

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Appendix 2
Individual Photo RMS Error Reports

Single Space Resection for F:\NPS_WRST\4077\AB581003013ROLL_4077_A.LAN

Number of points processed: 13

Ground Control Coordinates

Point Name	X	Y	Z
VC1	513253.83	1448042.00	697.00
VC2	513648.50	1454746.00	657.00
VC3	505606.70	1452997.70	707.14
VC4	506360.50	1447067.50	670.86
VC5	511451.00	1446776.00	682.00
VC6	505008.02	1456918.08	774.19
VC7	513163.86	1457217.28	743.62
VC10	509913.32	1453525.57	654.59
VC11	508825.40	1449077.33	668.56
VC12	512950.50	1452522.00	660.92
VC13	515361.83	1450733.00	677.00
VC14	510235.19	1446637.55	681.06
VC15	516479.50	1448166.00	689.00

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	7053.0	8828.5	30.873	-68.829	0.0000	-0.0005	0.0010
VC2	8188.0	3979.0	54.688	33.006	0.0000	-0.0010	-0.0006
VC3	2007.0	4244.0	-75.165	27.405	0.0000	0.0010	-0.0004
VC4	1843.3	8701.7	-78.577	-66.198	0.0000	0.0003	0.0002
VC5	5562.0	9532.0	-0.447	-83.610	0.0000	0.0000	0.0010
VC6	2044.0	1241.0	-74.407	90.463	-0.0000	-0.0003	0.0003
VC7	8115.5	2084.5	53.154	72.786	0.0000	-0.0005	-0.0006
VC10	5276.0	4394.0	-6.486	24.274	0.0000	0.0002	-0.0007
VC11	3909.0	7525.0	-35.186	-41.477	0.0000	0.0008	0.0009
VC12	7393.0	5518.0	37.995	0.686	0.0000	-0.0010	-0.0000
VC13	8935.3	7123.3	70.408	-33.013	0.0000	-0.0010	0.0005
VC14	4625.0	9490.0	-20.132	-82.734	0.0000	0.0002	0.0009
VC15	9428.0	9132.0	80.771	-75.189	-0.0000	0.0000	-0.0000

Mean Differenence in dX and dY: -0.0001 0.0002

Standard Deviation in dX and dY: 0.0006 0.0006

Initial Approximations:
Omega = 0.000
Phi   = 0.000
Kappa = 9.528
XL   = 510942.9
YL   = 1451109.7
ZL   = 20075.4

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2791731

Omega = -0.34 (Degrees)
Phi   = -0.80 (Degrees)
Kappa = 9.61 (Degrees)
XL   = 510313.9
YL   = 1452181.6
ZL   = 20125.3

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  36.85111
  -9.11644  34.02187
   0.54126  -0.64063   0.95632
  -180.13358  683.69188  -13.72455  13765.050
  -741.28785  180.03163  -11.14956  3555.788  14937.429
  26.48832  -1.73555   0.29608  -43.020  -514.413  373.979
```

Standard Deviation for Omega: 1252.13 (Seconds)
Standard Deviation for Phi: 1203.11 (Seconds)
Standard Deviation for Kappa: 201.71 (Seconds)
Standard Deviation for XL: 117.32 (Meters)
Standard Deviation for YL: 122.22 (Meters)
Standard Deviation for ZL: 19.34 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	10.03	-10.75
VC2	21.15	15.12
VC3	-12.52	7.75
VC4	-4.84	-4.82
VC5	0.50	-13.08
VC6	-7.50	3.05
VC7	-18.38	14.57
VC10	3.31	1.63
VC11	-8.09	-5.81
VC12	15.36	7.77

```
VC13  15.38   1.09
VC14  -25.79  -8.37
VC15  11.80  -8.31

Col RMS =  13.80
Row RMS =   9.02
```

Single Space Resection for F:\NPS_WRST\131\AB642700260ROLL_131_A.LAN

Number of points processed: 6

Ground Control Coordinates

Point Name	X	Y	Z
VC1	537825.33	1406965.33	1509.37
VC2	538204.00	1412627.00	2355.40
VC3	533506.24	1407005.40	1155.58
VC4	536095.00	1414399.50	1364.25
VC5	536850.33	1410169.00	1736.09
VC6	530345.49	1413153.10	1004.78

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	7363.5	8675.5	36.210	-59.249	0.0000	-0.0000	0.0000
VC2	8629.0	3886.3	62.959	41.301	0.0000	-0.0000	-0.0000
VC3	3712.0	7933.0	-40.484	-43.540	0.0000	0.0001	0.0001
VC4	6964.8	2241.3	28.048	75.905	-0.0000	0.0000	0.0000
VC5	7024.0	5836.7	29.172	0.387	0.0000	-0.0001	-0.0000
VC6	2056.0	2517.0	-75.096	70.267	-0.0000	-0.0002	0.0002

Mean Differenence in dX and dY: -0.0001 0.0001
Standard Deviation in dX and dY: 0.0001 0.0001

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 9.725
XL = 535471.1
YL = 1410719.9
ZL = 18874.5

A solution has been found after 4 iterations
Standard Deviation of unit weight = 0.5902581

Omega = 1.73 (Degrees)
Phi = -0.96 (Degrees)
Kappa = 10.07 (Degrees)
XL = 535001.7
YL = 1409355.4
ZL = 18562.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  506.76427
  -228.69869  454.37253
  37.41172  -8.99431  14.37261
  -3947.27244  7955.51511  -143.01104  139493.932
  -8883.59153  4038.13369  -658.41599  69713.399  155935.688
  -623.50221  -219.46833  -57.75812  -4070.307  10625.603  4844.125

Standard Deviation for Omega: 4643.31  (Seconds)
Standard Deviation for   Phi: 4396.74  (Seconds)
Standard Deviation for Kappa: 781.98  (Seconds)
Standard Deviation for    XL: 373.49  (Meters)
Standard Deviation for    YL: 394.89  (Meters)
Standard Deviation for    ZL:  69.60  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  21.62  -0.07
     VC2   0.90  12.43
     VC3  -29.35  -42.42
     VC4  10.72  -2.94
     VC5  13.54   4.57
     VC6  -18.44  28.04

    Col RMS =  18.11
    Row RMS =  21.49
```

Single Space Resection for F:\NPS_WRST\4078\AB581003013ROLL_4078_A.LAN

Number of points processed: 15

Ground Control Coordinates

Point Name	X	Y	Z
VC1	513660.50	1448667.00	682.00
VC2	516051.50	1455359.00	656.00
VC3	511575.50	1454932.50	724.67
VC4	522146.50	1449150.50	731.00
VC5	514852.00	1447027.00	701.00
VC6	521347.50	1455616.00	704.00
VC7	522156.50	1451649.50	723.23
VC8	518821.75	1448443.25	701.94
VC9	519047.62	1459824.42	658.06
VC10	513340.50	1452084.00	664.19
VC11	518538.50	1453137.00	701.00
VC12	517503.50	1450363.00	686.01
VC13	513157.42	1457217.28	743.62
VC14	521354.00	1447638.00	728.00
VC15	512004.00	1447155.33	684.81

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	2895.0	8328.0	-57.860	-58.316	0.0000	0.0007	0.0007
VC2	5547.0	3759.0	-2.135	37.620	0.0000	0.0001	-0.0010
VC3	2177.0	3456.0	-72.934	43.990	0.0000	0.0008	-0.0005
VC4	9176.3	9108.5	74.102	-74.719	0.0000	-0.0002	0.0002
VC5	3545.6	9678.4	-44.195	-86.674	0.0000	0.0003	0.0005
VC6	9481.0	4280.0	80.514	26.672	0.0000	-0.0009	-0.0003
VC7	9531.7	7288.7	81.572	-36.506	0.0000	-0.0007	0.0003
VC8	6644.3	9176.3	20.908	-76.137	0.0000	-0.0003	0.0010
VC9	8326.0	893.0	56.256	97.797	-0.0000	0.0001	0.0001
VC10	3117.0	5795.0	-53.190	-5.128	0.0000	0.0012	0.0001
VC11	7080.0	5714.0	30.068	-3.435	0.0000	-0.0008	0.0001
VC12	5942.0	7602.7	6.156	-43.091	0.0000	-0.0001	0.0010
VC13	3621.0	1982.5	-42.594	74.928	0.0000	0.0004	-0.0008
VC14	8390.0	10101.0	57.581	-95.559	-0.0000	0.0000	-0.0001

```
    VC15        1474.7   9209.0   -87.703   -76.814  -0.0000  -0.0003  -
0.0002

Mean Differenence in dX and dY:  0.0000   0.0001
Standard Deviation in dX and dY:   0.0006   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  10.431
XL      =  517037.2
YL      =  1451884.3
ZL      =  20233.0


A solution has been found after 4 iterations
Standard Deviation of unit weight = 0.2618717

Omega   =    -0.65  (Degrees)
Phi     =    -0.38  (Degrees)
Kappa   =    10.33  (Degrees)
XL      =  516498.8
YL      =  1453232.5
ZL      =  20169.2

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  19.39334
   2.47099  24.30709
   0.22847  -0.48121   0.67219
  49.81493  490.79551  -10.44883  9929.539
  -392.59846  -49.71749  -4.89583  -1002.455  7967.686
  26.70881  19.34850  -0.02680  383.937  -523.728  296.948

Standard Deviation for Omega: 908.35  (Seconds)
Standard Deviation for   Phi: 1016.93  (Seconds)
Standard Deviation for Kappa: 169.11  (Seconds)
Standard Deviation for    XL:  99.65  (Meters)
Standard Deviation for    YL:  89.26  (Meters)
Standard Deviation for    ZL:  17.23  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  -3.33  -6.16
     VC2   7.30   7.65
     VC3  -8.80  -0.70
     VC4   5.11  -3.48
     VC5  -6.68  -13.60
     VC6  22.26  10.13
```

```
 VC7  15.94   2.52
 VC8   0.52  -6.92
 VC9  -10.58  23.42
VC10   0.25   4.49
VC11  13.95   0.67
VC12   5.89  -2.41
VC13  -33.00   2.99
VC14   2.37  -8.73
VC15  -10.94  -10.06

Col RMS =  12.96
Row RMS =   8.99
```

Single Space Resection for F:\NPS_WRST\4079\AB581003013ROLL_4079_A.LAN

Number of points processed: 13

Ground Control Coordinates

Point Name	X	Y	Z
VC1	526523.00	1456227.50	786.00
VC2	521356.50	1451834.00	716.00
VC3	527809.50	1450240.00	793.65
VC4	523890.00	1449510.00	748.33
VC5	520048.00	1448284.67	717.21
VC6	518139.00	1457661.33	662.03
VC7	518355.00	1454468.67	673.53
VC8	525414.19	1460126.97	867.16
VC9	521790.33	1459825.33	928.42
VC10	518084.50	1451552.00	690.63
VC11	521338.50	1454963.00	702.98
VC12	527615.50	1452586.00	791.00
VC13	525356.50	1453850.00	771.31

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	8639.3	4906.7	64.931	13.378	0.0000	-0.0012	-0.0002
VC2	4219.0	7423.0	-27.935	-39.460	0.0000	0.0006	0.0009
VC3	8770.0	9490.0	67.677	-82.863	0.0000	-0.0001	0.0001
VC4	5765.0	9484.0	4.544	-82.737	0.0000	-0.0001	0.0010
VC5	2757.3	9856.3	-58.645	-90.556	0.0000	0.0001	0.0001
VC6	2658.3	2713.0	-60.723	59.440	0.0000	0.0007	-0.0007
VC7	2376.8	5076.8	-66.639	9.806	0.0000	0.0012	-0.0002
VC8	8342.3	1865.0	58.691	77.247	0.0000	-0.0003	-0.0005
VC9	5632.5	1577.0	1.762	83.294	0.0000	-0.0000	-0.0010
VC10	1769.0	7177.0	-79.408	-34.295	0.0000	0.0008	0.0004
VC11	4637.0	5123.0	-19.153	8.835	0.0000	0.0005	-0.0002
VC12	8948.0	7734.0	71.416	-45.990	0.0000	-0.0008	0.0005
VC13	7452.0	6493.0	39.986	-19.932	0.0000	-0.0010	0.0005

Mean Differenence in dX and dY: 0.0000 0.0001
Standard Deviation in dX and dY: 0.0007 0.0006

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   = 10.586
XL   = 522747.7
YL   = 1453933.0
ZL   = 20121.4

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1582690

Omega   =   0.58 (Degrees)
Phi   =   -0.08 (Degrees)
Kappa   =   10.54 (Degrees)
XL   = 522615.2
YL   = 1454431.3
ZL   = 20137.2

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  11.08434
   0.03439  13.81351
   0.10725  -0.23465   0.31685
   0.72221  276.17368  -4.90754  5529.480
  -222.34500  -0.80699  -2.18622  -16.829  4467.960
   5.75402   2.76849   0.00936  54.453  -112.353  120.484
```

Standard Deviation for Omega: 686.72 (Seconds)
Standard Deviation for   Phi: 766.61 (Seconds)
Standard Deviation for Kappa: 116.10 (Seconds)
Standard Deviation for   XL: 74.36 (Meters)
Standard Deviation for   YL: 66.84 (Meters)
Standard Deviation for   ZL: 10.98 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	13.23	10.56
VC2	-0.47	-1.10
VC3	5.85	-8.41
VC4	-1.37	-8.63
VC5	-7.71	-10.31
VC6	-7.15	3.99
VC7	-5.07	1.84
VC8	-7.95	3.47
VC9	-1.45	5.55
VC10	-7.39	-5.08
VC11	0.32	4.07
VC12	9.19	-0.02
VC13	9.89	4.13

```
Col RMS =   7.07
Row RMS =   6.11
```

Single Space Resection for F:\NPS_WRST\4080\AB581003013ROLL_4080_A.LAN

Number of points processed: 15

Ground Control Coordinates

Point Name	X	Y	Z
VC1	527615.00	1452586.00	791.00
VC2	526702.00	1455912.00	794.00
VC3	525415.83	1450878.33	759.00
VC4	534142.50	1452467.00	1067.81
VC5	532822.50	1458122.00	1295.43
VC6	525414.19	1460126.97	867.16
VC7	531107.00	1451540.50	1079.67
VC8	523847.33	1458901.33	820.31
VC9	524004.33	1453803.33	747.21
VC10	527621.33	1450036.67	790.25
VC11	531190.50	1455456.00	873.88
VC12	528873.98	1460389.37	809.62
VC13	532375.91	1462584.52	887.27
VC14	534102.50	1454406.00	932.25
VC15	529201.50	1457613.00	811.23

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	4289.5	7713.0	-26.602	-45.626	0.0000	0.0006	0.0010
VC2	4021.0	5137.0	-32.225	8.466	0.0000	0.0008	-0.0002
VC3	2439.3	8708.7	-65.480	-66.520	0.0000	0.0005	0.0005
VC4	9181.0	8645.0	76.157	-65.230	0.0000	-0.0003	0.0003
VC5	8925.0	4227.0	70.809	27.540	0.0000	-0.0010	-0.0004
VC6	3559.0	1836.3	-41.908	77.776	0.0000	0.0004	-0.0007
VC7	6780.7	8967.7	25.725	-71.988	0.0000	-0.0004	0.0010
VC8	2251.7	2564.3	-69.379	62.499	0.0000	0.0005	-0.0005
VC9	1758.5	6365.7	-79.767	-17.317	0.0000	0.0010	0.0002
VC10	3975.0	9608.7	-33.224	-85.429	0.0000	0.0003	0.0007
VC11	7309.3	6029.3	36.853	-10.294	0.0000	-0.0009	0.0003
VC12	6192.0	2094.0	13.407	72.347	0.0000	-0.0002	-0.0011
VC13	9041.0	891.0	73.272	97.590	-0.0000	0.0004	0.0006
VC14	9363.0	7168.0	79.990	-34.218	0.0000	-0.0008	0.0003

```
    VC15        6093.0   4190.0    11.312    28.336   0.0000  -0.0003  -
0.0008

Mean Differenence in dX and dY:  0.0000   0.0001
Standard Deviation in dX and dY:   0.0006   0.0007


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =   9.480
XL      =  528962.4
YL      =  1455654.9
ZL      =  20214.4


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2041834

Omega   =     0.55  (Degrees)
Phi     =    -0.58  (Degrees)
Kappa   =     9.42  (Degrees)
XL      =  528604.9
YL      =  1455530.9
ZL      =  20099.2

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  13.44856
   2.43760  18.63964
   0.31065  -0.05078   0.44212
  48.17481  369.37854  -1.03996  7331.011
  -267.92021  -48.29055  -6.27179  -954.340  5348.522
  -6.73034   5.87047  -0.19832  113.246  133.395  166.352

Standard Deviation for Omega: 756.42  (Seconds)
Standard Deviation for   Phi: 890.52  (Seconds)
Standard Deviation for Kappa: 137.15  (Seconds)
Standard Deviation for    XL:  85.62  (Meters)
Standard Deviation for    YL:  73.13  (Meters)
Standard Deviation for    ZL:  12.90  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  -1.26  -7.84
     VC2  -1.61   1.39
     VC3  -5.82  -12.60
     VC4  11.44  -0.14
     VC5   9.57  12.38
     VC6  -20.99  -0.62
```

VC7	3.95	-5.58
VC8	-14.30	4.54
VC9	-1.82	-5.04
VC10	-5.20	-13.61
VC11	5.97	2.66
VC12	8.46	8.75
VC13	-9.31	8.41
VC14	14.26	-1.92
VC15	6.26	9.13

Col RMS = 9.62
Row RMS = 7.66

Single Space Resection for F:\NPS_WRST\4081\AB581003013ROLL_4081_A.LAN

Number of points processed: 15

Ground Control Coordinates

Point Name	X	Y	Z
VC1	532079.50	1455710.00	900.04
VC2	537544.17	1453033.67	1091.69
VC3	531885.50	1451374.00	1207.40
VC4	529919.50	1457559.00	868.96
VC5	529999.67	1460616.67	878.94
VC6	531276.67	1453241.00	941.85
VC7	533107.00	1457791.67	1167.94
VC8	534736.67	1452206.67	1261.37
VC9	540038.83	1452854.33	1298.60
VC10	535736.75	1461623.40	1069.85
VC11	539064.88	1456042.19	1106.01
VC12	539605.62	1459898.18	1172.16
VC13	535340.50	1457225.25	1380.28
VC14	533606.50	1461505.00	1366.64
VC15	536771.00	1451380.50	1216.09

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	3361.0	5724.0	-47.713	-3.840	0.0000	0.0011	0.0001
VC2	7158.0	8390.0	32.013	-59.876	0.0000	-0.0006	0.0010
VC3	2658.0	8995.0	-62.536	-72.513	0.0000	0.0004	0.0005
VC4	1962.0	4091.0	-77.079	30.471	0.0000	0.0009	-0.0004
VC5	2380.0	1812.0	-68.262	78.319	0.0000	0.0002	-0.0002
VC6	2464.0	7482.0	-66.587	-40.740	0.0000	0.0009	0.0006
VC7	4363.0	4280.0	-26.640	26.466	0.0000	0.0007	-0.0007
VC8	4933.5	8711.5	-14.725	-66.594	0.0000	0.0003	0.0011
VC9	9055.5	8855.5	71.871	-69.680	0.0000	-0.0003	0.0003
VC10	6801.0	1720.0	24.620	80.184	0.0000	-0.0003	-0.0009
VC11	8678.5	6326.5	63.990	-16.570	0.0000	-0.0011	0.0003
VC12	9532.0	3473.0	81.967	43.334	0.0000	-0.0006	-0.0003
VC13	5998.7	4976.3	7.712	11.820	0.0000	-0.0002	-0.0003
VC14	5173.7	1480.0	-9.564	85.248	0.0000	0.0001	-0.0009

```
    VC15        6382.5   9575.5    15.702   -84.758   0.0000  -0.0002
0.0009

Mean Differenence in dX and dY:  0.0001   0.0001
Standard Deviation in dX and dY:   0.0006   0.0007


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =   8.853
XL      =  534714.2
YL      =  1456137.4
ZL      =  20116.1


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2056467

Omega   =    -0.03  (Degrees)
Phi     =    -0.56  (Degrees)
Kappa   =     8.98  (Degrees)
XL      =  534809.3
YL      =  1456435.0
ZL      =  20096.0

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  20.07532
  -2.06340  17.24466
   0.19772  -0.19244   0.47199
  -38.68741  336.60944  -3.87901  6581.565
  -393.95057  39.01503  -3.74276  730.331  7741.846
   1.11830  -1.50659   0.02495  -28.628  -19.114  168.781

Standard Deviation for Omega: 924.18  (Seconds)
Standard Deviation for   Phi: 856.55  (Seconds)
Standard Deviation for Kappa: 141.71  (Seconds)
Standard Deviation for    XL:  81.13  (Meters)
Standard Deviation for    YL:  87.99  (Meters)
Standard Deviation for    ZL:  12.99  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  -5.39  -6.25
     VC2   6.61  -7.65
     VC3  -7.78  -13.64
     VC4  -7.76  -1.59
     VC5  -7.63  -0.50
     VC6  -3.65  -6.58
```

VC7	-1.79	3.42
VC8	1.32	-9.67
VC9	11.70	-5.39
VC10	-6.74	12.12
VC11	24.48	16.30
VC12	0.08	12.37
VC13	2.61	8.76
VC14	-9.70	2.87
VC15	3.53	-4.62

Col RMS = 8.81
Row RMS = 8.70

Single Space Resection for F:\NPS_WRST\4082\AB581003013ROLL_4082_A.LAN

Number of points processed: 13

Ground Control Coordinates

Point Name	X	Y	Z
VC1	539158.50	1456041.00	1109.70
VC2	535273.67	1460657.00	1056.79
VC3	537544.25	1453034.25	1091.67
VC4	542560.37	1464372.16	921.11
VC5	544298.46	1452707.63	1255.90
VC6	545707.50	1453918.50	1950.89
VC7	540453.00	1454132.00	1112.99
VC8	540325.50	1452504.50	1296.93
VC9	544176.15	1461822.96	1002.96
VC10	539026.25	1459589.19	1168.78
VC11	538491.95	1462318.64	1097.30
VC12	543609.67	1458211.59	1099.01
VC13	536477.05	1455031.53	968.27

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	3929.0	6577.7	-35.596	-22.096	0.0000	0.0009	0.0005
VC2	1641.3	2586.3	-83.534	61.786	0.0000	0.0002	-0.0002
VC3	2288.0	8614.3	-70.136	-64.811	0.0000	0.0005	0.0004
VC4	7605.0	855.5	41.810	97.948	0.0000	-0.0001	-0.0002
VC5	7386.0	9810.0	36.928	-90.074	0.0000	-0.0002	0.0005
VC6	8729.0	9219.7	65.161	-77.719	0.0000	-0.0003	0.0003
VC7	4644.0	8193.0	-20.626	-56.036	0.0000	0.0004	0.0011
VC8	4308.5	9430.5	-27.713	-82.012	0.0000	0.0003	0.0008
VC9	8479.0	2932.0	60.106	54.318	0.0000	-0.0008	-0.0007
VC10	4309.0	3888.0	-27.529	34.370	0.0000	0.0007	-0.0008
VC11	4279.0	1765.0	-28.093	78.950	0.0000	0.0003	-0.0009
VC12	7592.0	5548.0	41.389	-0.586	0.0000	-0.0010	0.0000
VC13	1763.0	6949.0	-81.113	-29.828	0.0000	0.0008	0.0003

Mean Differenence in dX and dY: 0.0001 0.0001
Standard Deviation in dX and dY: 0.0006 0.0006

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   = 10.318
XL   = 540546.3
YL   = 1457257.0
ZL   = 19741.5

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2707563

Omega   =   1.00 (Degrees)
Phi   =   -0.59 (Degrees)
Kappa   =   10.36 (Degrees)
XL   = 540889.3
YL   = 1457446.8
ZL   = 20085.0

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  26.58877
   5.38933  38.60276
  -0.08308  -1.59205   0.91426
  105.61667  751.62800  -31.50198  14656.887
  -525.28890  -108.80870   2.16945  -2132.243  10399.735
  -20.71904  -15.94272   0.57886  -305.982  415.360  322.811
```

Standard Deviation for Omega: 1063.59 (Seconds)
Standard Deviation for   Phi: 1281.55 (Seconds)
Standard Deviation for Kappa: 197.22 (Seconds)
Standard Deviation for   XL: 121.07 (Meters)
Standard Deviation for   YL: 101.98 (Meters)
Standard Deviation for   ZL: 17.97 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	-1.14	6.29
VC2	-7.71	15.98
VC3	-3.98	-14.33
VC4	9.83	13.28
VC5	17.73	-13.98
VC6	6.21	1.15
VC7	-0.80	0.11
VC8	-4.35	-17.10
VC9	12.76	1.14
VC10	-7.05	13.64
VC11	-14.23	0.46
VC12	16.50	5.55
VC13	-23.93	-11.56

```
Col RMS =  11.78
Row RMS =  10.81
```

Single Space Resection for F:\NPS_WRST\4126\AB581003013ROLL_4126_A.LAN

Number of points processed: 9

Ground Control Coordinates

Point Name	X	Y	Z
VC1	561574.00	1456141.00	1955.96
VC2	564362.00	1447435.00	1375.85
VC3	569612.50	1449685.00	1823.96
VC4	566626.08	1458815.66	1174.03
VC5	563790.50	1452704.00	1531.16
VC6	562952.50	1450334.00	1729.21
VC7	566131.50	1449620.00	1785.99
VC8	562960.00	1455247.00	1300.18
VC9	568827.66	1454766.55	1928.81

