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IKONOS Geometric Verification (Brookings, SD Test Site)

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Introduction

- Space Imaging provided 'Standard Imagery' products, for which geolocational accuracy was verified.
- IKONOS pixels are geocoded with latitude/longitude Northing/Easting coordinate information in the geotiff format
- Data sites and dates used
  June 27, 2002 Brookings, SD
  July 3,and July 22, 2002 Brookings SD

Procedures

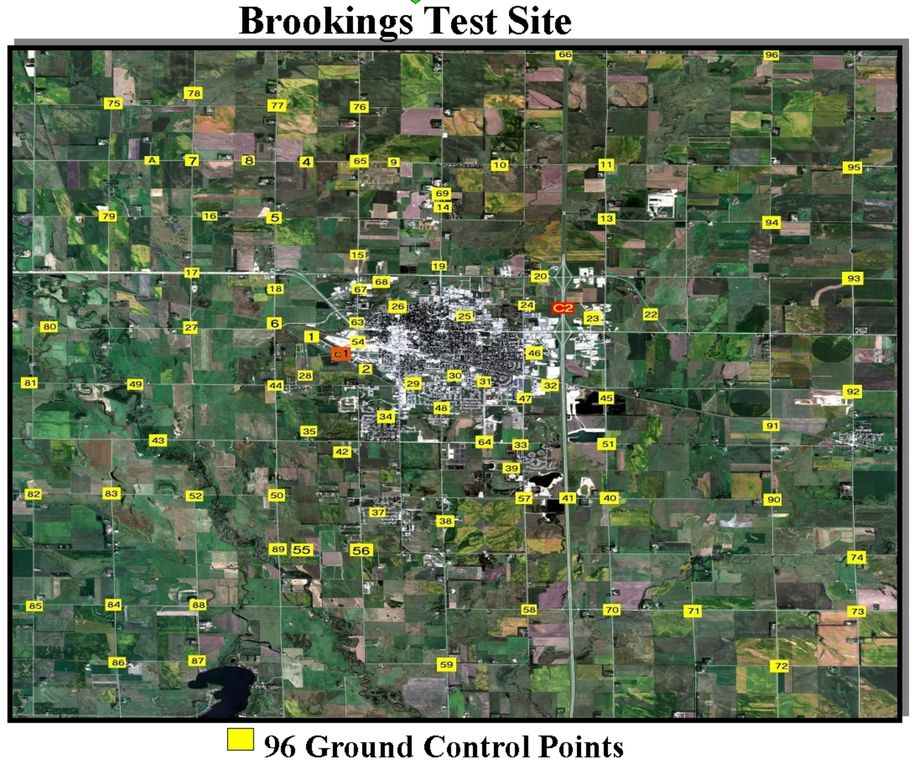
Ground Control Point Selection

- 31ground control points(GCPs) were selected in and around Brookings, SD.
- **Selection Criteria**.
  - Natural or man-made features on the ground requiring no maintenance.
  -Uniformly distributed throughout the IKONOS image.
  -Clearly visible in the images year-round.
  -Easy to access

Ground Measurements

- For the selected GCPs, Easting and Northing coordinates were measured with ground-based GPS instrumentation.
  -Ground Reference Information Team(GRIT) from NASA Stennis Space Center performed measurements.
  -Two NGS Survey Markers PID PR1201(airport) and PID PR1044 (near I29) were used as GPS reference points.
  -The ground based GPS measurement accuracy was ≤5cm.
  -Images were analyzed by 3 individuals using ENVI software.
  - Terrain corrections were not incorporated.

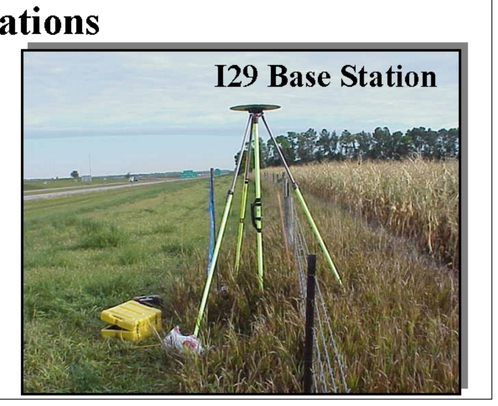
Brookings Test Site



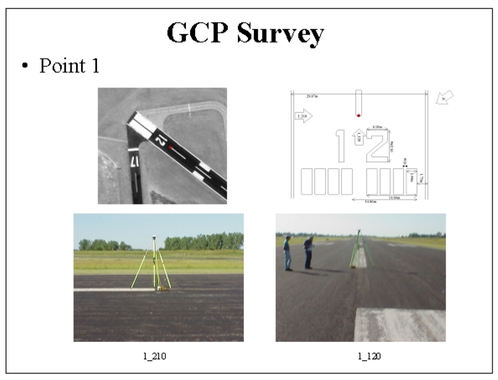
96 Ground Control Points
2 NGS Survey Markers