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	2698.0	2629.0	-59.845	68.926	0.0000	0.0005	-0.0006
VC2	3475.3	9732.3	-43.896	-80.277	0.0000	0.0004	0.0007
VC3	7879.0	9002.0	48.668	-65.174	0.0000	-0.0006	0.0008
VC4	7055.0	1566.0	31.757	91.017	0.0000	-0.0002	-0.0006
VC5	3891.0	5676.0	-34.943	4.879	0.0000	0.0009	-0.0001
VC6	2844.0	7345.0	-57.032	-30.112	0.0000	0.0010	0.0006
VC7	5164.0	8444.0	-8.346	-53.312	0.0000	0.0002	0.0011
VC8	3704.3	3641.8	-38.757	47.606	0.0000	0.0008	-0.0009
VC9	8143.0	4963.0	54.432	19.626	0.0000	-0.0011	-0.0004

Mean Differenence in dX and dY: 0.0002   0.0001
Standard Deviation in dX and dY: 0.0007   0.0007

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   = 12.577
XL   = 565204.1
YL   = 1452749.8
ZL   = 20520.2

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2978173

```
Omega   =    -0.96  (Degrees)
Phi     =     0.31  (Degrees)
Kappa   =    12.51  (Degrees)
XL      =  566030.0
YL      =  1453199.2
ZL      =  20158.5

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  48.88138
  14.49605  162.88962
  -1.16510  -1.05161   1.92701
  276.38152  3082.23962  -20.20496  58360.701
  -939.97377  -290.21795  23.80059  -5531.107  18113.978
  -7.29296  -114.67106   0.65432  -2141.711  163.507  733.393

Standard Deviation for Omega: 1442.10  (Seconds)
Standard Deviation for   Phi: 2632.52  (Seconds)
Standard Deviation for Kappa: 286.33  (Seconds)
Standard Deviation for    XL: 241.58  (Meters)
Standard Deviation for    YL: 134.59  (Meters)
Standard Deviation for    ZL:  27.08  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  -13.69   5.57
     VC2  -8.26  -5.58
     VC3  24.21  -0.62
     VC4  -1.85   5.23
     VC5  -8.09  -9.63
     VC6   0.71  -18.14
     VC7   5.03  -10.88
     VC8  -7.72   8.54
     VC9   9.16  25.10

    Col RMS =  10.95
    Row RMS =  12.17
```

Single Space Resection for F:\NPS_WRST\4127\AB581003013ROLL_4127_A.LAN

Number of points processed: 11

Ground Control Coordinates

Point Name	X	Y	Z
VC1	564292.50	1447412.00	1368.49
VC2	558288.50	1446843.00	1283.59
VC3	559436.17	1452876.33	1453.70
VC4	563985.50	1451509.00	2157.84
VC5	563639.14	1457071.13	1207.46
VC6	555660.43	1454831.97	1367.97
VC7	556063.50	1449459.00	1988.62
VC8	556902.67	1452633.33	1762.02
VC9	556713.50	1446024.00	1327.31
VC10	558145.26	1457703.04	1156.19
VC11	561080.50	1448673.00	1662.60

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	7913.0	9841.0	49.657	-82.053	0.0000	-0.0003	0.0005
VC2	3300.0	9263.0	-47.268	-69.982	0.0000	0.0005	0.0008
VC3	5131.3	4927.3	-8.854	21.085	0.0000	0.0002	-0.0006
VC4	8470.0	6743.0	61.315	-16.992	0.0000	-0.0011	0.0003
VC5	8965.0	2495.0	71.656	72.215	0.0000	-0.0003	-0.0003
VC6	2619.0	2867.0	-61.666	64.312	0.0000	0.0006	-0.0006
VC7	1921.0	6987.0	-76.272	-22.210	0.0000	0.0010	0.0003
VC8	3134.0	4683.0	-50.820	26.187	0.0000	0.0010	-0.0005
VC9	1978.3	9618.3	-75.031	-77.463	0.0000	0.0001	0.0001
VC10	4966.0	1133.0	-12.381	100.757	0.0000	0.0000	-0.0004
VC11	5692.0	8403.0	2.975	-51.889	0.0000	-0.0001	0.0011

Mean Differenence in dX and dY: 0.0002   0.0001
Standard Deviation in dX and dY: 0.0006   0.0006

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   = 12.338
XL   = 559473.4
YL   = 1451366.9

```
ZL      =  20494.5


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1841664

Omega   =    -0.15  (Degrees)
Phi     =     0.51  (Degrees)
Kappa   =    12.21  (Degrees)
XL      =  560405.6
YL      =  1451775.1
ZL      =  20218.2

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

   9.25149
   1.69316  22.25061
  -0.26502  -0.41564   0.48912
  32.29773  427.75644  -8.16490  8235.455
  -180.27710  -32.99794   5.52023  -629.392  3524.880
  -2.03688  -18.24598   0.36245  -342.726  43.646  182.784

Standard Deviation for Omega: 627.38  (Seconds)
Standard Deviation for   Phi: 972.96  (Seconds)
Standard Deviation for Kappa: 144.26  (Seconds)
Standard Deviation for    XL:  90.75  (Meters)
Standard Deviation for    YL:  59.37  (Meters)
Standard Deviation for    ZL:  13.52  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  10.96  -5.29
     VC2  -2.69  -4.65
     VC3  -3.77  -1.63
     VC4  11.57   0.77
     VC5  -0.42  11.72
     VC6  -2.04  18.01
     VC7  -5.04  -0.48
     VC8  -7.79   5.11
     VC9  -8.02  -11.63
    VC10   3.08  -9.66
    VC11   3.86  -2.44

    Col RMS =   6.43
    Row RMS =   8.40
```

Single Space Resection for F:\NPS_WRST\4128\AB581003013ROLL_4128_A.LAN

Number of points processed: 12

Ground Control Coordinates

Point Name	X	Y	Z
VC1	553588.50	1446990.00	1272.37
VC2	550792.50	1450344.00	1769.18
VC3	558177.45	1457760.97	1156.00
VC4	559008.50	1447326.00	1372.43
VC5	559175.50	1452499.00	1452.20
VC6	549246.50	1454377.00	1783.44
VC7	549583.50	1452038.00	1917.80
VC8	553645.50	1454447.00	1591.06
VC9	553009.50	1451190.00	2158.70
VC10	551122.50	1447881.00	1681.30
VC11	556268.50	1450927.00	2263.16
VC12	556452.00	1447384.50	1522.19

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	4309.0	8841.0	-26.730	-62.557	0.0000	0.0005	0.0011
VC2	2677.0	5855.0	-61.112	0.091	0.0000	0.0012	-0.0000
VC3	9482.0	1560.0	81.716	90.507	-0.0000	0.0005	0.0005
VC4	8477.0	9505.0	60.856	-76.364	0.0000	-0.0003	0.0004
VC5	9453.0	5609.0	81.235	5.480	0.0000	-0.0010	-0.0001
VC6	2174.0	2522.0	-71.787	70.063	0.0000	0.0003	-0.0003
VC7	2015.0	4358.0	-75.068	31.504	0.0000	0.0009	-0.0004
VC8	5563.0	3220.0	-0.565	55.517	0.0000	0.0000	-0.0012
VC9	4501.0	5571.0	-22.801	6.114	0.0000	0.0006	-0.0002
VC10	2513.0	7805.0	-64.495	-40.862	0.0000	0.0009	0.0006
VC11	7036.0	6328.0	30.480	-9.698	0.0000	-0.0008	0.0003
VC12	6538.0	9055.0	20.105	-66.978	0.0000	-0.0003	0.0011

Mean Differenence in dX and dY: 0.0002 0.0002
Standard Deviation in dX and dY: 0.0007 0.0006

Initial Approximations:
Omega = 0.000
Phi = 0.000

```
Kappa   =  12.531
XL      =  554172.5
YL      =  1451097.0
ZL      =  20249.1


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2063442

Omega   =     1.04  (Degrees)
Phi     =     0.84  (Degrees)
Kappa   =    12.13  (Degrees)
XL      =  554670.1
YL      =  1450789.0
ZL      =  20171.7

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  13.00962
   2.77448  18.54948
  -0.48650  -0.29229   0.61780
  52.96641  355.43128  -5.62230  6823.765
  -247.62156  -53.16387   9.41817  -1015.051  4726.321
  -16.31722   2.92043   0.54690  62.185  307.584  230.802

Standard Deviation for Omega: 743.97  (Seconds)
Standard Deviation for   Phi: 888.36  (Seconds)
Standard Deviation for Kappa: 162.12  (Seconds)
Standard Deviation for    XL:  82.61  (Meters)
Standard Deviation for    YL:  68.75  (Meters)
Standard Deviation for    ZL:  15.19  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1   3.13  -10.37
     VC2  -6.51  -6.03
     VC3  11.98  14.19
     VC4   9.93  -9.82
     VC5   9.56   0.08
     VC6  -8.13   6.52
     VC7  -0.68  12.29
     VC8  -0.42   6.64
     VC9  -1.30   4.17
    VC10  -20.67  -3.12
    VC11   4.14  -3.49
    VC12  -0.51  -10.94

    Col RMS =   8.66
    Row RMS =   8.36
```

Single Space Resection for F:\NPS_WRST\4129\AB581003013ROLL_4129_A.LAN

Number of points processed: 11

Ground Control Coordinates

Point Name	X	Y	Z
VC1	546874.00	1444230.50	1239.02
VC2	553029.50	1444945.00	1267.58
VC3	543607.50	1453182.00	1237.63
VC4	550935.50	1451885.00	2085.30
VC5	549968.50	1448677.00	1981.97
VC6	550355.50	1444022.00	1208.60
VC7	546247.83	1447380.00	1491.09
VC8	546004.00	1451436.50	1573.61
VC9	545605.00	1448490.67	1955.90
VC10	545085.00	1442978.00	1129.14
VC11	552512.50	1450608.00	1777.76

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	3360.0	9208.3	-46.123	-68.936	0.0000	0.0005	0.0008
VC2	8068.0	9753.0	52.804	-80.277	0.0000	-0.0003	0.0005
VC3	2442.3	1999.0	-65.548	82.433	0.0000	0.0001	-0.0002
VC4	7811.0	4171.0	47.294	36.934	0.0000	-0.0009	-0.0007
VC5	6462.0	6487.0	18.997	-11.727	0.0000	-0.0005	0.0003
VC6	5907.7	9957.0	7.419	-84.605	0.0000	-0.0001	0.0009
VC7	3402.3	6789.3	-45.281	-18.139	0.0000	0.0010	0.0004
VC8	3913.5	3678.5	-34.603	47.195	0.0000	0.0007	-0.0010
VC9	3034.3	5855.3	-53.031	1.466	0.0000	0.0012	-0.0000
VC10	1837.0	9796.5	-78.111	-81.320	-0.0000	-0.0001	-0.0001
VC11	8764.0	5455.0	67.342	9.991	0.0000	-0.0012	-0.0002

Mean Differenence in dX and dY: 0.0000 0.0001
Standard Deviation in dX and dY: 0.0008 0.0006

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 12.808
XL = 548202.3

```
YL      =  1447985.0
ZL      =  20509.5


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2096516

Omega   =    -1.37  (Degrees)
Phi     =     0.19  (Degrees)
Kappa   =    13.01  (Degrees)
XL      =  548772.6
YL      =  1449548.8
ZL      =  20200.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  15.78744
  -5.32781  24.15432
  -0.16062   0.45578   0.73194
  -100.75916  462.12435   7.97811  8857.475
  -301.89007  99.79104   3.37603  1886.936  5789.613
  47.14132  -41.03425  -0.94022  -774.938  -880.021  424.783

Standard Deviation for Omega: 819.56  (Seconds)
Standard Deviation for   Phi: 1013.73  (Seconds)
Standard Deviation for Kappa: 176.47  (Seconds)
Standard Deviation for    XL:  94.11  (Meters)
Standard Deviation for    YL:  76.09  (Meters)
Standard Deviation for    ZL:  20.61  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  -4.62  -7.80
     VC2  13.01  -6.39
     VC3  -7.82  18.23
     VC4   6.23   9.15
     VC5   6.12  -5.35
     VC6   0.48  -6.93
     VC7  -1.10  -4.85
     VC8   1.15   4.43
     VC9  -10.15   4.66
    VC10  -16.52  -8.28
    VC11  12.43   2.28

    Col RMS =   8.85
    Row RMS =   8.16
```

Single Space Resection for F:\NPS_WRST\4130\AB581003013ROLL_4130_A.LAN

Number of points processed: 11

Ground Control Coordinates

Point Name	X	Y	Z
VC1	547767.50	1444629.67	1168.07
VC2	538697.00	1451227.50	1171.78
VC3	539133.50	1443808.33	1067.37
VC4	539817.83	1447872.00	1529.26
VC5	543844.50	1443344.25	1129.28
VC6	546764.50	1450831.67	1512.44
VC7	544304.90	1452701.20	1256.16
VC8	541466.02	1452218.39	1420.40
VC9	546573.50	1448368.00	1489.47
VC10	542181.50	1449739.00	1537.69
VC11	543447.50	1446891.00	1786.04

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	8617.0	9566.7	63.374	-76.021	0.0000	-0.0003	0.0004
VC2	2915.0	3168.5	-56.503	58.263	0.0000	0.0007	-0.0007
VC3	2032.7	8735.3	-74.969	-58.644	0.0000	0.0005	0.0004
VC4	3148.0	5833.5	-51.573	2.305	0.0000	0.0011	-0.0001
VC5	5457.0	9868.0	-3.012	-82.387	0.0000	0.0000	0.0010
VC6	8938.5	4755.0	70.067	25.022	0.0000	-0.0011	-0.0004
VC7	7371.0	2968.0	37.112	62.528	0.0000	-0.0006	-0.0010
VC8	5143.0	2806.0	-9.699	65.902	0.0000	0.0002	-0.0012
VC9	8380.0	6589.5	58.356	-13.507	0.0000	-0.0012	0.0003
VC10	5259.0	4816.0	-7.236	23.696	0.0000	0.0002	-0.0007
VC11	5745.0	7203.0	3.005	-26.421	0.0000	-0.0001	0.0007

Mean Differenence in dX and dY: -0.0000 -0.0001
Standard Deviation in dX and dY: 0.0007 0.0007

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 12.212
XL = 543090.8
YL = 1448330.1

```
ZL      =  20371.9


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2228221

Omega   =    -0.00  (Degrees)
Phi     =     0.36  (Degrees)
Kappa   =    12.43  (Degrees)
XL      =  543035.9
YL      =  1448413.0
ZL      =  20152.8

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  28.81221
  -2.22542  32.99019
   0.18763   0.30177   0.90766
  -41.91401  635.02693   5.76162  12240.761
  -556.18124  41.69629  -3.80486  784.796  10753.535
  26.59998  -2.27437   0.17377  -44.409  -512.605  346.913

Standard Deviation for Omega: 1107.17  (Seconds)
Standard Deviation for   Phi: 1184.73  (Seconds)
Standard Deviation for Kappa: 196.51  (Seconds)
Standard Deviation for    XL: 110.64  (Meters)
Standard Deviation for    YL: 103.70  (Meters)
Standard Deviation for    ZL:  18.63  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  12.38  -9.44
     VC2  -5.65  20.51
     VC3  -10.02  -4.68
     VC4  -6.61  -0.19
     VC5  -2.54  -7.89
     VC6   0.58   6.17
     VC7  15.26  13.50
     VC8   1.92  -15.44
     VC9   5.68  -2.95
    VC10  -5.85   6.40
    VC11  -5.05  -5.85

    Col RMS =   7.77
    Row RMS =  10.16
```

Single Space Resection for
E:\WRANGELL\SCANS\LINE_4\4131\AB581003013ROLL_4131_A.LAN

Number of points processed: 17

Ground Control Coordinates

Point Name	X	Y	Z
VC1	531130.50	1451504.00	1080.73
VC2	532149.50	1451406.00	1257.97
VC3	531567.50	1450225.00	1242.82
VC4	536774.50	1452765.00	1151.39
VC5	540133.50	1452917.00	1252.72
VC6	535067.50	1450588.00	1414.39
VC7	534981.50	1447938.00	1157.00
VC8	539688.50	1449771.00	1578.90
VC9	534651.50	1445133.00	884.00
VC10	539805.50	1446033.00	1414.10
VC11	537541.50	1445805.00	1182.87
VC12	540862.50	1440999.00	974.00
VC13	541795.50	1443247.00	1094.47
VC14	542114.50	1445277.00	1293.76
VC15	538505.50	1443308.00	1031.53
VC17	536895.50	1440586.00	895.53
VC18	535270.50	1442150.00	886.90

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	1930.0	1602.0	-77.752	91.026	-0.0000	-0.0004	0.0004
VC2	2633.0	1807.0	-62.980	86.726	0.0000	0.0001	-0.0001
VC3	2004.0	2588.0	-76.189	70.321	0.0000	0.0002	-0.0002
VC4	6325.0	1582.0	14.586	91.482	0.0000	-0.0001	-0.0007
VC5	8877.0	2012.0	68.206	82.475	0.0000	-0.0001	-0.0001
VC6	4670.0	2885.0	-20.174	64.106	0.0000	0.0004	-0.0011
VC7	4169.0	4863.0	-30.683	22.566	0.0000	0.0008	-0.0006
VC8	8050.0	4253.0	50.849	35.408	0.0000	-0.0010	-0.0007
VC9	3503.0	6886.0	-44.659	-19.919	0.0000	0.0010	0.0005
VC10	7477.0	7113.0	38.834	-24.652	0.0000	-0.0009	0.0006
VC11	5725.0	6887.0	2.024	-19.921	0.0000	-0.0001	0.0006
VC12	7376.0	10969.0	36.745	-105.626	-0.0000	0.0000	-0.0001
VC13	8463.0	9495.0	59.570	-74.663	0.0000	-0.0004	0.0005

```
    VC14        9083.0   8070.0    72.584   -44.735   0.0000  -0.0008
0.0005
    VC15        6028.0   8886.0     8.406   -61.895   0.0000  -0.0002
0.0012
    VC17        4375.0  10585.0   -26.308   -97.587   0.0000   0.0001
0.0004
    VC18        3444.0   9169.0   -45.880   -67.860   0.0000   0.0006
0.0008

Mean Differenence in dX and dY: -0.0000   0.0001
Standard Deviation in dX and dY:   0.0006   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  12.603
XL      =  536996.2
YL      =  1447038.4
ZL      =  20355.6


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1743724

Omega   =    -0.20  (Degrees)
Phi     =     0.49  (Degrees)
Kappa   =    12.68  (Degrees)
XL      =  537307.5
YL      =  1447057.3
ZL      =  20192.1

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

   7.77158
  -2.96563  10.52119
  -0.08861   0.19670   0.25526
  -55.94508  205.62760   3.85864  4026.384
  -153.56711  55.89248   1.73671  1052.321  3042.248
   1.86165  -7.37502  -0.13790  -142.910  -35.147  96.449

Standard Deviation for Omega: 575.02  (Seconds)
Standard Deviation for   Phi: 669.05  (Seconds)
Standard Deviation for Kappa: 104.21  (Seconds)
Standard Deviation for    XL:  63.45  (Meters)
Standard Deviation for    YL:  55.16  (Meters)
Standard Deviation for    ZL:   9.82  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
```

VC1	-3.60	5.48
VC2	-7.62	7.99
VC3	-8.01	0.37
VC4	3.63	5.35
VC5	8.64	11.65
VC6	-1.83	12.20
VC7	-10.27	-8.80
VC8	8.85	-3.70
VC9	4.98	-1.95
VC10	4.88	-2.28
VC11	0.20	-2.14
VC12	0.96	-6.91
VC13	7.54	-3.33
VC14	14.76	2.67
VC15	6.37	-2.18
VC17	-14.95	-8.54
VC18	-15.31	-6.39

Col RMS = 8.52
Row RMS = 6.40

Single Space Resection for
E:\WRANGELL\SCANS\LINE_4\4132\AB581003013ROLL_4132_A.LAN

Number of points processed: 14

Ground Control Coordinates

Point Name	X	Y	Z
VC3	527902.50	1439983.00	805.86
VC4	533603.50	1442137.00	866.83
VC5	529873.50	1445728.00	823.00
VC6	526904.50	1447628.00	782.48
VC7	529131.50	1442689.00	816.72
VC8	526881.50	1443434.00	789.85
VC9	526280.50	1449895.00	766.74
VC10	529125.50	1447446.00	816.03
VC11	534805.50	1445132.00	885.11
VC12	538015.50	1443774.00	1027.35
VC13	536897.50	1440580.00	895.33
VC14	535005.50	1447159.00	1053.56
VC15	534551.50	1451487.00	1171.39
VC16	531124.50	1451500.00	1079.93

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC3	2035.0	9496.0	-74.821	-75.610	0.0000	0.0001	0.0001
VC4	6569.0	8884.0	20.436	-62.736	0.0000	-0.0004	0.0011
VC5	4422.0	5638.0	-24.684	5.416	0.0000	0.0007	-0.0001
VC6	2569.0	3769.0	-63.623	44.654	0.0000	0.0009	-0.0006
VC7	3372.0	7739.0	-46.737	-38.708	0.0000	0.0009	0.0008
VC8	1863.0	6813.0	-78.445	-19.270	0.0000	0.0010	0.0002
VC9	2494.0	2019.0	-65.207	81.402	0.0000	0.0002	-0.0002
VC10	4169.0	4261.0	-30.005	34.330	0.0000	0.0007	-0.0008
VC11	7955.0	6895.0	49.548	-20.962	0.0000	-0.0011	0.0005
VC12	10127.0	8441.0	95.189	-53.417	0.0000	-0.0000	0.0000
VC13	8737.0	10580.0	65.993	-98.341	-0.0000	0.0003	-0.0004
VC14	8464.0	5442.0	60.236	9.551	0.0000	-0.0012	-0.0002
VC15	8877.0	2143.0	68.902	78.830	0.0000	-0.0002	-0.0002
VC16	6314.0	1574.0	15.050	90.765	0.0000	-0.0001	-0.0007

Mean Differenence in dX and dY: 0.0001 -0.0000
Standard Deviation in dX and dY: 0.0007   0.0006

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   = 12.611
XL   = 531435.9
YL   = 1445612.3
ZL   = 20254.3

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2063550

Omega   =   0.04 (Degrees)
Phi   =   0.11 (Degrees)
Kappa   =   12.74 (Degrees)
XL   = 531503.0
YL   = 1445721.9
ZL   = 20175.4

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  14.90949
  -2.81836  14.75314
   0.14956   0.03230   0.43869
  -55.11196  295.34706   0.61536  5924.907
  -297.28787  54.90089  -2.99026  1072.942  5940.046
   4.21387   2.56753   0.05734  51.901  -83.653  163.955
```

Standard Deviation for Omega: 796.45 (Seconds)
Standard Deviation for   Phi: 792.26 (Seconds)
Standard Deviation for Kappa: 136.62 (Seconds)
Standard Deviation for   XL: 76.97 (Meters)
Standard Deviation for   YL: 77.07 (Meters)
Standard Deviation for   ZL: 12.80 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC3	-5.89	-17.15
VC4	2.14	-8.70
VC5	-8.49	-0.60
VC6	-11.90	7.41
VC7	-13.30	-0.12
VC8	-6.49	-6.93
VC9	-9.02	11.67
VC10	0.48	2.74
VC11	7.14	-0.50

VC12	13.49	-5.32
VC13	6.92	-11.09
VC14	7.91	6.27
VC15	12.44	12.72
VC16	3.88	9.33

Col RMS = 8.73
Row RMS = 8.69

Single Space Resection for
E:\WRANGELL\SCANS\LINE_4\4133\AB581003013ROLL_4133_A.LAN

Number of points processed: 13

Ground Control Coordinates

Point Name	X	Y	Z
VC1	527903.50	1439978.00	805.84
VC2	524026.50	1440872.00	784.51
VC3	524264.50	1438040.00	823.00
VC4	524096.50	1438643.00	815.00
VC5	532412.50	1440728.00	838.00
VC6	529035.50	1442569.00	814.82
VC7	525353.50	1444386.00	773.00
VC8	529869.50	1445727.00	823.00
VC9	520795.50	1442788.00	744.99
VC11	521024.50	1447795.00	723.57
VC12	526281.50	1449894.00	766.77
VC13	527939.50	1450330.00	800.30
VC14	528974.50	1450708.00	864.07

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	6583.0	9659.0	21.548	-78.348	0.0000	-0.0003	0.0010
VC2	3886.0	8344.0	-35.131	-50.767	0.0000	0.0007	0.0010
VC3	3588.0	10456.0	-41.365	-95.122	0.0000	0.0001	0.0003
VC4	3571.0	9995.0	-41.728	-85.441	0.0000	0.0003	0.0006
VC5	10039.0	9878.0	94.161	-82.906	-0.0000	0.0007	-0.0006
VC6	7847.0	7955.0	48.082	-42.550	0.0000	-0.0009	0.0008
VC7	5442.0	6013.0	-2.470	-1.799	0.0000	0.0001	0.0001
VC8	8990.0	5781.0	72.068	3.116	0.0000	-0.0011	-0.0000
VC9	1857.0	6417.0	-77.783	-10.327	0.0000	0.0010	0.0001
VC11	2858.0	2820.0	-56.799	65.220	0.0000	0.0006	-0.0007
VC12	7046.0	2151.0	31.180	79.319	0.0000	-0.0003	-0.0009
VC13	8338.0	2101.0	58.324	80.386	0.0000	-0.0003	-0.0004
VC14	9173.0	1983.0	75.866	82.874	-0.0000	0.0001	0.0001

Mean Differenence in dX and dY: 0.0001 0.0001
Standard Deviation in dX and dY: 0.0006 0.0006

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   = 12.974
XL   = 526306.0
YL   = 1444035.2
ZL   = 20136.4

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1947566

Omega   =   0.11 (Degrees)
Phi   =   0.57 (Degrees)
Kappa   =   12.84 (Degrees)
XL   = 525667.3
YL   = 1444486.7
ZL   = 20165.3

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  12.84286
  -0.67127  15.75478
   0.34316  -0.22723   0.40894
  -14.48629  314.12810  -4.75500  6275.399
  -261.52350  15.26202  -7.34738  326.784  5337.780
   0.48599  13.83366  -0.16938  270.465  -4.954  160.986
```

Standard Deviation for Omega: 739.19 (Seconds)
Standard Deviation for   Phi: 818.71 (Seconds)
Standard Deviation for Kappa: 131.90 (Seconds)
Standard Deviation for   XL: 79.22 (Meters)
Standard Deviation for   YL: 73.06 (Meters)
Standard Deviation for   ZL: 12.69 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	4.91	-4.92
VC2	-8.69	-8.57
VC3	-3.13	-14.81
VC4	0.80	-4.13
VC5	17.14	-6.45
VC6	4.90	-2.02
VC7	-7.29	4.90
VC8	6.26	-0.50
VC9	-13.92	4.23
VC11	-15.34	6.33
VC12	1.81	7.41
VC13	5.15	8.96

VC14 7.04 9.67

Col RMS = 8.90
Row RMS = 7.29

Single Space Resection for
E:\WRANGELL\SCANS\LINE_4\4134\AB581003013ROLL_4134_A.LAN

Number of points processed: 15

Ground Control Coordinates

Point Name	X	Y	Z
VC1	518012.50	1438113.00	817.18
VC2	517145.50	1437938.00	805.50
VC3	516590.50	1441326.00	776.28
VC4	516280.50	1445090.00	714.00
VC5	514981.50	1445692.00	699.96
VC6	521109.50	1442551.00	749.00
VC7	517641.50	1444940.00	715.72
VC8	520331.50	1440186.00	779.88
VC9	524841.50	1439933.00	797.00
VC10	525202.50	1444540.00	770.75
VC11	520262.50	1446149.00	715.00
VC12	522820.50	1447068.00	742.61
VC13	518593.50	1442802.00	742.60
VC14	513867.50	1443054.00	721.27
VC15	523789.50	1442373.00	760.90

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	3493.0	9435.0	-44.516	-74.361	0.0000	0.0005	0.0008
VC2	2825.0	9419.0	-58.551	-74.031	0.0000	0.0004	0.0005
VC3	2986.0	6855.0	-55.190	-20.188	0.0000	0.0011	0.0004
VC4	3384.0	4074.0	-46.854	38.213	0.0000	0.0009	-0.0008
VC5	2549.0	3428.0	-64.403	51.771	0.0000	0.0008	-0.0006
VC6	6495.0	6713.0	18.531	-17.175	0.0000	-0.0005	0.0005
VC7	4357.0	4400.0	-26.408	31.376	0.0000	0.0007	-0.0008
VC8	5535.0	8307.0	-1.624	-50.655	0.0000	0.0000	0.0011
VC9	8810.0	9248.0	67.192	-70.386	0.0000	-0.0004	0.0004
VC10	9834.0	5938.0	88.676	-0.871	0.0000	-0.0008	0.0000
VC11	6466.0	3954.0	17.897	40.760	0.0000	-0.0004	-0.0010

```
    VC12        8495.0   3701.0    60.523    46.091   0.0000  -0.0009  -
0.0007
    VC13        4698.0   6110.0   -19.228    -4.529   0.0000   0.0005
0.0001
    VC14        1305.0   5155.0   -90.524    15.495   0.0000   0.0007  -
0.0001
    VC15        8436.0   7282.0    59.316   -29.106   0.0000  -0.0011
0.0005

Mean Differenence in dX and dY:  0.0001   0.0000
Standard Deviation in dX and dY:   0.0007   0.0007


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  12.687
XL      =  519431.4
YL      =  1442783.7
ZL      =  20128.0


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1564226

Omega   =    -0.23  (Degrees)
Phi     =     0.78  (Degrees)
Kappa   =    12.70  (Degrees)
XL      =  519991.0
YL      =  1443432.6
ZL      =  20141.5

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  18.94032
   0.10477  13.45496
  -0.15624  -0.27727   0.34669
   2.04672  269.30082  -5.74536  5396.856
  -374.47328  -1.95093   3.17969  -37.992  7410.567
  17.43567  -6.27903  -0.00822  -122.345  -340.487  146.642

Standard Deviation for Omega: 897.67  (Seconds)
Standard Deviation for   Phi: 756.60  (Seconds)
Standard Deviation for Kappa: 121.45  (Seconds)
Standard Deviation for    XL:  73.46  (Meters)
Standard Deviation for    YL:  86.08  (Meters)
Standard Deviation for    ZL:  12.11  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
```

VC1	-1.90	-11.22
VC2	-10.95	-7.57
VC3	-6.77	-4.23
VC4	-9.06	7.01
VC5	-3.14	8.73
VC6	3.74	1.27
VC7	0.21	1.74
VC8	2.67	-6.52
VC9	10.22	-8.99
VC10	6.13	4.34
VC11	0.93	9.16
VC12	3.32	12.72
VC13	1.47	-2.42
VC14	-6.52	1.83
VC15	9.42	-5.73

Col RMS = 6.17
Row RMS = 7.12

Single Space Resection for F:\NPS_WRST\4135\AB581003013ROLL_4135_A.LAN

Number of points processed: 14

Ground Control Coordinates

Point Name	X	Y	Z
VC2	519499.50	1438658.00	794.34
VC3	516387.50	1444941.00	716.04
VC5	513070.83	1444837.00	699.43
VC6	515773.83	1437647.33	812.74
VC7	517478.33	1440291.67	807.60
VC8	515675.00	1447496.33	689.90
VC10	517054.20	1448461.80	692.37
VC15	514506.83	1442105.67	737.00
VC16	515027.17	1440677.67	760.12
VC17	518707.50	1442719.00	744.43
VC18	508181.33	1446589.17	679.72
VC19	509594.67	1443866.22	697.38
VC20	510521.66	1435838.78	831.19
VC21	511017.34	1440692.58	742.23

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC2	9244.0	9252.0	76.947	-69.486	0.0000	-0.0002	0.0002
VC3	7869.0	4179.0	47.981	37.019	0.0000	-0.0009	-0.0007
VC5	5413.7	3771.3	-3.610	45.540	0.0000	0.0001	-0.0011
VC6	6338.0	9436.3	15.894	-73.402	0.0000	-0.0002	0.0011
VC7	7993.5	7749.5	50.650	-37.954	0.0000	-0.0010	0.0007
VC8	7719.7	2206.7	44.815	78.434	0.0000	-0.0004	-0.0007
VC10	8876.5	1698.8	69.113	89.117	-0.0000	0.0001	0.0001
VC15	6065.7	5975.3	10.121	-0.730	0.0000	-0.0003	0.0000
VC16	6235.3	7096.7	13.702	-24.274	0.0000	-0.0004	0.0007
VC17	9258.0	6150.0	77.193	-4.347	0.0000	-0.0011	0.0001
VC18	2076.0	1796.0	-73.765	86.968	-0.0000	-0.0001	0.0002
VC19	2702.0	3993.0	-60.578	40.842	0.0000	0.0009	-0.0006
VC20	2183.0	9958.0	-71.394	-84.424	-0.0000	-0.0000	-0.0000
VC21	3272.0	6513.0	-48.565	-12.065	0.0000	0.0011	0.0003

Mean Differenence in dX and dY: -0.0002 0.0000

Standard Deviation in dX and dY: 0.0006 0.0006

Initial Approximations:
Omega = 0.000
Phi   = 0.000
Kappa = 11.633
XL   = 514464.0
YL   = 1442487.3
ZL   = 20154.9

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.3602472

Omega = -0.40 (Degrees)
Phi   = 0.66 (Degrees)
Kappa = 11.31 (Degrees)
XL   = 514100.0
YL   = 1442168.2
ZL   = 20138.4

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  42.05944
   0.76197  52.24762
   0.53915   0.42483   1.53694
  17.00258  1044.73943   9.19687  20928.599
  -844.50933  -16.59968  -11.76095  -367.623  16995.057
  -20.51657  -12.95945  -0.37223  -272.057  402.918  587.586
```

Standard Deviation for Omega: 1337.69 (Seconds)
Standard Deviation for Phi: 1490.93 (Seconds)
Standard Deviation for Kappa: 255.71 (Seconds)
Standard Deviation for XL: 144.67 (Meters)
Standard Deviation for YL: 130.37 (Meters)
Standard Deviation for ZL: 24.24 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC2	13.43	-10.74
VC3	10.96	5.04
VC5	6.34	3.95
VC6	4.70	-14.68
VC7	11.23	-9.26
VC8	10.07	12.57
VC10	8.46	15.86
VC15	7.39	-4.98
VC16	5.03	-9.90
VC17	16.10	0.35

```
VC18  -19.52  17.97
VC19  -24.06  20.51
VC20  -27.33  -37.06
VC21  -23.26  10.72

Col RMS =  15.23
Row RMS =  15.17
```

Single Space Resection for F:\NPS_WRST\4221\AB581003013ROLL_4221_A.LAN

Number of points processed: 8

Ground Control Coordinates

Point Name	X	Y	Z
VC1	516192.50	1435955.00	883.44
VC2	518248.00	1427254.00	1125.06
VC3	515493.50	1432822.50	1137.66
VC4	511638.86	1426786.20	1330.66
VC5	509230.96	1430717.86	1150.04
VC6	505832.01	1434116.81	915.97
VC7	510856.00	1436016.33	831.13
VC8	511808.79	1432011.76	1029.41

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	8547.0	2311.0	60.353	67.431	-0.0000	0.0001	0.0001
VC2	9312.0	9012.5	76.174	-70.579	-0.0000	0.0002	-0.0002
VC3	7760.0	4567.0	44.155	20.961	0.0000	-0.0001	-0.0001
VC4	4228.5	8777.0	-28.580	-65.778	0.0000	0.0000	0.0000
VC5	2815.5	5565.0	-57.724	0.360	0.0000	0.0001	-0.0000
VC6	675.0	2730.0	-101.856	58.727	-0.0000	-0.0004	0.0003
VC7	4557.6	1792.4	-21.858	78.074	-0.0000	-0.0000	0.0000
VC8	4886.0	4871.0	-15.065	14.673	0.0000	0.0001	-0.0001

Mean Differenence in dX and dY: -0.0000 0.0000
Standard Deviation in dX and dY: 0.0002 0.0001

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 7.060
XL = 512412.6
YL = 1431960.1
ZL = 20733.0

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.3726337

Omega = -0.28 (Degrees)
Phi = 1.02 (Degrees)
Kappa = 7.10 (Degrees)

XL = 513235.8
YL = 1431250.4
ZL = 20646.3

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  147.19150
  -47.07674  80.45013
  -1.55510   0.60862   2.83987
  -937.78084  1628.07376  14.31201  33024.128
  -2960.53135  938.03652  32.50824  18682.026  59621.012
  -75.11849  -42.06484   0.63148  -822.254  1483.944  1191.721
```

Standard Deviation for Omega: 2502.46 (Seconds)
Standard Deviation for Phi: 1850.07 (Seconds)
Standard Deviation for Kappa: 347.60 (Seconds)
Standard Deviation for XL: 181.73 (Meters)
Standard Deviation for YL: 244.17 (Meters)
Standard Deviation for ZL: 34.52 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	11.43	6.72
VC2	12.31	-27.21
VC3	17.56	-1.56
VC4	-23.32	-6.34
VC5	-13.11	-2.94
VC6	7.28	-3.57
VC7	-7.39	4.15
VC8	-4.64	31.15

Col RMS = 13.39
Row RMS = 15.15

Single Space Resection for F:\NPS_WRST\4222\AB581003013ROLL_4222_A.LAN

Number of points processed: 12

Ground Control Coordinates

Point Name	X	Y	Z
VC1	523193.17	1428982.00	981.77
VC2	518959.50	1431614.00	953.88
VC3	524143.17	1436056.00	860.26
VC4	518197.50	1426571.50	1142.29
VC5	520415.33	1437675.33	822.09
VC6	522484.67	1426833.33	1055.29
VC7	524195.67	1433151.00	914.19
VC8	515844.50	1436641.00	837.82
VC9	519031.50	1436218.00	836.95
VC10	519422.67	1430205.00	993.96
VC11	517139.50	1428822.00	1101.83
VC12	525565.33	1427604.67	945.11

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	8325.7	8085.7	56.930	-52.712	0.0000	-0.0008	0.0007
VC2	5412.0	5717.0	-4.298	-2.973	0.0000	0.0001	0.0001
VC3	9715.3	2916.3	86.126	55.858	0.0000	-0.0003	-0.0002
VC4	4337.5	9434.5	-26.872	-81.050	0.0000	0.0003	0.0009
VC5	7091.3	1348.7	30.985	88.775	0.0000	-0.0002	-0.0006
VC6	7587.0	9629.0	41.411	-85.127	0.0000	-0.0003	0.0006
VC7	9474.3	5081.0	81.063	10.395	0.0000	-0.0010	-0.0001
VC8	3564.0	1671.0	-43.135	81.996	0.0000	0.0003	-0.0006
VC9	5910.0	2303.0	6.162	68.728	0.0000	-0.0001	-0.0012
VC10	5623.0	6813.0	0.137	-25.990	0.0000	-0.0000	0.0007
VC11	3760.0	7636.0	-39.009	-43.279	0.0000	0.0008	0.0009
VC12	9945.3	9326.7	90.967	-78.772	-0.0000	0.0005	-0.0004

Mean Differenence in dX and dY: -0.0001 0.0001
Standard Deviation in dX and dY: 0.0005 0.0007

Initial Approximations:
Omega = 0.000
Phi = 0.000

```
Kappa   =   7.257
XL      =  520716.0
YL      =  1431697.8
ZL      =  20286.7


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1841765

Omega   =    -0.80  (Degrees)
Phi     =    -0.09  (Degrees)
Kappa   =     7.39  (Degrees)
XL      =  519172.2
YL      =  1432106.3
ZL      =  20227.3

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  18.76997
  -7.02831  21.28892
   0.90331  -0.38830   0.50581
  -136.13714  418.47882  -7.60783  8238.727
  -377.91099  140.39348  -18.87905  2718.834  7621.281
  -14.01625  44.09940  -0.77341  853.300  283.551  263.263

Standard Deviation for Omega: 893.63  (Seconds)
Standard Deviation for   Phi: 951.70  (Seconds)
Standard Deviation for Kappa: 146.70  (Seconds)
Standard Deviation for    XL:  90.77  (Meters)
Standard Deviation for    YL:  87.30  (Meters)
Standard Deviation for    ZL:  16.23  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1   8.84  -6.28
     VC2  -1.37  -0.40
     VC3  10.12   9.37
     VC4  -10.61  -0.93
     VC5   7.58   7.78
     VC6   2.16  -7.88
     VC7   8.25   3.52
     VC8  -15.16   3.25
     VC9  -2.38   9.58
    VC10   0.36  -3.37
    VC11  -13.42  -3.74
    VC12   5.82  -10.84

    Col RMS =   8.54
    Row RMS =   6.51
```

Single Space Resection for
E:\WRANGELL\SCANS\4223\AB581003013ROLL_4223_A.LAN

Number of points processed: 15

Ground Control Coordinates

Point Name	X	Y	Z
VC4	529951.50	1436089.00	839.00
VC25	527657.50	1436240.00	849.33
VC27	523871.17	1436006.00	862.13
VC28	520866.50	1434452.00	883.80
VC29	519623.50	1436046.00	837.80
VC31	521687.50	1432027.00	945.00
VC34	530888.50	1436824.00	849.90
VC37	526804.50	1428415.00	914.00
VC38	526346.50	1432093.00	908.50
VC39	526329.50	1436820.00	845.68
VC40	529741.50	1429412.00	858.95
VC41	520751.50	1428395.00	1036.06
VC42	522380.50	1426792.00	1053.95
VC43	523866.50	1429217.00	982.43
VC44	531480.50	1427376.00	908.02

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC4	9447.0	3623.0	80.718	40.594	0.0000	-0.0007	-0.0004
VC25	7762.0	3255.0	45.312	48.334	0.0000	-0.0008	-0.0009
VC27	4922.0	3004.3	-14.365	53.620	0.0000	0.0003	-0.0011
VC28	2505.0	3826.0	-65.161	36.379	0.0000	0.0010	-0.0005
VC29	1763.0	2507.0	-80.744	64.086	0.0000	0.0003	-0.0002
VC31	2845.0	5717.0	-58.032	-3.337	0.0000	0.0012	0.0001
VC34	10222.0	3181.0	97.008	49.872	0.0000	-0.0000	-0.0000
VC37	6259.0	8958.0	13.683	-71.428	0.0000	-0.0002	0.0011
VC38	6331.0	6181.0	15.218	-13.106	0.0000	-0.0004	0.0004
VC39	6841.0	2679.0	25.963	60.437	0.0000	-0.0005	-0.0011
VC40	8555.0	8519.0	61.934	-62.224	0.0000	-0.0006	0.0006
VC41	1726.0	8326.0	-81.568	-58.124	0.0000	0.0004	0.0003
VC42	2773.0	9699.0	-59.578	-86.967	0.0000	0.0001	0.0002
VC43	4162.0	8049.0	-30.375	-52.322	0.0000	0.0006	0.0010

```
    VC44        9617.0  10218.0    84.239   -97.916  -0.0000   0.0008  -
0.0009

Mean Differenence in dX and dY:  0.0001  -0.0001
Standard Deviation in dX and dY:   0.0006   0.0007


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =   8.303
XL      =  525483.1
YL      =  1432413.6
ZL      =  20277.9


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1957843

Omega   =    -0.62  (Degrees)
Phi     =    -0.45  (Degrees)
Kappa   =     8.48  (Degrees)
XL      =  525121.4
YL      =  1432981.5
ZL      =  20217.1

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  13.17394
  -1.53442  10.76671
   0.08790  -0.13614   0.36477
  -31.42498  216.10754  -2.86864  4348.046
  -263.70205  31.39944  -1.83590  642.736  5288.943
  11.42672   9.02396  -0.04832  178.301  -224.130  155.385

Standard Deviation for Omega: 748.66  (Seconds)
Standard Deviation for   Phi: 676.81  (Seconds)
Standard Deviation for Kappa: 124.58  (Seconds)
Standard Deviation for    XL:  65.94  (Meters)
Standard Deviation for    YL:  72.73  (Meters)
Standard Deviation for    ZL:  12.47  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC4   9.28   7.17
    VC25   3.31   7.29
    VC27  -0.84   5.84
    VC28  -8.18   6.44
    VC29  -4.97   9.64
    VC31  -7.07  -0.42
```

VC34	6.60	7.90
VC37	-3.66	-1.52
VC38	1.04	-1.22
VC39	2.63	10.26
VC40	15.67	-14.08
VC41	-14.16	-6.14
VC42	-8.97	-11.30
VC43	-3.97	-5.20
VC44	13.70	-14.66

Col RMS = 8.30
Row RMS = 8.37

Single Space Resection for F:\NPS_WRST\4224\AB581003013ROLL_4224_A.LAN

Number of points processed: 18

Ground Control Coordinates

Point Name	X	Y	Z
VC1	529333.50	1437644.33	837.00
VC2	535960.83	1432330.33	965.49
VC3	526920.50	1428309.00	914.00
VC4	535353.00	1438081.50	873.86
VC5	526314.50	1435119.25	869.00
VC6	532979.75	1429080.75	914.02
VC7	532120.10	1435475.60	867.34
VC8	536700.50	1429721.50	975.00
VC9	526781.00	1431907.75	904.63
VC10	525494.17	1438915.00	818.03
VC11	533071.50	1439853.00	839.15
VC12	536240.50	1434900.33	930.00
VC13	530249.50	1439890.00	824.00
VC14	530822.50	1428195.00	885.04
VC15	531647.50	1431728.67	882.58
VC16	532586.50	1438101.00	853.00
VC17	529229.17	1433723.67	856.03
VC18	533302.50	1434442.33	895.75

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	4656.2	2428.6	-21.012	65.735	0.0000	0.0004	-0.0011
VC2	8995.7	7108.0	70.102	-32.600	0.0000	-0.0010	0.0005
VC3	1800.8	9068.0	-81.112	-73.666	0.0000	0.0000	0.0000
VC4	9186.3	2779.7	74.173	58.301	0.0000	-0.0005	-0.0004
VC5	2119.8	3954.0	-74.332	33.734	0.0000	0.0009	-0.0004
VC6	6402.5	9172.8	15.582	-75.927	0.0000	-0.0002	0.0011
VC7	6485.5	4345.7	17.397	25.448	0.0000	-0.0005	-0.0007
VC8	9249.8	9124.5	75.414	-74.954	0.0000	-0.0001	0.0001
VC9	2102.8	6385.8	-74.724	-17.338	0.0000	0.0011	0.0002
VC10	1939.5	1054.8	-78.078	94.628	-0.0000	-0.0005	0.0006
VC11	7685.0	1214.0	42.649	91.203	0.0000	-0.0002	-0.0004
VC12	9491.8	5233.3	80.554	6.767	0.0000	-0.0010	-0.0001
VC13	5595.0	867.0	-1.263	98.520	0.0000	0.0000	-0.0005

```
    VC14        4697.0   9576.0   -20.261   -84.373   0.0000   0.0002
0.0009
    VC15        5710.3   7063.0     1.069   -31.609   0.0000  -0.0000
0.0008
    VC16        7132.3   2453.0    31.016    65.189   0.0000  -0.0005  -
0.0010
    VC17        4137.0   5315.0   -31.964     5.123   0.0000   0.0008  -
0.0001
    VC18        7249.5   5242.3    33.438     6.608   0.0000  -0.0009  -
0.0002

Mean Differenence in dX and dY: -0.0001  -0.0000
Standard Deviation in dX and dY:   0.0006   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =   8.486
XL      =  531394.9
YL      =  1434301.1
ZL      =  20209.2


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1976598

Omega   =    -0.34  (Degrees)
Phi     =    -0.35  (Degrees)
Kappa   =     8.67  (Degrees)
XL      =  531160.6
YL      =  1433822.6
ZL      =  20226.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  10.28584
  -1.25444  12.22042
   0.08978   0.14145   0.33319
  -24.65261  243.91471   3.02221  4877.317
  -206.71697  24.93330  -1.84700  489.922  4163.255
  -4.14538  -1.33273  -0.05809  -28.211  80.272  125.560

Standard Deviation for Omega: 661.52  (Seconds)
Standard Deviation for   Phi: 721.05  (Seconds)
Standard Deviation for Kappa: 119.06  (Seconds)
Standard Deviation for    XL:  69.84  (Meters)
Standard Deviation for    YL:  64.52  (Meters)
Standard Deviation for    ZL:  11.21  (Meters)



Residuals for the points entered
```

Point ID	Cols	Rows
VC1	-4.90	9.10
VC2	9.59	-4.76
VC3	-13.59	-10.55
VC4	12.94	6.48
VC5	-12.71	4.55
VC6	2.09	-10.32
VC7	2.66	3.59
VC8	10.34	-10.60
VC9	-11.46	-3.37
VC10	-16.27	12.96
VC11	4.94	9.81
VC12	12.01	0.50
VC13	2.03	8.63
VC14	-5.02	-16.49
VC15	-0.29	-4.80
VC16	8.22	5.49
VC17	-5.65	-0.82
VC18	5.07	0.65

Col RMS = 9.03
Row RMS = 8.12

Single Space Resection for F:\NPS_WRST\131\AB642700260ROLL_131_A.LAN

Number of points processed: 6

Ground Control Coordinates

Point Name	X	Y	Z
VC1	537825.33	1406965.33	1509.37
VC2	538204.00	1412627.00	2355.40
VC3	533506.24	1407005.40	1155.58
VC4	536095.00	1414399.50	1364.25
VC5	536850.33	1410169.00	1736.09
VC6	530345.49	1413153.10	1004.78

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	7363.5	8675.5	36.210	-59.249	0.0000	-0.0000	0.0000
VC2	8629.0	3886.3	62.959	41.301	0.0000	-0.0000	-0.0000
VC3	3712.0	7933.0	-40.484	-43.540	0.0000	0.0001	0.0001
VC4	6964.8	2241.3	28.048	75.905	-0.0000	0.0000	0.0000
VC5	7024.0	5836.7	29.172	0.387	0.0000	-0.0001	-0.0000
VC6	2056.0	2517.0	-75.096	70.267	-0.0000	-0.0002	0.0002

Mean Differenence in dX and dY: -0.0001 0.0001
Standard Deviation in dX and dY: 0.0001 0.0001

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 9.725
XL = 535471.1
YL = 1410719.9
ZL = 18874.5

A solution has been found after 4 iterations
Standard Deviation of unit weight = 0.5902581

Omega = 1.73 (Degrees)
Phi = -0.96 (Degrees)
Kappa = 10.07 (Degrees)
XL = 535001.7
YL = 1409355.4
ZL = 18562.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  506.76427
  -228.69869  454.37253
  37.41172  -8.99431  14.37261
  -3947.27244  7955.51511  -143.01104  139493.932
  -8883.59153  4038.13369  -658.41599  69713.399  155935.688
  -623.50221  -219.46833  -57.75812  -4070.307  10625.603  4844.125