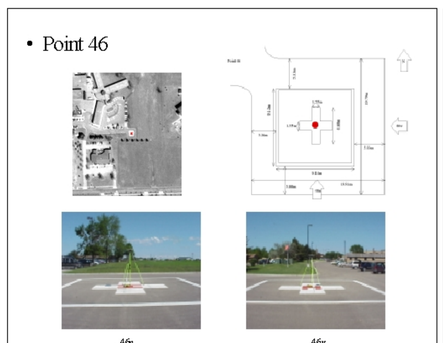
Base Station/GCP Examples

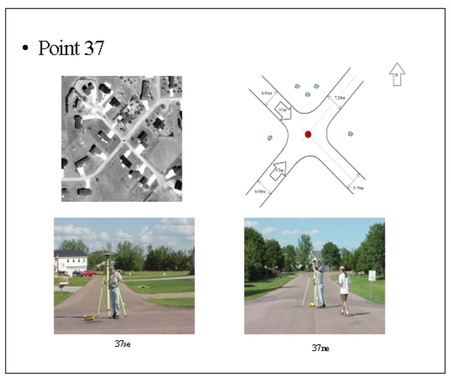
Base Stations



GCP Survey







Summer 2002 Brookings Collects

IKONOS Projection Angles

Date	Azimuth (degrees)	Elevation (degrees)
June 27	111.01	65.36
July 03	232.74	77.98
July 22	29.64	67.76

Circular Error 90 Measurements

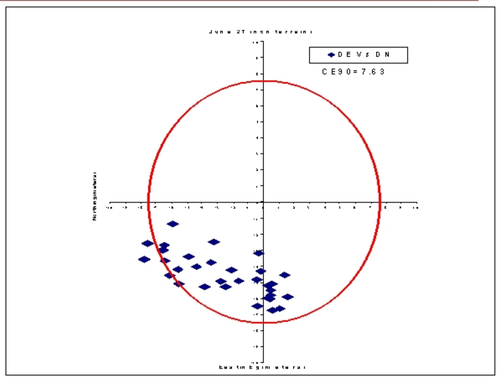
Date	Product Type	Circular Error 90(Meters)		
		Specification	Pan Band	Multispectral
6/27/02	Standard	250	10.95	10.04
7/3/02	Standard	250	5.07	5.15
7/22/02	Standard	250	5.56	5.85

$$CE\,90 = 1.675\sqrt{RMSE_X^2 + RMSE_Y^2}$$

(Ref. FGDC-Std-007.3-1998)

- CE90 tended to decrease with increasing elevation angle.

CE90 Plot(June27)



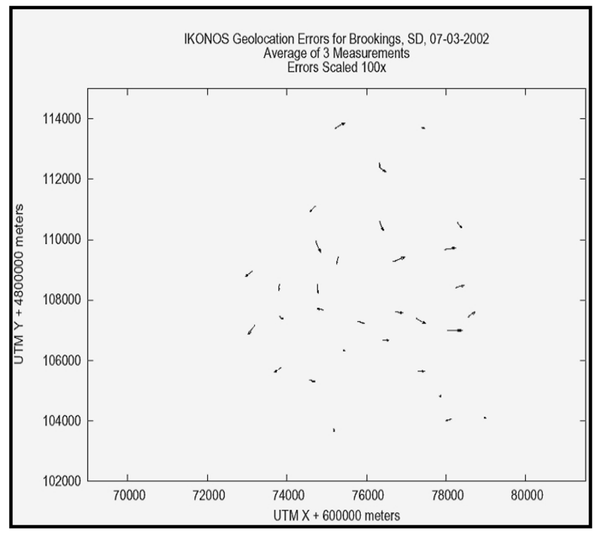
Results

	Panchromatic Band						
Date	Mean Northing Error	Mean Easting Error	Mean Error	Northing RMSE	Easting RMSE	RMSE	CE90
6/27/02	-4.54	-2.52	6.14	4.85	4.39	6.54	10.95
7/3/02	-1.68	1.25	2.81	2.16	2.12	3.02	5.07
7/22/02	-0.0009	1.01	2.99	2.70	1.93	3.32	5.55

	Multispectral Band						
Date	Mean Northing Error	Northing Error Std	Mean Error	Northing RMSE	Easting RMSE	RMSE	CE90
6/27/02	-3.90	1.73	5.76	4.27	4.21	6.00	10.04
7/3/02	-0.67	1.74	2.71	2.01	2.31	2.74	5.15
7/22/02	0.59	2.59	3.07	2.63	2.29	3.49	5.85

Notes
All measurements in meters
Measurements based on 31 GCPs in and around Brookings, SD
Three different individuals were involved in the analysis of each scene

Vector Plot (July 3)



Conclusions

- Geometric accuracy of the IKONOS Standard products met NASA Science Data Buy specifications.
- Circular Error 90 was ≤ 11m.
- Geometric accuracy improves with increasing elevation angle.
- The Brookings site provided excellent conditions for geometric verification due to its relatively flat terrain and observable rectangular grid structure.