Standard Deviation for Omega: 4643.31  (Seconds)
Standard Deviation for   Phi: 4396.74  (Seconds)
Standard Deviation for Kappa: 781.98  (Seconds)
Standard Deviation for    XL: 373.49  (Meters)
Standard Deviation for    YL: 394.89  (Meters)
Standard Deviation for    ZL:  69.60  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  21.62  -0.07
     VC2   0.90  12.43
     VC3  -29.35  -42.42
     VC4  10.72  -2.94
     VC5  13.54   4.57
     VC6  -18.44  28.04

    Col RMS =  18.11
    Row RMS =  21.49
```

Single Space Resection for
E:\WRANGELL\SCANS\4225\AB581003013ROLL_4225_A.LAN

Number of points processed: 14

Ground Control Coordinates

Point Name	X	Y	Z
VC1	542045.50	1431447.50	912.18
VC2	539058.50	1430832.00	965.00
VC3	538222.50	1433858.00	927.73
VC4	538755.50	1437341.00	869.33
VC5	539692.50	1439286.00	915.95
VC6	531448.50	1437885.00	851.48
VC7	532338.50	1428685.00	910.38
VC8	532119.50	1435455.00	867.32
VC9	535277.50	1436245.00	913.00
VC10	535781.50	1432341.00	961.38
VC11	533625.50	1433033.00	913.00
VC12	542580.50	1435175.00	914.00
VC13	538254.50	1439006.00	910.00
VC14	541513.50	1438174.00	945.00

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	8927.5	8841.5	68.959	-69.096	0.0000	-0.0004	0.0004
VC2	6623.0	8955.0	20.531	-71.464	0.0000	-0.0003	0.0011
VC3	6363.0	6594.0	15.085	-21.877	0.0000	-0.0004	0.0006
VC4	7161.0	4087.0	31.873	30.768	0.0000	-0.0008	-0.0007
VC5	8090.0	2755.0	51.406	58.737	0.0000	-0.0007	-0.0008
VC6	1813.0	2829.0	-80.500	57.225	0.0000	0.0004	-0.0003
VC7	1342.0	9744.0	-90.451	-88.000	-0.0000	-0.0007	-0.0007
VC8	2013.0	4694.0	-76.310	18.055	0.0000	0.0010	-0.0002
VC9	4452.0	4480.0	-25.056	22.533	0.0000	0.0007	-0.0006
VC10	4351.0	7437.0	-27.200	-39.568	0.0000	0.0006	0.0009
VC11	2832.0	6664.0	-59.115	-23.323	0.0000	0.0011	0.0004
VC12	9764.0	6136.0	86.558	-12.281	0.0000	-0.0009	0.0001
VC13	6987.0	2793.5	28.227	57.935	0.0000	-0.0005	-0.0011
VC14	9315.0	3789.0	77.140	37.013	0.0000	-0.0008	-0.0004

Mean Differenence in dX and dY: -0.0001 -0.0001
Standard Deviation in dX and dY: 0.0007   0.0007

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   =   9.243
XL   = 537193.9
YL   = 1434911.7
ZL   = 20164.7

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1912246

Omega   =   0.76 (Degrees)
Phi   =   0.08 (Degrees)
Kappa   =   9.11 (Degrees)
XL   = 537099.9
YL   = 1434825.3
ZL   = 20204.9

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  17.41626
   2.54934  15.01020
   0.03584  -0.18847   0.44821
  49.10683  299.73490  -3.85394  5995.993
  -344.92424  -48.96168  -0.78651  -942.008  6841.750
   7.01363  -4.53562   0.08719  -92.279  -139.853  170.718
```

Standard Deviation for Omega: 860.80 (Seconds)
Standard Deviation for   Phi: 799.13 (Seconds)
Standard Deviation for Kappa: 138.09 (Seconds)
Standard Deviation for   XL: 77.43 (Meters)
Standard Deviation for   YL: 82.71 (Meters)
Standard Deviation for   ZL: 13.07 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	10.52	-12.19
VC2	1.31	-10.59
VC3	7.01	-6.02
VC4	1.97	7.56
VC5	4.46	8.19
VC6	-10.32	13.01
VC7	-11.05	-14.85
VC8	-9.54	5.23
VC9	-0.23	4.69

VC10	-4.93	-5.95
VC11	-7.15	-1.91
VC12	14.21	-2.34
VC13	0.30	9.09
VC14	3.39	6.44

Col RMS = 7.53
Row RMS = 8.57

Single Space Resection for
E:\WRANGELL\SCANS\4226\AB581003013ROLL_4226_A.LAN

Number of points processed: 13

Ground Control Coordinates

Point Name	X	Y	Z
VC1	538681.50	1437337.00	868.00
VC2	539008.50	1433457.00	927.15
VC3	539310.50	1429222.00	976.77
VC4	542527.50	1430699.00	905.47
VC5	547041.50	1432906.50	1606.41
VC6	545455.50	1438494.00	960.97
VC7	546188.50	1439852.00	981.20
VC8	543448.50	1435780.00	930.32
VC9	542219.50	1438531.00	948.07
VC11	539607.50	1439317.00	915.00
VC12	547194.50	1434010.00	1313.74
VC13	546433.50	1436998.00	980.07
VC14	542995.50	1439720.00	964.57

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	2291.0	3987.0	-69.075	33.370	0.0000	0.0010	-0.0005
VC2	2119.0	6906.0	-72.719	-27.931	0.0000	0.0010	0.0004
VC3	1887.0	10119.0	-77.629	-95.407	-0.0000	-0.0005	-0.0006
VC4	4472.0	9315.0	-23.299	-78.545	0.0000	0.0003	0.0010
VC5	8178.5	8223.5	54.599	-55.657	0.0000	-0.0007	0.0008
VC6	7462.0	3814.0	39.587	36.954	0.0000	-0.0009	-0.0008
VC7	8153.0	2875.0	54.118	56.668	0.0000	-0.0007	-0.0008
VC8	5687.0	5625.0	2.270	-1.062	0.0000	-0.0001	0.0000
VC9	5049.0	3453.0	-11.114	44.558	0.0000	0.0003	-0.0011
VC11	3177.0	2607.0	-50.443	62.343	0.0000	0.0006	-0.0008
VC12	8371.0	7366.0	58.653	-37.650	0.0000	-0.0010	0.0006
VC13	8046.5	5024.5	51.857	11.527	0.0000	-0.0011	-0.0003
VC14	5753.0	2649.0	3.687	61.437	0.0000	-0.0001	-0.0012

Mean Differenence in dX and dY: -0.0001 -0.0002
Standard Deviation in dX and dY: 0.0007 0.0007

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   =   7.999
XL   = 543085.6
YL   = 1435871.0
ZL   = 20211.3

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1869809

Omega   =   0.69 (Degrees)
Phi   =   -0.27 (Degrees)
Kappa   =   7.87 (Degrees)
XL   = 543207.6
YL   = 1435597.8
ZL   = 20200.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  20.13749
  11.90279 39.03814
   0.10903 -0.43661   0.51620
  232.71187 767.04965 -8.59253 15082.267
  -397.29671 -232.13603 -2.10183 -4538.188 7849.248
   1.37477 -35.39036   0.57675 -695.470 -32.167 227.204

Standard Deviation for Omega: 925.61 (Seconds)
Standard Deviation for   Phi: 1288.75 (Seconds)
Standard Deviation for Kappa: 148.19 (Seconds)
Standard Deviation for   XL: 122.81 (Meters)
Standard Deviation for   YL: 88.60 (Meters)
Standard Deviation for   ZL: 15.07 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	-8.12	7.24
VC2	-7.58	-1.21
VC3	-10.62	-10.79
VC4	-2.14	-17.66
VC5	11.41	-7.60
VC6	1.33	5.52
VC7	6.29	4.36
VC8	1.37	-1.91
VC9	-2.78	4.94
VC11	-11.52	8.92
VC12	15.18	-0.07
VC13	6.06	0.64

VC14 0.46 8.07

Col RMS = 7.95
Row RMS = 7.66

Single Space Resection for
E:\WRANGELL\SCANS\4227\AB581003013ROLL_4227_A.LAN

Number of points processed: 20

Ground Control Coordinates

Point Name	X	Y	Z
VC1	546507.50	1436988.00	980.40
VC2	545196.50	1438958.00	975.00
VC3	543029.50	1439779.00	965.98
VC5	544339.50	1434456.00	937.78
VC6	548263.50	1438594.00	962.27
VC7	550368.50	1438056.00	925.20
VC8	552034.50	1441098.00	1027.09
VC9	553519.50	1438338.00	940.01
VC10	548738.50	1440038.00	966.63
VC12	551173.50	1434854.00	1145.19
VC13	553698.50	1435524.00	1006.95
VC15	544378.50	1430223.00	884.00
VC16	553474.50	1440249.00	1012.41
VC17	551117.50	1439143.00	963.43
VC18	550379.50	1436411.00	1066.06
VC19	547951.50	1435114.00	1108.52
VC20	551228.50	1431872.00	1419.37
VC21	553552.50	1432647.00	1298.30
VC22	554781.50	1436929.00	916.35
VC23	543894.50	1436274.00	944.85

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	3601.7	4775.0	-43.070	16.366	0.0000	0.0010	-0.0004
VC2	2842.0	3156.0	-59.025	50.371	0.0000	0.0008	-0.0007
VC3	1308.0	2299.0	-91.258	68.376	-0.0000	-0.0002	0.0001
VC5	1704.0	6409.0	-82.956	-17.943	0.0000	0.0009	0.0002
VC6	5101.0	3774.0	-11.558	37.382	0.0000	0.0003	-0.0009
VC7	6618.0	4416.0	20.316	23.893	0.0000	-0.0005	-0.0006
VC8	8219.0	2324.0	53.970	67.823	0.0000	-0.0006	-0.0007
VC9	9003.0	4559.0	70.433	20.881	0.0000	-0.0011	-0.0003
VC10	5620.0	2752.0	-0.647	58.844	0.0000	0.0000	-0.0012
VC12	6866.0	6899.0	25.515	-28.255	0.0000	-0.0006	0.0007
VC13	8826.0	6673.0	66.703	-23.516	0.0000	-0.0011	0.0004

```
    VC15        1277.0   9551.0   -91.946   -83.931  -0.0000  -0.0006  -
0.0006
    VC16        9197.0   3124.0    74.517    51.018   0.0000  -0.0007  -
0.0004
    VC17        7295.0   3689.0    34.546    39.159   0.0000  -0.0008  -
0.0009
    VC18        6447.0   5640.0    16.716    -1.812   0.0000  -0.0005
0.0001
    VC19        4464.0   6343.0   -24.957   -16.568   0.0000   0.0007
0.0004
    VC20        6582.0   9190.0    19.536   -76.369   0.0000  -0.0003
0.0010
    VC21        8421.0   8839.0    58.182   -69.005   0.0000  -0.0005
0.0006
    VC22        9771.0   5744.0    86.566    -4.010   0.0000  -0.0009
0.0000
    VC23        1572.0   5013.0   -85.722    11.376   0.0000   0.0009  -
0.0001

Mean Differenence in dX and dY: -0.0002  -0.0002
Standard Deviation in dX and dY:   0.0007   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =   8.753
XL      =  549381.4
YL      =  1436777.3
ZL      =  20287.3


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1730618

Omega   =    -0.63  (Degrees)
Phi     =    -0.45  (Degrees)
Kappa   =     8.59  (Degrees)
XL      =  549182.4
YL      =  1436581.0
ZL      =  20195.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  11.04139
   2.50071   8.87218
   0.14330   0.10444   0.27531
  49.19013  176.24988   2.17784  3507.277
  -216.39361  -48.54679  -2.81976  -954.838  4246.921
   2.31488  -4.80820  -0.01559  -96.737  -46.691  104.294

Standard Deviation for Omega: 685.39  (Seconds)
Standard Deviation for   Phi: 614.38  (Seconds)
```

Standard Deviation for Kappa: 108.23 (Seconds)
Standard Deviation for XL: 59.22 (Meters)
Standard Deviation for YL: 65.17 (Meters)
Standard Deviation for ZL: 10.21 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	-7.29	2.37
VC2	-4.88	8.71
VC3	-4.98	14.67
VC5	-8.79	-10.73
VC6	-2.69	3.74
VC7	5.02	2.91
VC8	6.31	10.69
VC9	11.96	1.38
VC10	-1.43	10.21
VC12	0.89	-5.84
VC13	11.79	-4.13
VC15	-11.32	-10.10
VC16	7.28	6.55
VC17	-2.10	5.90
VC18	5.01	-2.33
VC19	-8.12	0.07
VC20	0.79	-13.17
VC21	0.63	-16.67
VC22	8.98	-4.60
VC23	-7.02	0.66

Col RMS = 6.87
Row RMS = 8.26

Single Space Resection for
E:\WRANGELL\SCANS\4228\AB581003013ROLL_4228_A.LAN

Number of points processed: 13

Ground Control Coordinates

Point Name	X	Y	Z
VC1	550850.50	1439494.00	971.13
VC2	551419.50	1441148.00	1021.92
VC3	553530.50	1437299.00	917.97
VC4	555089.50	1441103.00	1048.98
VC5	557457.50	1438916.00	1296.13
VC6	557585.50	1442292.00	1107.29
VC9	561164.50	1433602.00	1222.03
VC10	561729.50	1434573.00	1316.85
VC12	558630.50	1441803.00	1118.43
VC13	550378.50	1436097.00	1101.19
VC14	548974.50	1439254.00	939.00
VC15	551329.50	1432499.00	1383.09
VC16	556105.50	1432872.00	1091.80

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	2549.0	3512.0	-64.320	43.276	0.0000	0.0009	-0.0006
VC2	3168.0	2344.0	-51.341	67.822	0.0000	0.0006	-0.0007
VC3	4289.0	5469.0	-27.710	2.220	0.0000	0.0008	-0.0001
VC4	5909.0	2821.0	6.268	57.873	0.0000	-0.0001	-0.0012
VC5	7445.0	4736.0	38.590	17.695	0.0000	-0.0009	-0.0004
VC6	7943.0	2229.0	48.995	70.359	0.0000	-0.0005	-0.0007
VC9	9558.0	9180.0	83.100	-75.583	-0.0000	0.0001	-0.0001
VC10	10141.0	8547.0	95.336	-62.274	-0.0000	0.0002	-0.0001
VC12	8666.0	2728.0	64.200	59.897	0.0000	-0.0006	-0.0006
VC13	1765.0	5986.0	-80.735	-8.702	0.0000	0.0010	0.0001
VC14	1122.0	3465.0	-94.309	44.227	0.0000	0.0003	-0.0001
VC15	1974.0	8835.0	-76.276	-68.531	0.0000	0.0003	0.0002
VC16	5661.0	9088.0	1.207	-73.749	0.0000	-0.0000	0.0011

Mean Differenence in dX and dY: 0.0001 -0.0002
Standard Deviation in dX and dY: 0.0006 0.0006

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   =   9.165
XL   = 554942.0
YL   = 1437765.5
ZL   = 20168.2

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1962396

Omega   =   -0.36 (Degrees)
Phi   =   -0.34 (Degrees)
Kappa   =   9.23 (Degrees)
XL   = 555166.8
YL   = 1437568.3
ZL   = 20214.8

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  21.18463
  -4.64257  13.14540
   0.12608   0.00385   0.41664
  -90.56201  261.98403   0.21511  5233.127
  -416.84019  90.17568  -2.35096  1758.534  8213.750
   8.92922   2.05300   0.06348  43.513  -177.523  156.283
```

Standard Deviation for Omega: 949.37 (Seconds)
Standard Deviation for   Phi: 747.85 (Seconds)
Standard Deviation for Kappa: 133.14 (Seconds)
Standard Deviation for   XL: 72.34 (Meters)
Standard Deviation for   YL: 90.63 (Meters)
Standard Deviation for   ZL: 12.50 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	-4.86	5.27
VC2	-5.04	11.32
VC3	-0.82	-3.22
VC4	-3.81	5.30
VC5	6.61	1.03
VC6	10.65	5.87
VC9	0.19	-13.55
VC10	15.47	-1.64
VC12	9.47	9.55
VC13	-0.19	-0.74
VC14	-8.73	6.17
VC15	-15.57	-13.84

```
VC16  -3.47  -11.27

Col RMS =   8.23
Row RMS =   8.15
```

Single Space Resection for
E:\WRANGELL\SCANS\4229\AB581003013ROLL_4229_A.LAN

Number of points processed: 11

Ground Control Coordinates

Point Name	X	Y	Z
VC4	565800.50	1442778.00	1398.25
VC7	557453.50	1438213.00	1282.39
VC14	556468.00	1435941.00	905.70
VC15	556834.00	1442696.00	1127.73
VC16	555496.00	1441796.00	1073.07
VC17	560234.00	1434218.00	1412.76
VC21	558271.00	1434220.00	895.33
VC22	560011.50	1442336.00	1156.91
VC23	563062.50	1437655.00	1611.92
VC24	567981.50	1433191.00	1219.73
VC25	564708.50	1433924.50	1404.36

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC4	9848.0	3160.0	87.139	52.898	0.0000	-0.0003	-0.0002
VC7	2812.0	5213.0	-60.668	9.598	0.0000	0.0012	-0.0002
VC14	1779.0	6723.0	-82.338	-22.141	0.0000	0.0009	0.0002
VC15	3100.0	1774.0	-54.706	81.831	0.0000	0.0003	-0.0004
VC16	1963.0	2232.0	-78.588	72.183	0.0000	0.0001	-0.0001
VC17	4234.5	8673.0	-30.685	-63.031	0.0000	0.0005	0.0010
VC21	2832.0	8267.0	-60.169	-54.541	0.0000	0.0007	0.0007
VC22	5421.0	2562.0	-5.910	65.341	0.0000	0.0001	-0.0012
VC23	6957.0	6575.0	26.473	-18.898	0.0000	-0.0007	0.0005
VC24	9859.0	10671.0	87.567	-104.849	-0.0000	0.0011	-0.0014
VC25	7557.5	9629.0	39.172	-83.023	0.0000	-0.0003	0.0007

Mean Differenence in dX and dY: 0.0003 -0.0000
Standard Deviation in dX and dY: 0.0006 0.0008

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 12.241
XL = 560574.6

```
YL      =  1437906.2
ZL      =  20272.5


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1585467

Omega   =    -0.37  (Degrees)
Phi     =    -0.34  (Degrees)
Kappa   =    12.31  (Degrees)
XL      =  561137.9
YL      =  1438553.1
ZL      =  20207.3

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  11.35976
  -3.73601   8.10984
   0.05292  -0.12986   0.29929
  -71.46492  160.16534  -2.71847  3172.748
  -222.86623  71.77089  -0.82408  1371.763  4381.823
   7.18899   0.22216  -0.00958   9.044  -138.099  112.916

Standard Deviation for Omega: 695.20  (Seconds)
Standard Deviation for   Phi: 587.40  (Seconds)
Standard Deviation for Kappa: 112.84  (Seconds)
Standard Deviation for    XL:  56.33  (Meters)
Standard Deviation for    YL:  66.20  (Meters)
Standard Deviation for    ZL:  10.63  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC4   0.26  11.22
     VC7  -4.36   2.53
    VC14  -3.00  -5.85
    VC15  -6.32   4.53
    VC16  -9.44   1.47
    VC17  -2.36  -7.36
    VC21  -1.81  -13.81
    VC22   6.52   5.22
    VC23   6.64   6.05
    VC24  11.22   0.84
    VC25   2.46  -5.30

    Col RMS =   5.91
    Row RMS =   6.92
```

Single Space Resection for
E:\WRANGELL\SCANS\4230\AB581003013ROLL_4230_A.LAN

Number of points processed: 12

Ground Control Coordinates

Point Name	X	Y	Z
VC2	564655.50	1433994.00	1415.82
VC3	564181.50	1435267.00	1705.67
VC4	566935.50	1438934.00	1003.02
VC5	563079.50	1441995.00	1153.39
VC6	562239.50	1438394.00	1811.43
VC7	561136.50	1442900.00	1247.45
VC8	565760.50	1443838.00	1229.12
VC9	568981.50	1443146.00	1252.04
VC10	571578.50	1444341.00	1301.57
VC11	571839.50	1441180.00	1098.99
VC13	573207.50	1436131.00	873.63
VC14	569925.50	1440052.00	1456.60

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC2	2637.0	9732.0	-62.495	-84.931	0.0000	0.0001	0.0002
VC3	2433.0	8751.0	-66.790	-64.330	0.0000	0.0005	0.0005
VC4	5177.0	6377.0	-9.149	-14.441	0.0000	0.0003	0.0004
VC5	2783.0	3479.0	-59.482	46.395	0.0000	0.0009	-0.0007
VC6	1428.0	6044.0	-87.933	-7.489	0.0000	0.0008	0.0001
VC7	1447.0	2472.0	-87.567	67.530	-0.0000	-0.0000	0.0000
VC8	5085.0	2525.0	-11.117	66.456	0.0000	0.0002	-0.0012
VC9	7396.0	3566.0	37.455	44.618	0.0000	-0.0008	-0.0009
VC10	9556.0	3084.0	82.841	54.766	0.0000	-0.0004	-0.0003
VC11	9195.0	5503.0	75.276	3.958	0.0000	-0.0011	-0.0001
VC13	9349.0	9419.0	78.548	-78.284	-0.0000	0.0000	-0.0000
VC14	7626.0	6042.0	42.310	-7.379	0.0000	-0.0010	0.0002

Mean Differenence in dX and dY: -0.0000 -0.0001
Standard Deviation in dX and dY: 0.0007   0.0005

Initial Approximations:
Omega   =   0.000

```
Phi     =   0.000
Kappa   =  11.994
XL      =  566960.1
YL      =  1440014.3
ZL      =  20389.9


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1874616

Omega   =    -0.81  (Degrees)
Phi     =     0.15  (Degrees)
Kappa   =    12.22  (Degrees)
XL      =  567359.5
YL      =  1440217.5
ZL      =  20156.0

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  16.96053
  -4.72058  13.46759
  -0.49308   0.14186   0.43857
  -93.94552  265.16364   2.84643  5232.173
  -330.29561  92.80976   9.77118  1846.876  6443.643
  12.67852  -5.76741  -0.37082  -110.510  -245.520  160.759

Standard Deviation for Omega: 849.46  (Seconds)
Standard Deviation for   Phi: 756.95  (Seconds)
Standard Deviation for Kappa: 136.60  (Seconds)
Standard Deviation for    XL:  72.33  (Meters)
Standard Deviation for    YL:  80.27  (Meters)
Standard Deviation for    ZL:  12.68  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC2  -4.54  -12.10
     VC3  -6.60  -9.51
     VC4   2.06  -1.80
     VC5  -2.75   5.09
     VC6  -11.12  -2.73
     VC7  -11.45   5.88
     VC8   1.41  10.90
     VC9   3.37   8.44
    VC10   0.03  11.06
    VC11   5.72  -0.97
    VC13  12.86  -11.12
    VC14  11.68  -3.14

    Col RMS =   7.52
    Row RMS =   7.93
```

Single Space Resection for
E:\WRANGELL\SCANS\4231\AB581003013ROLL_4231_A.LAN

Number of points processed: 15

Ground Control Coordinates

Point Name	X	Y	Z
VC1	573981.50	1440312.00	1218.05
VC2	569870.50	1441259.00	1283.33
VC3	570950.50	1440719.00	1405.08
VC4	570330.50	1444650.00	1710.17
VC5	569740.50	1443895.00	1373.23
VC6	575762.50	1441817.00	2075.51
VC7	573867.50	1445090.00	1410.97
VC8	576257.50	1445633.00	1845.58
VC9	579075.50	1442279.00	1592.85
VC10	577904.50	1438088.00	1264.85
VC11	576317.50	1439388.00	1261.38
VC12	572655.50	1437646.00	1302.97
VC13	570714.50	1436582.00	1102.86
VC14	570132.50	1439027.00	1304.43
VC15	574861.50	1436541.00	1417.47

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	5877.0	6725.0	3.598	-23.358	0.0000	-0.0001	0.0006
VC2	2945.0	5338.0	-58.032	5.738	0.0000	0.0012	-0.0001
VC3	3660.0	5925.0	-42.999	-6.582	0.0000	0.0010	0.0002
VC4	3833.0	2815.0	-39.399	58.736	0.0000	0.0006	-0.0010
VC5	3296.0	3332.0	-50.678	47.872	0.0000	0.0008	-0.0008
VC6	7559.0	5918.0	38.935	-6.390	0.0000	-0.0010	0.0002
VC7	6602.0	3138.0	18.794	51.984	0.0000	-0.0004	-0.0011
VC8	8565.0	3071.0	60.045	53.414	0.0000	-0.0008	-0.0007
VC9	10093.0	6120.0	92.190	-10.604	0.0000	-0.0007	0.0001
VC10	8434.0	9037.0	57.359	-71.886	0.0000	-0.0005	0.0006
VC11	7472.0	7811.0	37.129	-46.148	0.0000	-0.0007	0.0009
VC12	4439.0	8519.0	-26.600	-61.052	0.0000	0.0005	0.0011
VC13	2822.0	8957.0	-60.577	-70.270	0.0000	0.0005	0.0005

```
    VC14        2771.0   7055.0   -61.669   -30.324   0.0000   0.0010
0.0005
    VC15        5908.0   9740.0     4.284   -86.679   0.0000  -0.0000
0.0009

Mean Differenence in dX and dY:  0.0001   0.0001
Standard Deviation in dX and dY:   0.0008   0.0007


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  12.798
XL      =  573494.8
YL      =  1440861.7
ZL      =  20172.7


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1427288

Omega   =     0.26  (Degrees)
Phi     =    -0.83  (Degrees)
Kappa   =    12.60  (Degrees)
XL      =  573165.8
YL      =  1441606.5
ZL      =  20200.7

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  12.58377
   0.26898  12.65774
   0.28327   0.01998   0.29662
   4.87395  243.46000   0.14950  4688.088
  -241.56600  -5.07636  -5.45786  -91.940  4642.527
  14.75123   8.60343   0.33978  163.319  -279.385  124.900

Standard Deviation for Omega: 731.70  (Seconds)
Standard Deviation for   Phi: 733.84  (Seconds)
Standard Deviation for Kappa: 112.34  (Seconds)
Standard Deviation for    XL:  68.47  (Meters)
Standard Deviation for    YL:  68.14  (Meters)
Standard Deviation for    ZL:  11.18  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  -3.18  -7.73
     VC2  -10.82   1.04
     VC3  -5.27  -0.91
     VC4  -2.86   8.10
```

VC5	3.84	6.47
VC6	9.28	-1.83
VC7	-1.63	12.99
VC8	5.74	5.98
VC9	13.76	-3.83
VC10	-0.86	-11.19
VC11	2.27	-3.35
VC12	-0.24	0.65
VC13	-5.25	-4.29
VC14	-2.28	-4.47
VC15	-3.08	1.90

Col RMS = 5.98
Row RMS = 6.17

Single Space Resection for
E:\WRANGELL\SCANS\4232\AB581003013ROLL_4232_A.LAN

Number of points processed: 13

Ground Control Coordinates

Point Name	X	Y	Z
VC1	576177.50	1438254.00	990.17
VC2	576588.50	1437821.00	880.95
VC3	574391.50	1440430.00	1339.83
VC4	574826.50	1445047.00	1475.93
VC5	573871.50	1445095.00	1410.51
VC6	577601.50	1442731.00	1970.07
VC7	578469.50	1438331.00	1461.47
VC8	573553.50	1442084.00	1468.04
VC9	582764.50	1445944.00	736.29
VC10	582976.50	1444292.00	665.00
VC11	580885.50	1443538.00	851.46
VC12	583942.50	1439515.00	661.17
VC14	581251.50	1446197.00	1318.36

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	2591.0	8501.0	61.437	-63.461	0.0000	-0.0006	0.0006
VC2	2844.0	8863.0	69.035	-58.137	0.0000	-0.0006	0.0005
VC3	1526.0	6645.0	22.475	-85.878	0.0000	-0.0002	0.0008
VC4	2550.0	3233.0	-49.200	-64.428	0.0000	0.0006	0.0008
VC5	1842.0	3056.0	-52.906	-79.310	0.0000	0.0004	0.0005
VC6	4263.0	5413.0	-3.443	-28.387	0.0000	0.0001	0.0008
VC7	4270.0	8882.0	69.411	-28.171	0.0000	-0.0010	0.0004
VC8	1120.0	5271.0	-6.375	-94.437	0.0000	0.0000	0.0007
VC9	8607.0	3865.0	-36.024	62.865	0.0000	0.0006	-0.0010
VC10	8501.0	5101.0	-10.064	60.662	0.0000	0.0002	-0.0012
VC11	6885.0	5330.0	-5.228	26.708	0.0000	0.0001	-0.0007
VC12	8485.0	8704.0	65.606	60.398	0.0000	-0.0006	-0.0006
VC14	7611.0	3389.0	-46.004	41.926	0.0000	0.0009	-0.0008

Mean Differenence in dX and dY: -0.0000 0.0001
Standard Deviation in dX and dY: 0.0006 0.0008

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   = -78.682
XL   = 578253.9
YL   = 1442252.2
ZL   = 20336.9

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1779655

Omega   =   -0.62 (Degrees)
Phi   =   -0.07 (Degrees)
Kappa   =   -78.29 (Degrees)
XL   = 579280.5
YL   = 1443082.5
ZL   = 20201.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  17.29851
   0.72941  14.46406
  -1.04697  -0.10407   0.51028
  13.69419  285.28844  -2.28077  5637.294
  -337.51924  -12.63897  20.93051  -235.662  6596.019
  20.05355  -6.19486  -1.20599  -113.037  -385.343  189.403
```

Standard Deviation for Omega: 857.89 (Seconds)
Standard Deviation for   Phi: 784.46 (Seconds)
Standard Deviation for Kappa: 147.34 (Seconds)
Standard Deviation for   XL: 75.08 (Meters)
Standard Deviation for   YL: 81.22 (Meters)
Standard Deviation for   ZL: 13.76 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	-5.52	-6.61
VC2	-5.71	-6.87
VC3	-7.38	-6.00
VC4	-3.80	11.64
VC5	-6.60	14.10
VC6	1.02	-8.41
VC7	3.97	-5.24
VC8	-6.92	-2.32
VC9	-2.57	8.18
VC10	1.15	2.12
VC11	9.20	-0.31
VC12	14.43	-9.56

VC14 9.22 9.04

Col RMS = 6.94
Row RMS = 7.89

Single Space Resection for F:\NPS_WRST\4233\AB581003013ROLL_4233_A.LAN

Number of points processed: 11

Ground Control Coordinates

Point Name	X	Y	Z
VC1	583928.50	1439541.00	661.00
VC2	584538.50	1445370.00	649.25
VC3	589495.50	1444918.00	638.92
VC4	580881.00	1447891.00	1562.20
VC5	581998.00	1440101.00	660.00
VC6	581882.00	1444443.00	764.43
VC7	587187.86	1450157.73	640.00
VC8	584587.16	1448072.02	665.50
VC9	591752.99	1439920.64	1149.07
VC10	586263.50	1442759.00	767.49
VC11	586450.50	1445287.00	640.00

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	3981.0	9156.0	-35.304	-72.748	0.0000	0.0004	0.0009
VC2	5164.0	4962.0	-10.488	15.348	0.0000	0.0003	-0.0004
VC3	8735.0	5899.0	64.566	-4.289	0.0000	-0.0012	0.0001
VC4	2662.3	2529.3	-63.088	66.409	0.0000	0.0005	-0.0005
VC5	2627.0	8499.3	-63.765	-58.973	0.0000	0.0006	0.0006
VC6	3080.0	5302.0	-54.280	8.183	0.0000	0.0012	-0.0002
VC7	7688.0	1806.0	42.520	81.660	0.0000	-0.0003	-0.0007
VC8	5541.5	2991.5	-2.577	56.736	0.0000	0.0001	-0.0012
VC9	9928.0	9963.0	89.683	-89.629	-0.0000	0.0007	-0.0007
VC10	6102.0	7085.0	9.247	-29.228	0.0000	-0.0002	0.0008
VC11	6553.0	5260.0	18.704	9.105	0.0000	-0.0005	-0.0003

Mean Differenence in dX and dY: 0.0001 -0.0001
Standard Deviation in dX and dY: 0.0007 0.0007

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 9.361
XL = 585360.5
YL = 1444405.5

```
ZL      =  19625.6


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2070911

Omega   =     1.38  (Degrees)
Phi     =     0.77  (Degrees)
Kappa   =     9.53  (Degrees)
XL      =  585633.4
YL      =  1444028.8
ZL      =  20197.9

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  22.54667
   1.76342  30.05614
  -0.28985  -0.41471   0.73412
  37.37652  599.66125  -8.38376  11980.110
  -450.87037  -38.18518   5.84098  -805.763  9032.279
   4.45989  17.53262  -0.28172  353.595  -95.195  279.140

Standard Deviation for Omega: 979.41  (Seconds)
Standard Deviation for   Phi: 1130.82  (Seconds)
Standard Deviation for Kappa: 176.73  (Seconds)
Standard Deviation for    XL: 109.45  (Meters)
Standard Deviation for    YL:  95.04  (Meters)
Standard Deviation for    ZL:  16.71  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  -3.99  -9.42
     VC2   2.64   6.34
     VC3  -2.20   1.79
     VC4  -9.20  14.06
     VC5  -13.14  -8.54
     VC6  -12.43   0.30
     VC7  10.48   4.72
     VC8  11.39  -2.02
     VC9  13.74  -12.39
    VC10  -1.46  -3.32
    VC11   4.29   8.50

    Col RMS =   8.99
    Row RMS =   7.78
```

Single Space Resection for F:\NPS_WRST\4268\AB581003013ROLL_4268_A.LAN

Number of points processed: 14

Ground Control Coordinates

Point Name	X	Y	Z
VC1	585289.50	1436796.00	803.25
VC2	583521.00	1430315.00	912.59
VC3	591216.00	1439147.25	1269.05
VC4	583371.33	1437199.67	693.39
VC5	585491.50	1427939.50	974.90
VC6	582940.50	1435667.00	706.36
VC7	590780.94	1431609.99	1114.34
VC8	587792.00	1436969.50	1312.74
VC9	585552.00	1438737.00	888.74
VC10	586254.00	1432315.00	940.35
VC11	590327.40	1434622.78	1012.46
VC12	590913.20	1429955.69	966.17
VC13	588292.67	1428705.67	1950.42
VC14	588201.50	1439011.50	1599.58

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	4835.3	2980.7	-16.145	62.123	0.0000	0.0003	-0.0011
VC2	2428.0	7370.5	-66.639	-30.130	0.0000	0.0010	0.0005
VC3	9682.0	2236.4	85.695	77.870	-0.0000	0.0002	0.0002
VC4	3528.0	2369.0	-43.633	74.940	0.0000	0.0004	-0.0008
VC5	3430.5	9443.5	-45.526	-73.645	0.0000	0.0005	0.0008
VC6	2948.0	3413.0	-55.798	52.999	0.0000	0.0008	-0.0007
VC7	7980.0	7688.0	50.045	-36.669	0.0000	-0.0010	0.0007
VC8	6718.0	3219.5	23.425	57.151	0.0000	-0.0005	-0.0011
VC9	5365.5	1598.5	-5.034	91.165	0.0000	0.0000	-0.0008
VC10	4756.7	6394.3	-17.723	-9.574	0.0000	0.0005	0.0003
VC11	8153.7	5433.0	53.645	10.695	0.0000	-0.0011	-0.0002
VC12	7759.0	8922.0	45.428	-62.591	0.0000	-0.0006	0.0009
VC13	5628.5	9559.5	0.669	-76.030	0.0000	-0.0000	0.0011
VC14	7425.0	1713.3	38.251	88.802	0.0000	-0.0002	-0.0005

Mean Differenence in dX and dY: 0.0000 -0.0001

Standard Deviation in dX and dY: 0.0006 0.0008

Initial Approximations:
Omega = 0.000
Phi   = 0.000
Kappa = 13.838
XL   = 587138.8
YL   = 1434213.7
ZL   = 20229.4

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.3055000

Omega = -0.57 (Degrees)
Phi   = -0.37 (Degrees)
Kappa = 13.40 (Degrees)
XL   = 587071.4
YL   = 1433362.7
ZL   = 20310.3

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  53.75292
   3.42280  43.82977
   1.44095   0.87699   1.21229
  69.76425  860.81917  18.49806  16934.392
  -1074.55636  -68.85148  -28.79936  -1402.881  21508.385
  -54.30238  -5.70470  -1.51063  -117.398  1066.402  481.363
```

Standard Deviation for Omega: 1512.26 (Seconds)
Standard Deviation for Phi: 1365.56 (Seconds)
Standard Deviation for Kappa: 227.11 (Seconds)
Standard Deviation for XL: 130.13 (Meters)
Standard Deviation for YL: 146.66 (Meters)
Standard Deviation for ZL: 21.94 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	-12.93	4.97
VC2	-3.92	-5.73
VC3	32.46	19.74
VC4	-8.90	3.10
VC5	-18.31	-9.84
VC6	-13.14	14.74
VC7	21.48	-27.65
VC8	-5.25	-0.02
VC9	-9.12	7.92
VC10	-9.89	-3.54

VC11	8.21	7.67
VC12	12.88	-4.29
VC13	2.04	-13.35
VC14	3.22	6.68

Col RMS = 13.99
Row RMS = 11.68

Single Space Resection for F:\NPS_WRST\4269\AB581003013ROLL_4269_A.LAN

Number of points processed: 15

Ground Control Coordinates

Point Name	X	Y	Z
VC1	584326.50	1434865.00	752.82
VC2	580632.50	1430057.00	865.00
VC3	576618.67	1435634.00	786.55
VC4	579068.50	1428071.50	1189.48
VC5	577643.33	1431874.33	697.00
VC6	584139.50	1438970.00	678.42
VC7	580529.50	1437120.00	739.18
VC8	585111.00	1429429.00	1197.64
VC9	582679.50	1427768.00	1291.24
VC10	586712.50	1433400.00	853.17
VC11	578190.50	1429073.00	912.43
VC12	582577.50	1436584.00	691.90
VC13	581353.50	1433925.00	725.95
VC14	577703.50	1426386.00	1226.09
VC15	576694.50	1434339.00	722.19

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	8156.0	4365.0	54.905	30.795	0.0000	-0.0010	-0.0006
VC2	4624.0	7196.0	-19.128	-28.911	0.0000	0.0005	0.0008
VC3	2705.7	2447.7	-59.777	70.683	0.0000	0.0005	-0.0006
VC4	3080.0	8398.5	-51.495	-54.276	0.0000	0.0008	0.0008
VC5	2793.8	5348.2	-57.721	9.770	0.0000	0.0012	-0.0002
VC6	8732.0	1395.0	66.805	93.216	-0.0000	0.0001	0.0002
VC7	5802.0	2074.0	5.272	78.748	0.0000	-0.0001	-0.0010
VC8	7815.5	8478.0	48.036	-55.614	0.0000	-0.0007	0.0009
VC9	5712.0	9290.0	3.884	-72.815	0.0000	-0.0001	0.0011
VC10	9645.0	5842.0	86.302	-0.122	0.0000	-0.0009	0.0000
VC11	2662.0	7473.0	-60.344	-34.867	0.0000	0.0010	0.0006
VC12	7185.0	2823.0	34.390	63.113	0.0000	-0.0005	-0.0010
VC13	5829.0	4516.0	6.010	27.460	0.0000	-0.0002	-0.0007
VC14	1764.0	9397.0	-79.084	-75.340	0.0000	0.0000	0.0000

```
    VC15        2538.0   3409.0   -63.234    50.480   0.0000   0.0008  -
0.0006

Mean Differenence in dX and dY:  0.0001  -0.0000
Standard Deviation in dX and dY:   0.0007   0.0007


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  13.790
XL      =  580932.1
YL      =  1432499.7
ZL      =  20224.4


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1692957

Omega   =     0.39  (Degrees)
Phi     =     0.27  (Degrees)
Kappa   =    13.56  (Degrees)
XL      =  581480.4
YL      =  1431992.6
ZL      =  20257.4

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  12.92864
   3.53387  15.56604
  -0.31158  -0.43310   0.33959
  68.18540  308.74256  -8.46047  6131.842
  -259.13728  -69.09220   6.34938  -1332.144  5202.087
  -18.06660  -11.72994   0.60229  -226.896  358.944  149.538

Standard Deviation for Omega: 741.65  (Seconds)
Standard Deviation for   Phi: 813.79  (Seconds)
Standard Deviation for Kappa: 120.20  (Seconds)
Standard Deviation for    XL:  78.31  (Meters)
Standard Deviation for    YL:  72.13  (Meters)
Standard Deviation for    ZL:  12.23  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1   8.89   3.74
     VC2   1.75   4.26
     VC3  -10.19   4.50
     VC4  -9.18  -1.51
     VC5  -6.07   5.22
     VC6  10.97  10.32
```

VC7	-0.11	5.38
VC8	7.23	-15.52
VC9	5.64	-10.26
VC10	7.89	0.10
VC11	-3.04	-3.25
VC12	4.19	0.98
VC13	-3.70	-1.33
VC14	-2.02	-10.96
VC15	-12.37	9.48

Col RMS = 7.17
Row RMS = 7.24

Single Space Resection for F:\NPS_WRST\4270\AB581003013ROLL_4270_A.LAN

Number of points processed: 20

Ground Control Coordinates

Point Name	X	Y	Z
VC1	572361.50	1431741.50	818.23
VC2	573726.50	1425311.00	852.30
VC3	578035.50	1435181.00	770.87
VC4	580630.50	1430057.00	864.87
VC5	577500.50	1428400.00	999.03
VC6	579873.50	1433606.00	699.23
VC7	572119.50	1434831.00	1008.79
VC8	574962.50	1434786.00	839.18
VC9	569253.50	1433279.00	1344.77
VC10	580838.00	1428064.50	1258.19
VC11	578099.50	1426391.00	1358.92
VC12	571383.00	1429715.00	761.00
VC13	570588.50	1427347.00	752.00
VC14	577594.50	1431503.00	704.00
VC15	580080.50	1431562.00	729.28
VC16	573939.50	1429504.00	723.96
VC17	575686.50	1426528.00	1184.18
VC18	576959.50	1437338.00	847.80
VC19	576173.50	1433409.00	707.00
VC20	569663.50	1431711.00	1039.82

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	3657.5	4574.0	-42.418	27.813	0.0000	0.0010	-0.0006
VC2	3424.0	9457.5	-47.201	-74.759	0.0000	0.0005	0.0007
VC3	8423.0	3174.0	57.705	57.340	0.0000	-0.0007	-0.0007
VC4	9342.0	7369.0	77.128	-30.742	0.0000	-0.0009	0.0004
VC5	6750.0	7975.0	22.666	-43.536	0.0000	-0.0005	0.0010
VC6	9442.0	4663.0	79.161	26.093	0.0000	-0.0009	-0.0003
VC7	4050.0	2266.0	-34.228	76.298	0.0000	0.0004	-0.0009
VC8	6121.0	2871.0	9.315	63.644	0.0000	-0.0002	-0.0012
VC9	1589.0	2801.0	-85.940	64.999	0.0000	0.0001	-0.0001
VC10	9170.0	8901.0	73.553	-62.923	0.0000	-0.0004	0.0004
VC11	6818.0	9611.0	24.137	-77.895	0.0000	-0.0003	0.0010
VC12	2564.0	5846.3	-65.368	1.063	0.0000	0.0012	-0.0000

```
    VC13        1570.0   7387.0   -86.221   -31.321   0.0000   0.0007
0.0003
    VC14        7391.0   5740.0    36.081     3.421   0.0000  -0.0009  -
0.0001
    VC15        9202.0   6166.0    74.155    -5.480   0.0000  -0.0011
0.0001
    VC16        4383.0   6480.0   -27.121   -12.199   0.0000   0.0007
0.0003
    VC17        5058.0   9020.0   -12.869   -65.528   0.0000   0.0002
0.0012
    VC18        8060.0   1392.0    50.031    94.758   0.0000  -0.0001  -
0.0001
    VC19        6734.0   4105.0    22.230    37.743   0.0000  -0.0005  -
0.0009
    VC20        1657.0   4062.0   -84.478    38.515   0.0000   0.0006  -
0.0003

Mean Differenence in dX and dY: -0.0001   0.0000
Standard Deviation in dX and dY:   0.0007   0.0007


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  14.498
XL      =  575473.5
YL      =  1431013.3
ZL      =  19862.1


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2079044

Omega   =    -0.53  (Degrees)
Phi     =     0.31  (Degrees)
Kappa   =    14.68  (Degrees)
XL      =  575526.2
YL      =  1430885.0
ZL      =  20251.7

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  17.12515
   4.10247  16.30643
  -0.05733   0.03745   0.36522
  82.35555  326.41668   0.85583  6542.823
  -340.60661  -81.83359   1.12032  -1642.771  6783.110
  -7.00987  -6.39055   0.00710  -127.679  138.638  139.962

Standard Deviation for Omega: 853.58  (Seconds)
Standard Deviation for   Phi: 832.92  (Seconds)
Standard Deviation for Kappa: 124.65  (Seconds)
Standard Deviation for    XL:  80.89  (Meters)
```

Standard Deviation for YL: 82.36 (Meters)
Standard Deviation for ZL: 11.83 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	-6.38	2.43
VC2	-5.27	-14.81
VC3	8.28	9.98
VC4	16.21	2.46
VC5	3.21	-7.17
VC6	13.47	6.35
VC7	-6.97	11.47
VC8	0.23	13.41
VC9	-11.20	11.64
VC10	8.42	-10.50
VC11	1.74	-19.21
VC12	-21.94	-2.66
VC13	-4.41	-11.89
VC14	2.76	1.02
VC15	9.56	-1.84
VC16	-2.26	-3.90
VC17	-2.47	-5.21
VC18	1.68	12.47
VC19	5.58	6.54
VC20	-10.11	-0.30

Col RMS = 8.91
Row RMS = 9.33

Single Space Resection for F:\NPS_WRST\4271\AB581003013ROLL_4271_A.LAN

Number of points processed: 20

Ground Control Coordinates

Point Name	X	Y	Z
VC1	572364.00	1431730.00	817.60
VC2	566093.17	1423109.67	846.25
VC3	575677.50	1426549.00	1177.16
VC4	564990.83	1433665.67	1411.48
VC5	565809.50	1428005.00	818.97
VC6	570121.50	1424446.00	776.71
VC7	565278.50	1431291.00	1149.92
VC8	572914.00	1436012.50	799.60
VC9	568385.00	1433671.50	1212.83
VC10	568966.83	1429261.33	823.00
VC11	575318.50	1429915.00	717.40
VC12	568290.50	1426778.00	755.11
VC13	573884.00	1426222.00	768.99
VC14	571670.00	1433903.00	1199.29
VC15	571276.50	1429451.00	761.28
VC16	565133.50	1425623.00	868.60
VC17	568436.50	1431902.00	1287.33
VC18	567434.50	1433614.00	1266.69
VC19	574799.50	1434217.00	726.00
VC20	574952.50	1432576.00	743.08

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	7769.3	4960.7	46.518	19.670	0.0000	-0.0010	-0.0004
VC2	1615.0	10028.0	-82.783	-86.833	-0.0000	-0.0004	-0.0004
VC3	9293.0	9373.0	78.587	-72.983	0.0000	-0.0001	0.0001
VC4	2704.3	2091.0	-59.966	79.881	0.0000	0.0003	-0.0004
VC5	2330.0	6430.0	-67.789	-11.255	0.0000	0.0012	0.0002
VC6	4801.0	9796.0	-15.821	-81.920	0.0000	0.0002	0.0009
VC7	2502.0	3931.0	-64.199	41.233	0.0000	0.0009	-0.0006
VC8	8948.0	1988.5	71.262	82.109	0.0000	-0.0000	-0.0000
VC9	5242.0	2763.0	-6.623	65.797	0.0000	0.0001	-0.0012
VC10	4852.0	6111.0	-14.786	-4.524	0.0000	0.0004	0.0001
VC11	9552.0	6808.0	84.004	-19.107	0.0000	-0.0009	0.0002
VC12	3905.0	7770.0	-34.673	-39.379	0.0000	0.0008	0.0009

```
    VC13        7851.7   9207.3    48.291   -69.520   0.0000  -0.0005
0.0008
    VC14        7709.0   3215.0    45.232    56.334   0.0000  -0.0007  -
0.0009
    VC15        6559.0   6396.0    21.094   -10.490   0.0000  -0.0006
0.0003
    VC16        1386.0   8030.0   -87.615   -44.871   0.0000   0.0005
0.0002
    VC17        4944.0   4065.0   -12.873    38.448   0.0000   0.0003  -
0.0010
    VC18        4525.0   2619.0   -21.694    68.813   0.0000   0.0003  -
0.0011
    VC19        9971.0   3635.0    92.780    47.540   0.0000  -0.0002  -
0.0001
    VC20        9777.0   4838.0    88.714    22.271   0.0000  -0.0007  -
0.0002

Mean Differenence in dX and dY: -0.0000  -0.0001
Standard Deviation in dX and dY:   0.0006   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  14.497
XL      =  570089.8
YL      =  1430097.1
ZL      =  20413.8


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1959202

Omega   =     0.45  (Degrees)
Phi     =     0.21  (Degrees)
Kappa   =    14.35  (Degrees)
XL      =  569879.0
YL      =  1429623.6
ZL      =  20276.5

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  10.87132
   4.83846  12.31589
  -0.02851   0.15381   0.29730
  95.58287  245.88307   3.18240  4916.851
  -217.16310  -95.74518   0.51049  -1891.199  4345.885
   4.01890   7.19360   0.07875  142.517  -82.625  114.371

Standard Deviation for Omega: 680.09  (Seconds)
Standard Deviation for   Phi: 723.87  (Seconds)
Standard Deviation for Kappa: 112.47  (Seconds)
Standard Deviation for    XL:  70.12  (Meters)
```

Standard Deviation for YL: 65.92 (Meters)
Standard Deviation for ZL: 10.69 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	5.71	3.09
VC2	-10.01	-10.96
VC3	17.96	-13.64
VC4	-12.79	10.38
VC5	-10.21	-4.32
VC6	5.49	-10.57
VC7	-15.54	2.87
VC8	2.98	13.02
VC9	-1.75	7.11
VC10	-1.17	-0.71
VC11	6.51	-5.62
VC12	-3.83	-7.17
VC13	10.36	-11.87
VC14	4.63	8.52
VC15	4.68	-5.90
VC16	-10.69	-7.50
VC17	-0.81	5.42
VC18	-5.67	9.40
VC19	11.44	10.39
VC20	3.22	7.51

Col RMS = 8.67
Row RMS = 8.52

Single Space Resection for F:\NPS_WRST\4272\AB581003013ROLL_4272_A.LAN

Number of points processed: 22

Ground Control Coordinates

Point Name	X	Y	Z
	566092.50	1423109.67	846.27
	568967.50	1429260.00	823.00
	559171.50	1432383.00	892.90
	568540.50	1433636.00	1213.05
	564720.00	1427467.50	884.75
	563387.00	1433096.50	1447.65
	570275.00	1424983.00	763.90
	566424.50	1433293.00	1378.71
	561642.50	1429492.00	1034.54
	561734.50	1423036.00	1827.44
	558944.50	1428474.00	1679.75
	565540.50	1430010.00	934.35
	559608.50	1424228.50	2152.68
	561396.50	1431695.00	870.30
	564231.00	1422271.00	939.72
	567508.00	1431824.50	1101.93
	564768.00	1425248.00	898.71
	567670.00	1435090.00	1535.78
	568498.50	1424144.50	917.76
	566883.50	1428514.00	898.53
	563413.50	1431087.00	911.75
	568267.50	1426599.00	758.60

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
	6099.0	9922.0	11.451	-83.718	0.0000	0.0000	0.0000
	9352.0	6045.0	79.806	-2.268	0.0000	0.0000	0.0000
	2825.0	1920.0	-57.399	84.330	0.0000	0.0000	0.0000
	9972.0	2742.0	92.823	67.109	0.0000	0.0000	0.0000
	5932.0	6532.5	7.926	-12.528	0.0000	0.0000	0.0000
	6046.0	2098.5	10.302	80.601	0.0000	0.0000	0.0000
	9476.0	9354.5	82.427	-71.778	0.0000	0.0000	0.0000
	8351.0	2556.0	58.751	71.006	0.0000	0.0000	0.0000
	4070.0	4476.0	-31.220	30.654	0.0000	0.0000	0.0000
	2793.0	9332.0	-58.038	-71.346	0.0000	0.0000	0.0000
	1770.0	4665.0	-79.561	26.670	0.0000	0.0000	0.0000

```
                7016.0   4850.0    30.702    22.816   0.0000   0.0000
0.0000
                1327.5   8051.5   -88.846   -44.460   0.0000   0.0000
0.0000
                4323.0   2844.0   -25.909    64.932   0.0000   0.0000
0.0000
                4588.5  10186.5   -20.296   -89.282   0.0000   0.0000
0.0000
                8832.5   3888.0    68.877    43.032   0.0000   0.0000
0.0000
                5545.0   8143.0    -0.201   -46.356   0.0000   0.0000
0.0000
                9674.0   1426.0    86.553    94.747   0.0000   0.0000
0.0000
                8038.0   9650.0    52.204   -77.993   0.0000   0.0000
0.0000
                7706.5   6187.0    45.221    -5.261   0.0000   0.0000
0.0000
                5674.0   3667.0     2.490    47.655   0.0000   0.0000
0.0000
                8328.0   7818.0    58.291   -39.513   0.0000   0.0000
0.0000

Mean Differenence in dX and dY:  0.0000   0.0000
Standard Deviation in dX and dY:   0.0000   0.0000


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  14.979
XL      =  564894.8
YL      =  1428588.3
ZL      =  19544.3


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2191318

Omega   =    -0.77  (Degrees)
Phi     =     0.17  (Degrees)
Kappa   =    14.69  (Degrees)
XL      =  564087.8
YL      =  1428377.3
ZL      =  20272.9

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  11.11803
  -3.18978  12.74875
  -0.07317   0.23828   0.33641
  -63.39372  251.34321   4.86184  4964.128
  -221.51748  63.94315   1.19759  1270.664  4422.388
```

-5.11304 15.43675   0.29928 299.866 100.660 138.997

Standard Deviation for Omega: 687.76 (Seconds)
Standard Deviation for   Phi: 736.48 (Seconds)
Standard Deviation for Kappa: 119.64 (Seconds)
Standard Deviation for   XL: 70.46 (Meters)
Standard Deviation for   YL: 66.50 (Meters)
Standard Deviation for   ZL: 11.79 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
	3.71	-10.83
	11.40	-0.26
	-17.01	8.53
	10.74	12.20
	0.25	-4.05
	-3.13	11.35
	23.67	-10.96
	-0.59	9.49
	-5.79	1.25
	-9.04	-7.57
	-16.49	-0.82
	1.78	2.65
	-23.09	-2.34
	-4.44	5.01
	-3.73	-16.18
	9.75	4.11
	-0.17	-7.88
	2.37	19.51
	3.29	-10.60
	7.03	-3.61
	0.28	7.38
	11.87	-7.91

Col RMS = 10.40
Row RMS =   8.93

Single Space Resection for F:\NPS_WRST\4275\AB581003013ROLL_4275_A.LAN

Number of points processed: 24

Ground Control Coordinates

Point Name	X	Y	Z
VC1	546486.50	1422697.00	881.00
VC2	542064.50	1426889.00	1059.15
VC3	549664.50	1429080.00	1359.30
VC4	551572.50	1420654.00	1269.73
VC5	544054.50	1419078.00	1473.31
VC6	545584.50	1429961.00	935.21
VC7	546958.50	1420324.00	906.08
VC8	541823.50	1424890.00	965.23
VC9	550708.83	1424961.33	1496.95
VC10	540030.50	1428764.00	1001.01
VC11	550122.50	1431427.00	1392.95
VC12	542285.50	1422693.00	1632.32
VC13	542401.50	1429216.00	879.00
VC14	550147.50	1427474.00	1425.78
VC15	549156.50	1420573.00	1456.85
VC16	546343.50	1427941.00	922.90
VC17	545907.50	1425993.00	894.02
VC18	549705.50	1423328.00	1156.06
VC19	551451.50	1422351.00	1604.25
VC20	542674.50	1420591.00	1771.29
VC21	545233.50	1423152.00	880.33
VC22	548550.50	1425810.00	1065.12
VC23	543164.50	1418921.00	1672.60
VC24	547663.50	1430492.00	1366.79

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	5221.0	7179.0	-7.191	-26.365	0.0000	0.0002	0.0007
VC2	2736.0	3315.0	-59.294	54.881	0.0000	0.0007	-0.0007
VC3	8785.5	3061.0	67.872	60.028	0.0000	-0.0006	-0.0005
VC4	8611.5	9657.5	63.992	-78.537	0.0000	-0.0003	0.0003
VC5	2708.0	9459.0	-60.090	-74.182	0.0000	0.0004	0.0005
VC6	5888.0	1739.0	7.012	87.889	0.0000	-0.0001	-0.0008
VC7	5131.0	8985.0	-9.144	-64.300	0.0000	0.0002	0.0012
VC8	2205.0	4737.0	-70.503	25.027	0.0000	0.0010	-0.0004
VC9	8818.3	6324.7	68.451	-8.531	0.0000	-0.0012	0.0001

```
    VC10        1600.5   1579.5   -83.105    91.376  -0.0000  -0.0005
0.0006
    VC11        9582.0   1388.0    84.672    95.149  -0.0000   0.0007
0.0008
    VC12        2019.0   6441.0   -74.471   -10.762   0.0000   0.0011
0.0002
    VC13        3432.0   1708.0   -44.611    88.618   0.0000   0.0002  -
0.0004
    VC14        8853.7   4340.7    69.261    33.144   0.0000  -0.0010  -
0.0005
    VC15        6816.0   9304.0    26.263   -71.054   0.0000  -0.0004
0.0010
    VC16        6075.0   3346.0    10.889    54.125   0.0000  -0.0002  -
0.0011
    VC17        5401.0   4685.0    -3.324    26.019   0.0000   0.0001  -
0.0007
    VC18        7710.0   7332.0    45.120   -29.657   0.0000  -0.0010
0.0006
    VC19        8893.0   8423.0    69.950   -52.613   0.0000  -0.0007
0.0005
    VC20        1892.5   8112.5   -77.186   -45.871   0.0000   0.0007
0.0004
    VC21        4387.0   6623.0   -24.702   -14.659   0.0000   0.0007
0.0004
    VC22        7310.0   5294.0    36.781    13.166   0.0000  -0.0009  -
0.0003
    VC23        1968.0   9454.0   -75.645   -74.054   0.0000   0.0001
0.0001
    VC24        7551.0   1635.0    41.971    90.022   0.0000  -0.0002  -
0.0004

Mean Differenence in dX and dY: -0.0000   0.0001
Standard Deviation in dX and dY:   0.0007   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  14.365
XL      =  546406.5
YL      =  1424885.8
ZL      =  19951.8


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2039841

Omega   =    -0.13  (Degrees)
Phi     =    -0.02  (Degrees)
Kappa   =    14.19  (Degrees)
XL      =  546510.5
YL      =  1424481.9
ZL      =  20258.0
```

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
   8.48136
  -1.71514   9.91837
   0.04712  -0.04966   0.25960
  -33.94516  194.83676  -0.87094  3834.179
  -167.66809  34.25904  -0.90959  677.985  3321.422
  -7.66761  -2.88066  -0.02437  -55.973  149.705  102.046
```

Standard Deviation for Omega: 600.70 (Seconds)
Standard Deviation for Phi: 649.60 (Seconds)
Standard Deviation for Kappa: 105.09 (Seconds)
Standard Deviation for XL: 61.92 (Meters)
Standard Deviation for YL: 57.63 (Meters)
Standard Deviation for ZL: 10.10 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	-0.38	-4.19
VC2	-11.40	9.46
VC3	11.80	6.97
VC4	9.90	-12.52
VC5	-1.73	-17.78
VC6	-3.81	12.83
VC7	-0.07	-11.42
VC8	-14.83	3.39
VC9	14.98	2.20
VC10	-11.73	12.32
VC11	20.04	6.79
VC12	-14.30	0.19
VC13	-10.24	9.27
VC14	9.62	4.29
VC15	6.58	-10.18
VC16	0.11	5.71
VC17	-0.64	3.30
VC18	5.99	-0.67
VC19	6.26	-12.18
VC20	-9.64	-7.01
VC21	-7.50	-1.00
VC22	5.45	1.62
VC23	-7.88	-10.79
VC24	2.66	10.65

Col RMS = 9.44
Row RMS = 8.71

Single Space Resection for F:\NPS_WRST\4276\AB581003013ROLL_4276_A.LAN

Number of points processed: 20

Ground Control Coordinates

Point Name	X	Y	Z
VC1	534651.50	1426518.00	942.03
VC2	546486.50	1422697.33	881.00
VC3	543874.50	1429887.00	883.64
VC4	537107.50	1419158.00	1780.40
VC5	546959.50	1420326.00	906.18
VC6	538791.50	1427837.00	1092.03
VC7	540147.50	1418765.00	1274.42
VC8	536077.83	1423989.33	1121.82
VC9	545795.50	1426877.00	882.17
VC10	536890.00	1422315.50	1401.16
VC11	543162.50	1418919.00	1673.47
VC12	536020.50	1428752.00	1009.63
VC13	543284.50	1426955.00	1050.52
VC14	536275.50	1416928.00	1802.73
VC15	545340.50	1424878.00	879.02
VC16	539603.50	1422013.00	1491.34
VC17	542454.50	1425283.00	890.18
VC18	540919.50	1429048.00	985.95
VC19	539754.50	1424925.00	1049.11
VC20	542458.50	1422627.00	1634.55

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	1778.0	2462.0	-79.746	70.472	0.0000	0.0001	-0.0001
VC2	9696.7	7400.7	86.585	-33.477	0.0000	-0.0007	0.0003
VC3	9107.0	1722.0	74.330	85.826	-0.0000	0.0001	0.0001
VC4	2040.0	8353.0	-74.383	-53.283	0.0000	0.0006	0.0004
VC5	9612.0	9211.0	84.761	-71.504	-0.0000	0.0000	-0.0000
VC6	5025.0	2234.0	-11.488	75.176	0.0000	0.0002	-0.0011
VC7	4321.0	9156.0	-26.455	-70.210	0.0000	0.0004	0.0010
VC8	2310.3	4537.7	-68.606	26.855	0.0000	0.0010	-0.0004
VC9	9956.0	4247.0	92.113	32.763	0.0000	-0.0005	-0.0002
VC10	2554.0	5912.5	-63.518	-2.031	0.0000	0.0012	0.0000
VC11	6620.0	9688.0	21.857	-81.445	0.0000	-0.0002	0.0009
VC12	3178.0	1072.0	-50.284	99.634	-0.0000	-0.0000	0.0001

```
    VC13        8161.0   3712.0    54.395    44.047   0.0000  -0.0009  -
0.0007
    VC14         964.0   9894.0   -97.040   -85.627  -0.0000  -0.0009  -
0.0008
    VC15        9259.0   5610.0    77.428     4.149   0.0000  -0.0011  -
0.0001
    VC16        4517.0   6654.0   -22.274   -17.658   0.0000   0.0006
0.0005
    VC17        7228.0   4787.0    34.756    21.490   0.0000  -0.0009  -
0.0005
    VC18        6811.0   1765.0    26.066    84.981   0.0000  -0.0002  -
0.0008
    VC19        5195.0   4537.0    -7.971    26.794   0.0000   0.0002  -
0.0007
    VC20        6792.0   6745.0    25.544   -19.628   0.0000  -0.0007
0.0005

Mean Differenence in dX and dY: -0.0001  -0.0001
Standard Deviation in dX and dY:   0.0007   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  14.599
XL      =  540802.8
YL      =  1423934.9
ZL      =  20080.4


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1951372

Omega   =     0.62  (Degrees)
Phi     =     0.44  (Degrees)
Kappa   =    14.28  (Degrees)
XL      =  540806.3
YL      =  1423202.3
ZL      =  20253.7

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

   7.75429
  -0.56579   6.70705
  -0.13921  -0.16078   0.27429
  -11.73722  132.75358  -3.05888  2635.140
  -153.36636  11.60261   2.71507  240.279  3040.881
  -8.27260   0.54770   0.14942  11.685  160.776  105.976

Standard Deviation for Omega: 574.38  (Seconds)
Standard Deviation for   Phi: 534.18  (Seconds)
Standard Deviation for Kappa: 108.03  (Seconds)
Standard Deviation for    XL:  51.33  (Meters)
```

Standard Deviation for YL: 55.14 (Meters)
Standard Deviation for ZL: 10.29 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	-14.37	8.89
VC2	8.80	-6.51
VC3	11.36	12.82
VC4	-7.25	-7.40
VC5	6.08	-19.85
VC6	-6.67	9.52
VC7	-1.13	-9.19
VC8	-14.38	3.60
VC9	11.20	7.40
VC10	-6.47	0.08
VC11	8.07	-12.92
VC12	-10.77	2.15
VC13	5.70	8.82
VC14	-8.72	-14.52
VC15	9.48	2.06
VC16	-1.72	-0.78
VC17	2.11	4.26
VC18	4.38	9.71
VC19	-1.49	1.85
VC20	6.34	1.81

Col RMS = 8.28
Row RMS = 8.83

Single Space Resection for F:\NPS_WRST\4277\AB581003013ROLL_4277_A.LAN

Number of points processed: 22

Ground Control Coordinates

Point Name	X	Y	Z
VC1	538791.50	1427837.33	1092.04
VC2	530320.50	1420103.50	1006.84
VC3	540156.50	1419459.00	1272.15
VC4	530791.50	1426099.00	912.95
VC5	535663.00	1428417.50	1012.56
VC6	533674.50	1418434.00	1382.28
VC7	540719.50	1424749.00	1021.11
VC8	531188.50	1416651.00	997.22
VC9	528801.50	1427124.00	891.00
VC10	533852.50	1426569.00	945.08
VC11	538476.50	1417795.00	1848.62
VC12	534892.50	1416426.00	1655.00
VC13	530080.50	1423842.00	879.14
VC14	538824.50	1422800.00	1549.55
VC15	533475.50	1422125.00	1260.37
VC16	536644.50	1419894.00	1561.13
VC17	536659.50	1427157.00	1095.25
VC18	532421.50	1420985.00	1475.97
VC19	541124.50	1418692.00	1400.01
VC20	536099.00	1424071.75	1127.26
VC21	531531.50	1422972.00	912.09
VC22	540328.50	1426653.00	1026.21

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	9672.5	2143.5	78.485	74.275	0.0000	-0.0001	-0.0001
VC2	2230.8	6588.3	-77.710	-19.459	0.0000	0.0010	0.0003
VC3	9475.0	8570.0	74.674	-60.739	0.0000	-0.0005	0.0004
VC4	3494.0	2265.0	-51.385	71.423	0.0000	0.0005	-0.0007
VC5	7432.5	1267.5	31.352	92.569	0.0000	-0.0002	-0.0005
VC6	4439.0	8369.5	-31.197	-56.771	0.0000	0.0006	0.0010
VC7	10639.0	4717.0	98.938	20.259	0.0000	-0.0004	-0.0001
VC8	2356.0	9263.0	-74.936	-75.643	0.0000	0.0001	0.0001
VC9	2191.0	1222.0	-78.832	93.272	-0.0000	-0.0005	0.0005
VC10	5818.0	2366.0	-2.528	69.413	0.0000	0.0000	-0.0012
VC11	8028.0	9684.0	44.316	-84.212	0.0000	-0.0003	0.0006

```
    VC12        5038.0  10137.0   -18.512   -93.873   0.0000   0.0001
0.0006
    VC13        2638.0   3813.0   -69.297    38.862   0.0000   0.0009  -
0.0005
    VC14        9028.0   5873.0    65.134    -4.104   0.0000  -0.0012
0.0001
    VC15        4859.0   5567.0   -22.516     2.123   0.0000   0.0006  -
0.0001
    VC16        6916.0   7744.0    20.838   -43.510   0.0000  -0.0005
0.0010
    VC17        7994.0   2328.0    43.211    70.317   0.0000  -0.0005  -
0.0008
    VC18        3867.0   6272.0   -43.331   -12.736   0.0000   0.0010
0.0003
    VC19       10113.0   9311.0    88.126   -76.276  -0.0000   0.0003  -
0.0002
    VC20        7112.5   4520.0    24.797    24.226   0.0000  -0.0006  -
0.0006
    VC21        3572.0   4662.0   -49.618    21.072   0.0000   0.0011  -
0.0005
    VC22       10623.0   3259.0    98.525    50.887  -0.0000   0.0000
0.0000

Mean Differenence in dX and dY:  0.0001  -0.0000
Standard Deviation in dX and dY:   0.0006   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  11.059
XL      =  535205.4
YL      =  1422675.3
ZL      =  20333.0


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2097978

Omega   =     0.44  (Degrees)
Phi     =     0.02  (Degrees)
Kappa   =    11.29  (Degrees)
XL      =  534878.8
YL      =  1422123.6
ZL      =  20260.9

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

   8.66871
  -0.03967   7.19257
   0.22292  -0.13943   0.28491
  -0.48467  142.35612  -2.66218  2825.425
  -171.57145   0.73050  -4.51598   8.524  3403.654
```

-9.60141 2.75757 -0.30437 52.143 187.812 112.392

Standard Deviation for Omega: 607.30 (Seconds)
Standard Deviation for Phi: 553.18 (Seconds)
Standard Deviation for Kappa: 110.10 (Seconds)
Standard Deviation for XL: 53.15 (Meters)
Standard Deviation for YL: 58.34 (Meters)
Standard Deviation for ZL: 10.60 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	7.10	9.76
VC2	-11.89	-4.77
VC3	8.72	-9.59
VC4	-10.73	10.23
VC5	2.58	11.78
VC6	-3.04	-12.22
VC7	20.44	4.53
VC8	-8.79	-16.24
VC9	-11.64	7.88
VC10	-2.36	7.39
VC11	8.33	-10.79
VC12	-3.02	-13.13
VC13	-12.80	4.79
VC14	12.42	0.76
VC15	-4.61	0.17
VC16	1.78	-6.32
VC17	7.71	10.88
VC18	-11.22	5.20
VC19	7.74	-15.84
VC20	0.01	4.28
VC21	-8.66	2.74
VC22	11.06	10.53

Col RMS = 9.29
Row RMS = 9.27

Single Space Resection for F:\NPS_WRST\131\AB642700260ROLL_131_A.LAN

Number of points processed: 6

Ground Control Coordinates

Point Name	X	Y	Z
VC1	537825.33	1406965.33	1509.37
VC2	538204.00	1412627.00	2355.40
VC3	533506.24	1407005.40	1155.58
VC4	536095.00	1414399.50	1364.25
VC5	536850.33	1410169.00	1736.09
VC6	530345.49	1413153.10	1004.78

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	7363.5	8675.5	36.210	-59.249	0.0000	-0.0000	0.0000
VC2	8629.0	3886.3	62.959	41.301	0.0000	-0.0000	-0.0000
VC3	3712.0	7933.0	-40.484	-43.540	0.0000	0.0001	0.0001
VC4	6964.8	2241.3	28.048	75.905	-0.0000	0.0000	0.0000
VC5	7024.0	5836.7	29.172	0.387	0.0000	-0.0001	-0.0000
VC6	2056.0	2517.0	-75.096	70.267	-0.0000	-0.0002	0.0002

Mean Differenence in dX and dY: -0.0001 0.0001
Standard Deviation in dX and dY: 0.0001 0.0001

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 9.725
XL = 535471.1
YL = 1410719.9
ZL = 18874.5

A solution has been found after 4 iterations
Standard Deviation of unit weight = 0.5902581

Omega = 1.73 (Degrees)
Phi = -0.96 (Degrees)
Kappa = 10.07 (Degrees)
XL = 535001.7
YL = 1409355.4
ZL = 18562.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  506.76427
  -228.69869  454.37253
  37.41172  -8.99431  14.37261
  -3947.27244  7955.51511  -143.01104  139493.932
  -8883.59153  4038.13369  -658.41599  69713.399  155935.688
  -623.50221  -219.46833  -57.75812  -4070.307  10625.603  4844.125

Standard Deviation for Omega: 4643.31  (Seconds)
Standard Deviation for   Phi: 4396.74  (Seconds)
Standard Deviation for Kappa: 781.98  (Seconds)
Standard Deviation for    XL: 373.49  (Meters)
Standard Deviation for    YL: 394.89  (Meters)
Standard Deviation for    ZL:  69.60  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  21.62  -0.07
     VC2   0.90  12.43
     VC3  -29.35  -42.42
     VC4  10.72  -2.94
     VC5  13.54   4.57
     VC6  -18.44  28.04

    Col RMS =  18.11
    Row RMS =  21.49
```

Single Space Resection for F:\NPS_WRST\4277\AB581003013ROLL_4277_A.LAN

Number of points processed: 22

Ground Control Coordinates

Point Name	X	Y	Z
VC1	538791.50	1427837.33	1092.04
VC2	530320.50	1420103.50	1006.84
VC3	540156.50	1419459.00	1272.15
VC4	530791.50	1426099.00	912.95
VC5	535663.00	1428417.50	1012.56
VC6	533674.50	1418434.00	1382.28
VC7	540719.50	1424749.00	1021.11
VC8	531188.50	1416651.00	997.22
VC9	528801.50	1427124.00	891.00
VC10	533852.50	1426569.00	945.08
VC11	538476.50	1417795.00	1848.62
VC12	534892.50	1416426.00	1655.00
VC13	530080.50	1423842.00	879.14
VC14	538824.50	1422800.00	1549.55
VC15	533475.50	1422125.00	1260.37
VC16	536644.50	1419894.00	1561.13
VC17	536659.50	1427157.00	1095.25
VC18	532421.50	1420985.00	1475.97
VC19	541124.50	1418692.00	1400.01
VC20	536099.00	1424071.75	1127.26
VC21	531531.50	1422972.00	912.09
VC22	540328.50	1426653.00	1026.21

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	9672.5	2143.5	78.485	74.275	0.0000	-0.0001	-0.0001
VC2	2230.8	6588.3	-77.710	-19.459	0.0000	0.0010	0.0003
VC3	9475.0	8570.0	74.674	-60.739	0.0000	-0.0005	0.0004
VC4	3494.0	2265.0	-51.385	71.423	0.0000	0.0005	-0.0007
VC5	7432.5	1267.5	31.352	92.569	0.0000	-0.0002	-0.0005
VC6	4439.0	8369.5	-31.197	-56.771	0.0000	0.0006	0.0010
VC7	10639.0	4717.0	98.938	20.259	0.0000	-0.0004	-0.0001
VC8	2356.0	9263.0	-74.936	-75.643	0.0000	0.0001	0.0001
VC9	2191.0	1222.0	-78.832	93.272	-0.0000	-0.0005	0.0005
VC10	5818.0	2366.0	-2.528	69.413	0.0000	0.0000	-0.0012
VC11	8028.0	9684.0	44.316	-84.212	0.0000	-0.0003	0.0006

```
    VC12        5038.0  10137.0   -18.512   -93.873   0.0000   0.0001
0.0006
    VC13        2638.0   3813.0   -69.297    38.862   0.0000   0.0009  -
0.0005
    VC14        9028.0   5873.0    65.134    -4.104   0.0000  -0.0012
0.0001
    VC15        4859.0   5567.0   -22.516     2.123   0.0000   0.0006  -
0.0001
    VC16        6916.0   7744.0    20.838   -43.510   0.0000  -0.0005
0.0010
    VC17        7994.0   2328.0    43.211    70.317   0.0000  -0.0005  -
0.0008
    VC18        3867.0   6272.0   -43.331   -12.736   0.0000   0.0010
0.0003
    VC19       10113.0   9311.0    88.126   -76.276  -0.0000   0.0003  -
0.0002
    VC20        7112.5   4520.0    24.797    24.226   0.0000  -0.0006  -
0.0006
    VC21        3572.0   4662.0   -49.618    21.072   0.0000   0.0011  -
0.0005
    VC22       10623.0   3259.0    98.525    50.887  -0.0000   0.0000
0.0000

Mean Differenence in dX and dY:  0.0001  -0.0000
Standard Deviation in dX and dY:   0.0006   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  11.059
XL      =  535205.4
YL      =  1422675.3
ZL      =  20333.0


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2097978

Omega   =     0.44  (Degrees)
Phi     =     0.02  (Degrees)
Kappa   =    11.29  (Degrees)
XL      =  534878.8
YL      =  1422123.6
ZL      =  20260.9

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

   8.66871
  -0.03967   7.19257
   0.22292  -0.13943   0.28491
  -0.48467  142.35612  -2.66218  2825.425
  -171.57145   0.73050  -4.51598   8.524  3403.654
```

-9.60141 2.75757 -0.30437 52.143 187.812 112.392

Standard Deviation for Omega: 607.30 (Seconds)
Standard Deviation for Phi: 553.18 (Seconds)
Standard Deviation for Kappa: 110.10 (Seconds)
Standard Deviation for XL: 53.15 (Meters)
Standard Deviation for YL: 58.34 (Meters)
Standard Deviation for ZL: 10.60 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	7.10	9.76
VC2	-11.89	-4.77
VC3	8.72	-9.59
VC4	-10.73	10.23
VC5	2.58	11.78
VC6	-3.04	-12.22
VC7	20.44	4.53
VC8	-8.79	-16.24
VC9	-11.64	7.88
VC10	-2.36	7.39
VC11	8.33	-10.79
VC12	-3.02	-13.13
VC13	-12.80	4.79
VC14	12.42	0.76
VC15	-4.61	0.17
VC16	1.78	-6.32
VC17	7.71	10.88
VC18	-11.22	5.20
VC19	7.74	-15.84
VC20	0.01	4.28
VC21	-8.66	2.74
VC22	11.06	10.53

Col RMS = 9.29
Row RMS = 9.27

Single Space Resection for F:\NPS_WRST\4278\AB581003013ROLL_4278_A.LAN

Number of points processed: 19

Ground Control Coordinates

Point Name	X	Y	Z
VC1	532581.50	1425967.00	933.08
VC2	532027.50	1423368.00	885.80
VC3	524041.50	1416561.00	942.00
VC4	523615.50	1425751.00	1068.18
VC5	533996.50	1418414.00	1469.55
VC6	523848.50	1422091.00	1029.76
VC7	530334.50	1416875.00	1011.50
VC8	527938.50	1426922.00	898.12
VC9	524089.50	1419623.00	967.88
VC10	533119.50	1427234.00	935.65
VC11	534711.50	1417201.00	1399.28
VC12	528602.50	1416591.00	1188.90
VC13	527329.50	1425053.00	917.35
VC14	533816.50	1421486.00	1396.78
VC15	527351.17	1422468.00	911.00
VC16	530320.50	1420104.00	1006.83
VC17	527347.50	1419514.00	913.22
VC18	530518.50	1423040.00	898.00
VC19	524964.50	1424430.00	969.18

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	9314.0	2759.0	70.156	61.577	0.0000	-0.0005	-0.0005
VC2	8544.0	4595.0	54.103	22.956	0.0000	-0.0011	-0.0005
VC3	1690.0	8521.0	-89.667	-59.971	0.0000	0.0001	0.0001
VC4	2627.0	1663.0	-70.460	84.163	0.0000	0.0000	-0.0000
VC5	9429.0	8595.0	72.987	-61.017	0.0000	-0.0005	0.0004
VC6	2310.0	4401.0	-76.928	26.622	0.0000	0.0010	-0.0003
VC7	6406.5	9166.5	9.504	-73.221	0.0000	-0.0001	0.0011
VC8	6010.0	1429.0	0.623	89.300	0.0000	-0.0000	-0.0008
VC9	2144.0	6268.0	-80.284	-12.610	0.0000	0.0010	0.0002
VC10	9886.0	1899.0	82.118	79.682	-0.0000	0.0002	0.0002
VC11	9792.0	9598.0	80.687	-82.064	-0.0000	0.0002	-0.0002
VC12	5065.0	9167.0	-18.690	-73.319	0.0000	0.0003	0.0011

```
    VC13        5302.0   2712.0   -14.166    62.300   0.0000   0.0003  -
0.0012
    VC14        9709.0   6238.0    78.704   -11.483   0.0000  -0.0010
0.0002
    VC15        4962.0   4618.0   -21.176    22.237   0.0000   0.0006  -
0.0006
    VC16        6839.3   6768.0    18.431   -22.805   0.0000  -0.0005
0.0006
    VC17        4555.0   6795.0   -29.576   -23.522   0.0000   0.0008
0.0006
    VC18        7383.0   4631.0    29.705    22.123   0.0000  -0.0008  -
0.0006
    VC19        3460.0   2844.0   -52.869    59.406   0.0000   0.0007  -
0.0008

Mean Differenence in dX and dY:  0.0000  -0.0001
Standard Deviation in dX and dY:   0.0006   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  10.507
XL      =  528976.6
YL      =  1421720.7
ZL      =  20053.0


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1883494

Omega   =     0.51  (Degrees)
Phi     =    -0.02  (Degrees)
Kappa   =    10.32  (Degrees)
XL      =  528912.4
YL      =  1421141.8
ZL      =  20241.1

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

   9.46985
   1.42674  10.59012
   0.14600  -0.03626   0.28802
  28.89602  210.94921  -0.61047  4209.459
  -187.89434  -28.73695  -2.92064  -581.860  3735.569
  -7.47399  -1.06520  -0.11763  -22.230  145.549  110.646

Standard Deviation for Omega: 634.74  (Seconds)
Standard Deviation for   Phi: 671.24  (Seconds)
Standard Deviation for Kappa: 110.70  (Seconds)
Standard Deviation for    XL:  64.88  (Meters)
Standard Deviation for    YL:  61.12  (Meters)
Standard Deviation for    ZL:  10.52  (Meters)
```

Residuals for the points entered

Point ID	Cols	Rows
VC1	10.76	9.48
VC2	8.08	2.74
VC3	-8.86	-12.08
VC4	-12.88	10.29
VC5	7.75	-6.26
VC6	0.68	-3.48
VC7	0.38	-9.99
VC8	-0.88	9.31
VC9	-11.89	-1.85
VC10	14.57	8.59
VC11	10.31	-15.55
VC12	-6.19	-13.63
VC13	-4.43	5.63
VC14	10.79	3.29
VC15	-5.82	3.57
VC16	-0.49	-3.22
VC17	-3.50	-0.55
VC18	1.86	4.17
VC19	-10.73	10.48

Col RMS = 8.23
Row RMS = 8.22

Single Space Resection for F:\NPS_WRST\9486\AB582003097ROLL_9486_A.LAN

Number of points processed: 9

Ground Control Coordinates

Point Name	X	Y	Z
VC1	517183.50	1421000.00	1181.58
VC2	520552.00	1416264.50	1550.36
VC3	518139.50	1425375.67	1157.74
VC5	513576.51	1422466.72	1535.70
VC6	519204.70	1420232.00	1411.43
VC7	518920.17	1418328.00	1470.08
VC8	518392.50	1423820.00	1188.24
VC9	515269.15	1414730.25	1584.77
VC10	516099.57	1420453.08	1204.10

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	7823.3	4413.0	46.531	24.379	0.0000	0.0000	0.0000
VC2	9703.0	8387.0	86.234	-59.768	0.0000	0.0000	0.0000
VC3	9138.3	1357.7	74.430	89.030	0.0000	0.0000	0.0000
VC5	5376.0	2768.0	-5.237	59.237	0.0000	0.0000	0.0000
VC6	9245.8	5262.3	76.622	6.380	0.0000	0.0000	0.0000
VC7	8776.0	6631.3	66.650	-22.592	0.0000	0.0000	0.0000
VC8	9104.0	2529.0	73.679	64.237	0.0000	0.0000	0.0000
VC9	5547.0	8795.0	-1.744	-68.339	0.0000	0.0000	0.0000
VC10	6971.0	4656.5	28.485	19.238	0.0000	0.0000	0.0000

Mean Differenence in dX and dY: 0.0000   0.0000
Standard Deviation in dX and dY: 0.0000   0.0000

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   = 10.739
XL   = 517482.0
YL   = 1420296.7
ZL   = 10975.6

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2316060

```
Omega   =    -1.33  (Degrees)
Phi     =    -0.12  (Degrees)
Kappa   =    10.84  (Degrees)
XL      =  514540.0
YL      =  1419149.0
ZL      =  10985.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  11.60620
   1.71033  30.94151
   2.61980   1.73952   2.23897
  21.98850  308.48538  20.56202  3117.685
  -131.83813  -25.25814  -34.62755  -308.891  1537.609
  -8.86847  104.36037   2.73214  989.952  63.198  516.767

Standard Deviation for Omega: 702.70  (Seconds)
Standard Deviation for   Phi: 1147.35  (Seconds)
Standard Deviation for Kappa: 308.64  (Seconds)
Standard Deviation for    XL:  55.84  (Meters)
Standard Deviation for    YL:  39.21  (Meters)
Standard Deviation for    ZL:  22.73  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  10.25  -10.33
     VC2  -0.99  -10.18
     VC3   1.55   3.95
     VC5  -16.65  13.08
     VC6  -2.08   6.14
     VC7   2.41   4.00
     VC8   1.17   2.24
     VC9  -11.62   2.85
    VC10  16.96  -12.36

    Col RMS =   9.54
    Row RMS =   8.28
```

Single Space Resection for F:\NPS_WRST\9487\AB582003097ROLL_9487_A.LAN

Number of points processed: 15

Ground Control Coordinates

Point Name	X	Y	Z
VC1	523362.50	1419346.00	998.17
VC2	520921.50	1424784.00	1117.20
VC3	525249.00	1416498.00	937.72
VC4	524688.50	1422734.00	1007.08
VC5	515330.31	1423906.70	1412.98
VC6	518265.75	1417282.64	1547.45
VC7	516669.28	1420559.27	1189.00
VC8	523614.00	1426378.00	1072.27
VC9	526029.25	1420503.75	915.78
VC10	521082.00	1415306.00	1380.25
VC11	520885.83	1420569.33	1357.30
VC12	519461.50	1425864.00	1114.04
VC13	523886.50	1415863.00	941.95
VC14	522011.50	1422886.00	1195.17
VC15	514557.82	1421112.88	1343.29

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	7671.0	6609.5	43.991	-22.165	0.0000	-0.0010	0.0005
VC2	6685.0	2299.0	23.274	68.367	0.0000	-0.0004	-0.0011
VC3	8627.5	8935.5	64.091	-71.019	0.0000	-0.0004	0.0005
VC4	9121.0	4344.0	74.467	25.408	0.0000	-0.0010	-0.0003
VC5	2382.0	2054.0	-67.157	73.530	0.0000	0.0003	-0.0003
VC6	3593.0	7423.0	-41.711	-39.233	0.0000	0.0009	0.0008
VC7	2931.0	4736.0	-55.621	17.200	0.0000	0.0011	-0.0003
VC8	8872.5	1546.5	69.248	84.163	0.0000	-0.0000	-0.0000
VC9	9753.3	6150.0	87.754	-12.523	0.0000	-0.0008	0.0001
VC10	5429.7	9296.7	-3.114	-78.591	0.0000	0.0000	0.0011
VC11	6058.0	5362.3	10.094	4.034	0.0000	-0.0003	-0.0001
VC12	5769.0	1300.0	4.025	89.351	0.0000	-0.0000	-0.0008
VC13	7549.0	9204.0	41.425	-76.654	0.0000	-0.0004	0.0008
VC14	7216.5	3830.5	34.442	36.200	0.0000	-0.0008	-0.0008

```
    VC15        1404.0   4017.0   -87.712    32.307   0.0000   0.0007  -
0.0002

Mean Differenence in dX and dY: -0.0001  -0.0000
Standard Deviation in dX and dY:   0.0007   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  11.004
XL      =  521067.7
YL      =  1420906.2
ZL      =  20505.7


A solution has been found after 4 iterations
Standard Deviation of unit weight = 0.2596537

Omega   =     0.66  (Degrees)
Phi     =    -1.01  (Degrees)
Kappa   =    11.20  (Degrees)
XL      =  519977.6
YL      =  1419970.3
ZL      =  20523.0

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  27.19701
  -3.90598  28.68383
   0.17753   0.39712   0.76562
  -74.60463  572.51864   8.48311  11446.919
  -542.00262  73.72815  -4.11303  1404.929  10821.160
  -38.41855  44.96823   0.35777  879.399  746.648  393.833

Standard Deviation for Omega: 1075.69  (Seconds)
Standard Deviation for   Phi: 1104.70  (Seconds)
Standard Deviation for Kappa: 180.48  (Seconds)
Standard Deviation for    XL: 106.99  (Meters)
Standard Deviation for    YL: 104.02  (Meters)
Standard Deviation for    ZL:  19.85  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1   4.08  -1.89
     VC2   3.47  13.82
     VC3   8.86  -9.95
     VC4  12.07   4.02
     VC5  -24.85  10.90
     VC6  -12.10  -16.76
```

VC7	-6.46	-15.49
VC8	12.08	14.38
VC9	12.34	1.05
VC10	0.23	-14.21
VC11	1.31	3.84
VC12	-1.70	18.23
VC13	5.46	-13.19
VC14	4.85	6.94
VC15	-17.92	-1.12

Col RMS = 10.76
Row RMS = 11.34

Single Space Resection for F:\NPS_WRST\9488\AB582003097ROLL_9488_A.LAN

Number of points processed: 17

Ground Control Coordinates

Point Name	X	Y	Z
VC1	527351.75	1422468.25	911.00
VC2	521958.50	1419429.00	1341.68
VC3	522864.50	1425699.00	1101.94
VC4	530792.50	1418443.00	1036.52
VC5	528452.50	1427872.00	894.73
VC6	521406.50	1424038.00	1162.52
VC7	523680.50	1416422.00	941.08
VC8	527254.50	1417612.00	1120.91
VC9	525878.83	1426827.00	940.37
VC10	530792.50	1426100.00	912.92
VC11	526540.50	1424742.00	934.35
VC12	532141.50	1422660.00	1063.45
VC13	524934.50	1421626.00	967.83
VC14	524515.50	1415637.00	942.00
VC15	531651.50	1416505.00	1013.88
VC16	522426.50	1422494.00	1140.98
VC17	530234.50	1420362.00	997.08

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	6344.8	4864.5	15.234	14.723	0.0000	-0.0004	-0.0004
VC2	1895.0	6356.0	-78.205	-16.676	0.0000	0.0010	0.0002
VC3	3492.0	1870.0	-44.750	77.548	0.0000	0.0004	-0.0007
VC4	8319.0	8259.0	56.773	-56.517	0.0000	-0.0007	0.0007
VC5	7869.0	1126.0	47.177	93.251	0.0000	-0.0001	-0.0002
VC6	2166.0	2867.0	-72.583	56.590	0.0000	0.0006	-0.0005
VC7	2820.0	8780.0	-58.726	-67.557	0.0000	0.0005	0.0006
VC8	5623.0	8411.0	0.145	-59.757	0.0000	-0.0000	0.0012
VC9	5865.0	1508.0	5.089	85.192	0.0000	-0.0001	-0.0009
VC10	9311.0	2724.0	77.499	59.722	0.0000	-0.0004	-0.0003
VC11	6064.0	3105.0	9.301	51.662	0.0000	-0.0002	-0.0011
VC12	9869.0	5374.0	89.273	4.089	0.0000	-0.0008	-0.0000
VC13	4463.0	5145.0	-24.287	8.799	0.0000	0.0007	-0.0002

```
    VC14        3330.0   9471.0   -47.999   -82.057   0.0000   0.0003
0.0006
    VC15        8682.0   9784.0    64.429   -88.533   0.0000  -0.0000
0.0000
    VC16        2713.0   4151.0   -61.067    29.638   0.0000   0.0011  -
0.0005
    VC17        8164.0   6781.0    53.486   -25.485   0.0000  -0.0011
0.0005

Mean Differenence in dX and dY:  0.0000  -0.0001
Standard Deviation in dX and dY:   0.0006   0.0006


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  10.661
XL      =  526639.8
YL      =  1421702.1
ZL      =  20455.5


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.1892457

Omega   =     0.95  (Degrees)
Phi     =    -1.32  (Degrees)
Kappa   =    10.53  (Degrees)
XL      =  526111.8
YL      =  1421029.7
ZL      =  20521.5

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  10.00101
   0.58112  15.31171
   0.06819  -0.05793   0.32857
  11.97042  307.94871  -1.05871  6202.185
  -202.20452  -12.54473  -1.38590  -257.931  4097.045
  -6.83395  16.60158  -0.11160  330.962  133.435  148.257

Standard Deviation for Omega: 652.30  (Seconds)
Standard Deviation for   Phi: 807.12  (Seconds)
Standard Deviation for Kappa: 118.23  (Seconds)
Standard Deviation for    XL:  78.75  (Meters)
Standard Deviation for    YL:  64.01  (Meters)
Standard Deviation for    ZL:  12.18  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
```

VC1	2.89	1.96
VC2	-14.33	-2.86
VC3	-7.86	9.91
VC4	6.94	-8.35
VC5	11.52	9.08
VC6	-14.27	3.27
VC7	-8.18	-10.86
VC8	5.50	-6.08
VC9	1.52	9.55
VC10	5.48	12.43
VC11	2.52	4.76
VC12	13.18	2.58
VC13	-3.79	1.90
VC14	-4.14	-9.75
VC15	8.91	-14.16
VC16	-11.02	2.17
VC17	6.22	-5.10

Col RMS = 8.54
Row RMS = 7.79

Single Space Resection for F:\NPS_WRST\123\AB642700260ROLL_123_A.LAN

Number of points processed: 9

Ground Control Coordinates

Point Name	X	Y	Z
VC1	573315.17	1417363.00	811.89
VC2	573532.50	1420025.00	801.26
VC3	578940.40	1412002.38	1076.56
VC5	580928.83	1421284.54	1676.76
VC6	582030.34	1414152.46	2401.82
VC7	574788.29	1413708.28	914.44
VC8	574840.50	1416012.00	874.33
VC9	576869.50	1419844.00	2107.31
VC10	580021.16	1416392.13	1521.55

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	1639.7	4558.0	-84.312	21.522	-0.0000	-0.0001	0.0000
VC2	2211.0	2442.0	-72.244	65.951	-0.0000	-0.0002	0.0002
VC3	5418.0	9753.0	-5.081	-87.700	-0.0000	-0.0000	-0.0001
VC5	8467.0	2410.0	59.202	66.448	-0.0000	0.0001	0.0001
VC6	8530.0	8671.0	60.338	-65.060	-0.0000	0.0001	-0.0001
VC7	2245.0	7769.0	-71.689	-45.939	-0.0000	-0.0001	-0.0001
VC8	2670.6	5870.6	-62.690	-6.077	0.0000	0.0001	0.0000
VC9	4852.0	2854.5	-16.766	57.212	0.0000	0.0000	-0.0001
VC10	7018.0	6323.0	28.640	-15.701	0.0000	-0.0001	0.0001

Mean Differenence in dX and dY: -0.0000 -0.0000
Standard Deviation in dX and dY: 0.0001 0.0001

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 10.012
XL = 577251.9
YL = 1416753.8
ZL = 18272.1

A solution has been found after 4 iterations
Standard Deviation of unit weight = 0.4132080

```
Omega   =     1.91  (Degrees)
Phi     =    -2.20  (Degrees)
Kappa   =    10.32  (Degrees)
XL      =  577654.3
YL      =  1416420.0
ZL      =  18569.8

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  97.31603
  10.95749  90.81034
   6.46026  -0.49507   3.61802
  200.60014  1613.42855  -9.16791  28726.428
  -1717.41421  -199.73435  -110.94019  -3654.110  30372.120
  -50.76545  -92.97323  -2.05822  -1640.170  886.463  1048.557

Standard Deviation for Omega: 2034.78  (Seconds)
Standard Deviation for   Phi: 1965.59  (Seconds)
Standard Deviation for Kappa: 392.34  (Seconds)
Standard Deviation for    XL: 169.49  (Meters)
Standard Deviation for    YL: 174.28  (Meters)
Standard Deviation for    ZL:  32.38  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  11.66   2.83
     VC2  -1.65  -1.79
     VC3  -2.85  -31.03
     VC5  -14.84  22.01
     VC6  15.89  25.93
     VC7  -18.31   9.97
     VC8   6.99  -5.43
     VC9  -21.80  -13.37
    VC10  24.86  -10.38

    Col RMS =  15.26
    Row RMS =  16.82
```

Single Space Resection for F:\NPS_WRST\124\AB642700260ROLL_124_A.LAN

Number of points processed: 12

Ground Control Coordinates

Point Name	X	Y	Z
VC1	569997.50	1414991.33	1216.99
VC2	570725.50	1418883.00	788.18
VC3	575204.50	1421417.50	1658.54
VC4	577795.00	1415452.00	1268.10
VC5	567754.00	1419695.50	851.00
VC6	577600.67	1413033.00	1098.80
VC7	576266.67	1418584.67	1380.96
VC8	574441.50	1414912.50	892.14
VC9	569734.24	1411660.66	994.80
VC11	576153.83	1420727.33	1998.30
VC12	572900.75	1416427.00	817.73
VC13	574312.00	1419912.50	1046.71

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	2861.7	6135.7	-57.394	-5.562	0.0000	0.0001	0.0000
VC2	4095.0	3107.0	-31.396	58.014	0.0000	0.0000	-0.0001
VC3	8223.5	1540.0	55.394	90.805	-0.0000	0.0002	0.0003
VC4	9395.5	6931.0	79.869	-22.458	-0.0000	0.0001	-0.0000
VC5	1801.5	1993.0	-79.554	81.479	-0.0000	-0.0003	0.0003
VC6	8811.0	8881.7	67.533	-63.411	-0.0000	0.0001	-0.0001
VC7	8635.7	4097.0	63.983	37.088	0.0000	-0.0000	-0.0000
VC8	6500.0	6874.0	19.031	-21.176	0.0000	-0.0001	0.0001
VC9	2168.0	8809.0	-72.044	-61.691	-0.0000	-0.0002	-0.0001
VC11	8990.5	2193.0	71.492	77.068	-0.0000	0.0002	0.0003
VC12	5491.5	5404.3	-2.117	9.723	0.0000	0.0000	-0.0001
VC13	7173.3	2778.3	33.294	64.827	0.0000	-0.0000	-0.0000

Mean Differenence in dX and dY: 0.0000   0.0000
Standard Deviation in dX and dY: 0.0002   0.0002

Initial Approximations:
Omega   =   0.000
Phi   =   0.000

```
Kappa   =  10.486
XL      =  573573.8
YL      =  1417141.4
ZL      =  18746.6


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2396545

Omega   =     0.45  (Degrees)
Phi     =    -0.81  (Degrees)
Kappa   =    10.58  (Degrees)
XL      =  572877.5
YL      =  1415758.3
ZL      =  18519.3

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  36.95217
  -12.19316  28.78307
   1.06324   1.09287   0.91217
  -219.95614  519.28355  20.74881  9385.825
  -663.54121  220.80462  -19.38317  3983.537  11932.537
  -39.31194  12.80210  -1.14474  220.547  686.094  279.752

Standard Deviation for Omega: 1253.85  (Seconds)
Standard Deviation for   Phi: 1106.61  (Seconds)
Standard Deviation for Kappa: 197.00  (Seconds)
Standard Deviation for    XL:  96.88  (Meters)
Standard Deviation for    YL: 109.24  (Meters)
Standard Deviation for    ZL:  16.73  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  -6.48   0.37
     VC2  -8.01   6.32
     VC3   4.45   9.90
     VC4  14.14  -15.65
     VC5  -7.68  13.45
     VC6  -10.58  -6.68
     VC7  15.49  -18.84
     VC8  -10.55  12.06
     VC9  -6.40  -12.78
    VC11   7.78   5.62
    VC12   1.86  -1.38
    VC13   4.93   7.78

    Col RMS =   9.02
    Row RMS =  10.67
```

Single Space Resection for F:\NPS_WRST\125\AB642700260ROLL_125_A.LAN

Number of points processed: 12

Ground Control Coordinates

Point Name	X	Y	Z
VC1	569108.50	1419194.00	851.44
VC2	568721.17	1415474.67	960.10
VC3	562131.50	1418829.00	1044.49
VC4	563474.83	1415452.67	1378.50
VC5	571785.67	1411542.67	844.38
VC6	570827.00	1417045.00	1073.97
VC7	570459.67	1420421.67	858.46
VC8	569986.01	1410141.97	983.28
VC9	569683.00	1411854.67	991.21
VC10	565899.00	1416677.50	1220.33
VC11	566178.83	1419325.33	1131.61
VC12	567056.47	1410423.94	1340.25

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	7477.5	2692.0	39.301	66.627	-0.0000	0.0000	0.0000
VC2	6631.8	5623.0	21.475	5.084	0.0000	-0.0001	-0.0000
VC3	1733.0	1919.0	-81.383	82.972	-0.0000	-0.0003	0.0004
VC4	2266.0	4851.0	-70.239	21.381	0.0000	0.0000	-0.0000
VC5	8509.3	9253.3	60.856	-71.200	-0.0000	0.0001	-0.0001
VC6	8598.7	4655.3	62.820	25.370	0.0000	-0.0001	-0.0000
VC7	8745.3	1911.3	65.954	83.000	-0.0000	0.0002	0.0003
VC8	6878.0	10133.0	26.563	-89.645	-0.0000	0.0001	-0.0002
VC9	6879.7	8705.3	26.625	-59.659	0.0000	-0.0000	0.0001
VC10	4492.5	4210.5	-23.446	34.791	0.0000	0.0001	-0.0001
VC11	5116.0	2100.0	-10.306	79.106	-0.0000	-0.0000	0.0000
VC12	4486.0	9551.0	-23.684	-77.376	-0.0000	-0.0000	-0.0000

Mean Differenence in dX and dY: -0.0000 0.0000
Standard Deviation in dX and dY: 0.0001 0.0002

Initial Approximations:
Omega = 0.000
Phi = 0.000

```
Kappa   =  10.262
XL      =  567942.6
YL      =  1415531.9
ZL      =  18659.2


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2480963

Omega   =    -0.03  (Degrees)
Phi     =    -0.25  (Degrees)
Kappa   =    10.33  (Degrees)
XL      =  567488.4
YL      =  1414983.6
ZL      =  18577.9

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  27.24104
  -5.72156  31.60706
   0.00614   0.33162   0.81203
  -98.40670  568.06103   6.41457  10227.540
  -495.53434  98.87451  -0.44097  1696.405  9032.238
  -19.72213  18.41037   0.16059  322.644  348.733  269.570

Standard Deviation for Omega: 1076.56  (Seconds)
Standard Deviation for   Phi: 1159.62  (Seconds)
Standard Deviation for Kappa: 185.87  (Seconds)
Standard Deviation for    XL: 101.13  (Meters)
Standard Deviation for    YL:  95.04  (Meters)
Standard Deviation for    ZL:  16.42  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1   5.40   4.76
     VC2   8.99  -6.34
     VC3  -12.27   6.92
     VC4  -15.55   0.50
     VC5   0.69   7.44
     VC6  18.45  -2.23
     VC7   4.02  17.20
     VC8  12.19  -13.79
     VC9   7.05  -7.41
    VC10  -1.23  -2.18
    VC11  -5.99   9.08
    VC12  -20.79  -13.55

    Col RMS =  11.28
    Row RMS =   9.05
```

Single Space Resection for F:\NPS_WRST\126\AB642700260ROLL_126_A.LAN

Number of points processed: 11

Ground Control Coordinates

Point Name	X	Y	Z
VC1	561819.50	1419184.50	1227.25
VC2	560702.00	1414004.50	1009.95
VC3	557366.00	1417195.50	1460.76
VC4	565167.00	1417612.00	1394.37
VC5	565721.00	1410767.25	1831.26
VC6	566095.50	1415158.00	1684.39
VC7	564352.00	1418245.00	1447.92
VC8	558829.48	1409381.08	970.68
VC9	562798.50	1416750.50	1084.11
VC10	558491.00	1415828.00	1020.30
VC11	560484.50	1417807.00	1557.56

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	6077.5	1581.0	9.980	89.851	-0.0000	0.0000	0.0002
VC2	4384.3	5674.0	-25.700	3.919	0.0000	0.0001	-0.0000
VC3	2035.5	2496.0	-74.976	70.718	-0.0000	-0.0002	0.0002
VC4	8638.0	3358.0	63.738	52.474	-0.0000	0.0001	0.0000
VC5	8129.0	9204.0	52.897	-70.301	-0.0000	0.0001	-0.0001
VC6	9106.5	5530.0	73.528	6.845	0.0000	-0.0000	-0.0000
VC7	8068.3	2702.7	51.784	66.250	-0.0000	0.0001	0.0001
VC8	2186.0	9151.0	-71.980	-69.063	-0.0000	-0.0002	-0.0002
VC9	6511.0	3753.0	19.035	44.222	0.0000	-0.0001	-0.0001
VC10	2845.5	3861.0	-57.989	42.031	0.0000	0.0000	-0.0000
VC11	4747.0	2451.5	-17.999	71.595	0.0000	0.0000	-0.0000

Mean Differenence in dX and dY: -0.0000 -0.0000
Standard Deviation in dX and dY: 0.0001 0.0001

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 10.225
XL = 561984.2
YL = 1415630.3

```
ZL      =  18240.9


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2236224

Omega   =    -0.42  (Degrees)
Phi     =    -0.76  (Degrees)
Kappa   =    10.35  (Degrees)
XL      =  561950.6
YL      =  1414188.1
ZL      =  18562.4

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  30.15533
  12.20665  45.31261
   1.52706   2.70927   1.01001
  218.50951  807.18068  49.59748  14395.349
  -536.40192  -214.62995  -26.90681  -3841.987  9557.867
  -18.32976  -27.90966  -2.00213  -498.799  304.028  264.925

Standard Deviation for Omega: 1132.68  (Seconds)
Standard Deviation for   Phi: 1388.46  (Seconds)
Standard Deviation for Kappa: 207.29  (Seconds)
Standard Deviation for    XL: 119.98  (Meters)
Standard Deviation for    YL:  97.76  (Meters)
Standard Deviation for    ZL:  16.28  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
     VC1  -1.69  13.28
     VC2  -9.24  -9.91
     VC3  -9.64   4.21
     VC4   6.78   2.32
     VC5  10.32  -9.27
     VC6  17.83  -5.71
     VC7   9.17   9.19
     VC8  -6.51  -16.70
     VC9  -1.85   5.62
    VC10  -7.19  -2.55
    VC11  -8.82   9.18

    Col RMS =   9.10
    Row RMS =   9.05
```

Single Space Resection for F:\NPS_WRST\127\AB642700260ROLL_127_A.LAN

Number of points processed: 13

Ground Control Coordinates

Point Name	X	Y	Z
VC1	560040.50	1416745.00	916.01
VC2	555473.83	1415369.67	1061.66
VC3	560508.20	1412445.80	925.52
VC4	560717.67	1410437.33	1195.31
VC5	559226.00	1418334.50	1692.37
VC6	560398.25	1414722.50	1218.12
VC7	553199.50	1413504.50	1980.53
VC8	552609.17	1417013.33	1607.01
VC9	554670.91	1410887.43	1462.00
VC10	556048.52	1408087.16	991.44
VC11	558298.33	1410974.33	1539.84
VC12	556388.75	1417824.50	1639.36
VC13	558017.83	1413342.33	1726.58

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	8727.0	3452.0	65.068	50.508	-0.0000	0.0000	0.0000
VC2	4814.3	3895.0	-17.148	41.292	0.0000	0.0001	-0.0001
VC3	8506.8	6988.4	60.344	-23.769	0.0000	-0.0001	0.0000
VC4	8445.5	8683.3	59.010	-59.367	-0.0000	0.0001	-0.0001
VC5	8410.0	1881.3	58.452	83.507	-0.0000	0.0002	0.0002
VC6	8795.2	5124.0	66.455	15.386	0.0000	-0.0001	-0.0000
VC7	2518.0	5045.0	-65.425	17.188	0.0000	0.0001	-0.0000
VC8	2597.7	2015.7	-63.668	80.817	-0.0000	-0.0002	0.0002
VC9	3454.3	7478.3	-45.820	-33.945	0.0000	0.0001	0.0001
VC10	4257.0	9895.0	-29.023	-84.725	-0.0000	-0.0000	-0.0001
VC11	6547.8	7945.5	19.159	-43.828	0.0000	-0.0001	0.0001
VC12	5932.0	1892.8	6.389	83.322	-0.0000	0.0000	0.0001
VC13	6656.0	5918.3	21.489	-1.248	0.0000	-0.0001	0.0000

Mean Differenence in dX and dY: -0.0000 0.0000
Standard Deviation in dX and dY: 0.0001 0.0001

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   = 10.245
XL   = 557353.7
YL   = 1413822.2
ZL   = 18654.4

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2738739

Omega   =   -0.02 (Degrees)
Phi   =   -0.33 (Degrees)
Kappa   =   9.94 (Degrees)
XL   = 556743.6
YL   = 1413209.3
ZL   = 18559.8

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  31.08212
   0.36439  45.50114
  -0.23487   1.56882   1.14912
   6.99565  801.49301  28.34022  14137.158
  -550.18393  -8.68026   3.58360  -163.058  9757.863
  -19.81046  34.75368   1.39183  602.108  336.496  361.630
```

Standard Deviation for Omega: 1149.95 (Seconds)
Standard Deviation for   Phi: 1391.35 (Seconds)
Standard Deviation for Kappa: 221.11 (Seconds)
Standard Deviation for   XL: 118.90 (Meters)
Standard Deviation for   YL: 98.78 (Meters)
Standard Deviation for   ZL: 19.02 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	4.48	11.38
VC2	-5.65	3.33
VC3	10.47	-3.96
VC4	19.01	-10.76
VC5	-3.08	20.46
VC6	13.12	5.49
VC7	-14.02	-7.21
VC8	-17.19	1.19
VC9	-22.32	-6.16
VC10	-1.99	-22.84
VC11	15.95	-2.73
VC12	1.17	10.00
VC13	1.45	1.26

```
Col RMS =  12.27
Row RMS =  10.53
```

Single Space Resection for F:\NPS_WRST\128\AB642700260ROLL_128_A.LAN

Number of points processed: 11

Ground Control Coordinates

Point Name	X	Y	Z
	547941.50	1414719.50	2014.32
	552907.83	1415663.33	1026.42
	549896.81	1408233.04	1362.15
	554535.73	1411305.86	1455.74
	556367.50	1408477.00	1101.24
	553968.33	1417047.67	1336.71
	554881.33	1409357.33	1456.43
	550819.50	1416685.50	1274.26
	550598.50	1412650.67	1309.25
	546542.50	1413627.50	1031.04
	548153.00	1416977.50	1159.98

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
	2870.5	3290.8	-57.298	53.802	0.0000	0.0000	0.0000
	7224.3	3378.0	34.178	51.858	0.0000	0.0000	0.0000
	3668.0	9058.0	-40.700	-67.349	0.0000	0.0000	0.0000
	7982.0	7180.0	49.993	-28.016	0.0000	0.0000	0.0000
	9059.3	9730.0	72.559	-81.602	0.0000	0.0000	0.0000
	8339.3	2345.0	57.634	73.526	0.0000	0.0000	0.0000
	8016.0	8861.5	50.661	-63.334	0.0000	0.0000	0.0000
	5668.3	2192.3	1.518	76.801	0.0000	0.0000	0.0000
	4888.7	5494.7	-14.955	7.461	0.0000	0.0000	0.0000
	1709.0	4126.5	-81.725	36.278	0.0000	0.0000	0.0000
	3503.0	1592.0	-43.962	89.465	0.0000	0.0000	0.0000

Mean Differenence in dX and dY: 0.0000   0.0000
Standard Deviation in dX and dY: 0.0000   0.0000

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   =   9.759
XL   = 551510.2
YL   = 1413158.6

```
ZL      =  18755.7


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2560960

Omega   =     0.30  (Degrees)
Phi     =    -0.50  (Degrees)
Kappa   =     9.86  (Degrees)
XL      =  551341.2
YL      =  1412287.7
ZL      =  18556.7

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  34.21769
  -8.40363  37.06578
   0.13547   0.62723   0.96651
  -141.72284  657.67029  11.93088  11690.538
  -608.67256  140.81994  -2.57232  2366.904  10849.072
  -21.34290  25.48666   0.31095  446.579  360.534  308.988

Standard Deviation for Omega: 1206.56  (Seconds)
Standard Deviation for   Phi: 1255.77  (Seconds)
Standard Deviation for Kappa: 202.78  (Seconds)
Standard Deviation for    XL: 108.12  (Meters)
Standard Deviation for    YL: 104.16  (Meters)
Standard Deviation for    ZL:  17.58  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
          -11.40   4.53
           7.88   8.21
          -7.29  -20.91
          -11.93  -5.04
          16.06  -6.20
          15.60  14.82
          13.00  -4.74
           7.97   5.36
          -10.77   0.09
          -15.87  -0.68
          -2.58   4.67

    Col RMS =  11.66
    Row RMS =   8.95
```

Single Space Resection for F:\NPS_WRST\129\AB642700260ROLL_129_A.LAN

Number of points processed: 10

Ground Control Coordinates

Point Name	X	Y	Z
VC1	546191.17	1414868.67	1003.65
VC2	543513.50	1413994.00	1489.28
VC3	548151.00	1408373.67	1120.67
VC4	549691.50	1412328.50	1401.78
VC5	549875.00	1407787.00	1437.21
VC6	543266.29	1409964.70	1625.78
VC7	546791.50	1412151.50	1065.00
VC8	548795.00	1417051.00	973.95
VC9	544926.50	1416109.50	1240.66
VC10	547332.33	1410716.00	1112.52

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	6162.3	3142.0	11.640	56.970	0.0000	-0.0000	-0.0001
VC2	3797.0	3411.0	-38.068	51.382	0.0000	0.0001	-0.0001
VC3	6870.5	8710.5	26.359	-59.997	0.0000	-0.0000	0.0001
VC4	8729.5	5692.0	65.508	3.349	0.0000	-0.0001	-0.0000
VC5	8257.0	9494.5	55.469	-76.499	-0.0000	0.0001	-0.0002
VC6	2980.0	6737.0	-55.331	-18.449	0.0000	0.0001	0.0000
VC7	6269.7	5430.3	13.829	8.908	0.0000	-0.0001	-0.0000
VC8	8593.0	1745.5	62.754	86.237	-0.0000	0.0002	0.0003
VC9	5298.5	1901.0	-6.474	83.057	-0.0000	-0.0000	0.0001
VC10	6519.5	6682.8	19.042	-17.401	0.0000	-0.0001	0.0001

Mean Differenence in dX and dY: 0.0000   0.0000
Standard Deviation in dX and dY: 0.0001   0.0001

Initial Approximations:
Omega   =   0.000
Phi   =   0.000
Kappa   =   9.518
XL   = 546853.4
YL   = 1412334.5
ZL   = 18516.9

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2548507

Omega   =   0.48 (Degrees)
Phi   =   0.02 (Degrees)
Kappa   =   9.80 (Degrees)
XL   = 546099.1
YL   = 1411361.7
ZL   = 18584.1

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  40.12537
   2.84218  146.65841
   0.84348  -0.10952   1.49364
  55.70261  2584.18013  -0.64698  45557.729
  -715.81124  -70.45825  -16.11858  -1341.632  12795.282
  -58.34909  191.63372  -1.47486  3349.413  991.333  788.822
```

Standard Deviation for Omega: 1306.58 (Seconds)
Standard Deviation for   Phi: 2497.92 (Seconds)
Standard Deviation for Kappa: 252.09 (Seconds)
Standard Deviation for   XL: 213.44 (Meters)
Standard Deviation for   YL: 113.12 (Meters)
Standard Deviation for   ZL: 28.09 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	1.65	5.45
VC2	-14.44	8.08
VC3	8.09	-10.65
VC4	1.18	7.66
VC5	12.34	-16.73
VC6	-21.56	-10.67
VC7	-4.09	1.97
VC8	18.92	10.10
VC9	-2.71	2.71
VC10	1.52	2.63

Col RMS = 11.31
Row RMS =   8.84

Single Space Resection for F:\NPS_WRST\130\AB642700260ROLL_130_A.LAN

Number of points processed: 7

Ground Control Coordinates

Point Name	X	Y	Z
VC1	543671.50	1413847.00	1376.43
VC2	544444.00	1407781.50	1733.18
VC3	536061.88	1414389.07	1360.99
VC4	537799.97	1407031.15	1496.13
VC5	536885.86	1410397.90	1764.46
VC6	542726.67	1411683.67	2402.71
VC7	541014.00	1414982.50	1817.99

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
VC1	8558.7	3655.0	62.056	46.258	-0.0000	0.0000	0.0000
VC2	8394.3	8828.7	58.454	-62.404	-0.0000	0.0001	-0.0001
VC3	2304.0	2096.0	-69.324	79.148	-0.0000	-0.0002	0.0003
VC4	2675.0	8491.0	-61.713	-55.179	-0.0000	-0.0001	-0.0000
VC5	2346.0	5501.0	-68.539	7.629	0.0000	0.0001	-0.0000
VC6	7584.8	5264.5	41.545	12.475	0.0000	-0.0001	-0.0000
VC7	6538.7	2240.0	19.653	76.025	-0.0000	0.0000	0.0000

Mean Differenence in dX and dY: -0.0000 0.0000
Standard Deviation in dX and dY: 0.0001 0.0001

Initial Approximations:
Omega = 0.000
Phi = 0.000
Kappa = 9.679
XL = 540372.0
YL = 1411444.7
ZL = 18794.3

A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2455382

Omega = 0.63 (Degrees)
Phi = -1.01 (Degrees)
Kappa = 9.87 (Degrees)
XL = 540367.5
YL = 1410463.0
ZL = 18617.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

```
  42.87702
  -10.38264  46.86127
   0.78615   0.54620   1.44574
  -180.45343  820.31471  10.69348  14387.065
  -746.29322  181.82308  -13.28289  3160.634  13017.419
  -32.19271  -18.13525  -1.00746  -319.142  536.777  449.513
```

Standard Deviation for Omega: 1350.63 (Seconds)
Standard Deviation for Phi: 1411.99 (Seconds)
Standard Deviation for Kappa: 248.01 (Seconds)
Standard Deviation for XL: 119.95 (Meters)
Standard Deviation for YL: 114.09 (Meters)
Standard Deviation for ZL: 21.20 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
VC1	16.80	4.96
VC2	6.35	-11.60
VC3	-8.79	4.67
VC4	0.99	3.03
VC5	-4.55	-16.82
VC6	-7.44	5.64
VC7	-2.76	10.19

Col RMS = 8.32
Row RMS = 9.32

Single Space Resection for F:\NPS_WRST\4273\AB581003013ROLL_4273_A.LAN

Number of points processed: 20

Ground Control Coordinates

Point Name	X	Y	Z
	561150.50	1430841.00	913.60
	553857.50	1427878.00	1530.26
	563422.50	1422622.00	1044.77
	556240.50	1423045.00	1656.53
	552013.50	1430815.00	1487.17
	559327.50	1432804.00	879.13
	563125.50	1428686.00	955.97

ºI

 +‡†?   557619.50 1427787.00 1768.02
",V^"a-@   556349.50 1433035.00 1009.12
             556736.50 1430576.00 1712.94
             561656.50 1433503.00 1141.35
             559022.50 1423086.00 1747.53
             554158.50 1421275.00 1479.38
             554314.50 1425409.00 1635.38
             560326.50 1426014.00 1428.56
             563632.50 1427104.00 1047.32
             558043.50 1424894.00 2073.42
             556211.50 1428249.00 1700.58
             552633.50 1429847.00 1367.43
             560573.50 1429250.00 1117.88

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
	8501.0	3791.0	61.624	44.938	0.0000	0.0000	0.0000
	2535.0	4526.0	-63.805	29.673	0.0000	0.0000	0.0000
	8642.0	10202.0	64.377	-89.729	0.0000	0.0000	0.0000
	3377.0	8615.0	-46.241	-56.241	0.0000	0.0000	0.0000
	1729.0	1986.0	-80.663	83.049	0.0000	0.0000	0.0000
	7535.0	2029.0	41.377	81.977	0.0000	0.0000	0.0000
	9548.0	5716.0	83.569	4.473	0.0000	0.0000	0.0000

ºI

```
 +‡†?        5339.0   5313.0    -4.891    13.060   0.0000   0.0000
0.0000
",V^"a-@        5415.0   1280.0    -3.160    97.771   0.0000   0.0000
0.0000
                5220.0   3032.0    -7.317    60.976   0.0000   0.0000
0.0000
                9409.0   1909.0    80.773    84.443   0.0000   0.0000
0.0000
                5489.0   9146.0    -1.865   -67.456   0.0000   0.0000
0.0000
                1495.0   9507.0   -85.830   -74.923   0.0000   0.0000
0.0000
                2381.0   6463.0   -67.106   -11.010   0.0000   0.0000
0.0000
                7041.0   7172.0    30.824   -26.037   0.0000   0.0000
0.0000
                9639.0   6967.0    85.440   -21.807   0.0000   0.0000
0.0000
                5091.0   7611.0   -10.180   -35.202   0.0000   0.0000
0.0000
                4363.0   4694.0   -25.386    26.091   0.0000   0.0000
0.0000
                2033.0   2852.0   -74.302    64.850   0.0000   0.0000
0.0000
                7804.0   4819.0    46.940    23.365   0.0000   0.0000
0.0000

Mean Differenence in dX and dY:  0.0000   0.0000
Standard Deviation in dX and dY:   0.0000   0.0000


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  14.756
XL      =  558020.8
YL      =  1427836.0
ZL      =  20357.9


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2035106

Omega   =     0.14  (Degrees)
Phi     =     0.42  (Degrees)
Kappa   =    14.54  (Degrees)
XL      =  558238.5
YL      =  1427044.4
ZL      =  20261.6

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

   7.89551
```

```
  -0.02265   7.72495
  -0.25806  -0.04295   0.33108
  -0.77469  150.72256  -0.60649  2948.892
  -154.00058   0.41988   5.07735  14.646  3011.848
  -9.63645   0.68883   0.31551  15.645  183.672  127.852

Standard Deviation for Omega: 579.58  (Seconds)
Standard Deviation for   Phi: 573.29  (Seconds)
Standard Deviation for Kappa: 118.68  (Seconds)
Standard Deviation for    XL:  54.30  (Meters)
Standard Deviation for    YL:  54.88  (Meters)
Standard Deviation for    ZL:  11.31  (Meters)



Residuals for the points entered

Point ID   Cols   Rows
           7.96  10.12
          -12.03   1.48
          10.87  -17.47
          -3.09  -12.63
          -17.19   4.53
           4.20   6.38
          10.87  -1.15
ºI
```

```
 +‡†?  -2.60   3.23
",V^"a-@   0.49   7.95
           1.67   3.82
           6.54  16.49
           1.64  -11.47
          -10.96  -16.61
          -11.99  -2.48
          13.62   4.36
           9.04  -4.48
           3.28  -8.11
          -5.20   5.67
          -11.46   9.48
           5.55   1.92

    Col RMS =   8.81
    Row RMS =   9.04
```

Single Space Resection for F:\NPS_WRST\4274\AB581003013ROLL_4274_A.LAN

Number of points processed: 17

Ground Control Coordinates

Point Name	X	Y	Z
	550775.50	1424958.00	1497.83
	550656.50	1430225.00	1377.51
	554841.50	1430849.00	1679.41
	546693.50	1430631.00	1259.62
	558543.50	1422376.00	1386.64
	549364.50	1419985.00	1454.06
	547007.50	1428501.00	1002.47

ºI

 +‡†?   556140.50 1427028.00 1769.63
",V^"a-@   553635.50 1421535.00 1542.95
             556796.50 1424998.00 1756.68
             547780.50 1424351.00 1112.78
             552629.50 1428721.00 1439.88
             549972.17 1427508.33 1404.85
             548080.50 1421506.00 1152.30
             552285.50 1431038.00 1472.72
             554820.50 1432410.00 1162.08
             553020.50 1426918.00 1520.85

Photo Control Coordinates

Point Name	Column	Row	x	y	dR	dX	dY
	4286.5	6144.5	-27.412	-7.330	0.0000	0.0000	0.0000
	5193.0	2210.0	-8.243	75.296	0.0000	0.0000	0.0000
	8481.0	2475.0	60.860	69.646	0.0000	0.0000	0.0000
	2338.0	1206.0	-68.224	96.460	0.0000	0.0000	0.0000
	9627.0	9517.0	84.742	-78.311	0.0000	0.0000	0.0000
	2299.0	9584.0	-69.289	-79.531	0.0000	0.0000	0.0000
	2220.0	2869.0	-70.753	61.529	0.0000	0.0000	0.0000

ºI

```
 +‡†?        8765.0   5602.0    66.738     3.951   0.0000   0.0000
0.0000
",V^"a-@        5793.0   9248.0     4.162   -72.562   0.0000   0.0000
0.0000
                8867.0   7262.0    68.834   -30.922   0.0000   0.0000
0.0000
                2002.0   6030.0   -75.428    -4.867   0.0000   0.0000
0.0000
                6388.0   3690.0    16.831    44.176   0.0000   0.0000
0.0000
                4173.7   4096.7   -29.724    35.690   0.0000   0.0000
0.0000
                1695.0   8168.0   -81.943   -49.771   0.0000   0.0000
0.0000
                6570.0   1891.0    20.710    81.962   0.0000   0.0000
0.0000
                8680.0   1410.0    65.074    92.012   0.0000   0.0000
0.0000
                6349.0   5100.0    15.970    14.558   0.0000   0.0000
0.0000

Mean Differenence in dX and dY:  0.0000   0.0000
Standard Deviation in dX and dY:   0.0000   0.0000


Initial Approximations:
Omega   =   0.000
Phi     =   0.000
Kappa   =  13.944
XL      =  551943.8
YL      =  1426678.7
ZL      =  20373.9


A solution has been found after 3 iterations
Standard Deviation of unit weight = 0.2115623

Omega   =     0.22  (Degrees)
Phi     =     0.22  (Degrees)
Kappa   =    14.17  (Degrees)
XL      =  552364.8
YL      =  1425736.8
ZL      =  20285.0

The Covariance Matrix (omega phi kappa X Y Z)
(Angles in radians multiplied by 1000)

  10.49432
  -0.86848  11.29137
   0.07701   0.18904   0.39767
  -16.82832  220.32283   4.02825  4309.473
  -205.74745  17.32662  -1.38921  335.751  4044.269
  -5.81718  -7.53152  -0.18978  -144.572  106.959  149.776
```

Standard Deviation for Omega: 668.19 (Seconds)
Standard Deviation for Phi: 693.10 (Seconds)
Standard Deviation for Kappa: 130.07 (Seconds)
Standard Deviation for XL: 65.65 (Meters)
Standard Deviation for YL: 63.59 (Meters)
Standard Deviation for ZL: 12.24 (Meters)

Residuals for the points entered

Point ID	Cols	Rows
	-7.69	-0.51
	-5.41	6.79
	7.87	10.55
	-13.57	12.08
	15.87	-11.02
	-9.00	-15.81
	-12.89	4.80

ºI

```
 +‡†?  16.58   2.15
",V^"a-@  -0.21  -12.83
           7.71  -7.55
          -10.97  -2.46
           0.57   8.21
          -6.47   4.01
          -3.67  -14.06
           4.12   8.77
          11.93   5.00
           4.14   2.07

    Col RMS =   9.46
    Row RMS =   8.81
```