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QuickBird Geometric Verification (Brookings, SD Test Site)

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Introduction

- DigitalGlobe provided QuickBird sensor's 'Standard' and 'Orthorectified' imagery products, for which geolocational accuracy was verified.
- QuickBird pixels are geocoded with latitude/longitude, Northing/Easting coordinate information in the geotiff format.
- Data of Brookings, SD was obtained on August 23, September 15, and October 21, 2003.

Procedures

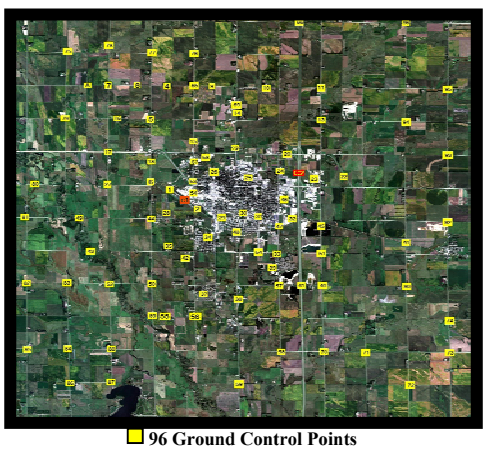
Ground Control Point Selection

- Approximately 70 ground 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, clearly visible, and easily accessible in the images.

Ground Measurements

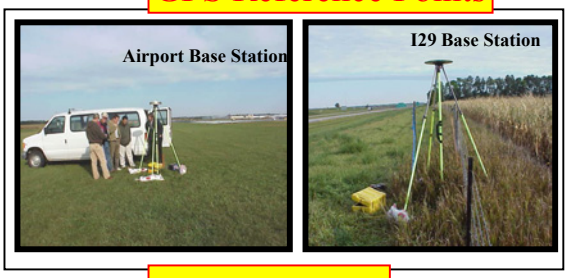
- For the selected GCPs, Easting and Northing coordinates were measured with ground-based GPS instrumentation.
  - Ground Reference Information Team (GRIT) from NASA Stennis Space Center performed measurements.
  - Two NGS Survey Markers PID PR1201 and PID PR1044 were used as GPS reference points.
  - GPS survey accuracy was ≤5cm.
  - Images were analyzed by 3 individuals using ENVI software.

Brookings, SD Test Site

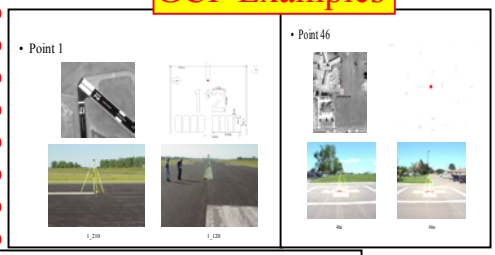


96 Ground Control Points
2 NGS Survey Markers

GPS Reference Points



GCP Examples



QuickBird Projection Angles in 2003

Date	Azimuth (degrees)	Elevation (degrees)
Aug 23	148.3	76.8
Sept 15	285.3	83.3
Oct 21	279.5	81.3

Circular Error 90 Measurements

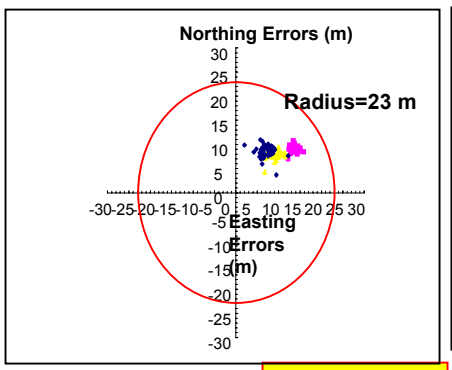
Date	Product Type	Circular Error 90 (Meters)		
		Specification	Pan Band	Multispectral
8/23/2003	Standard	23	12.67	12.81
9/15/2003	Standard	23	17.40	17.37
10/21/2003	Standard	23	13.62	13.75
8/23/2003	Ortho	12.7	7.97	7.54

- Empirical approach was used in calculating CE90 (Ref. Thomas P. Ager, NGA InnoVision, November 2002).
- Pointing errors were not normally distributed and bias was not zero.
- FGDC and MIL based CE90 approach was not used because the data did not satisfy the assumptions of normal distribution and positional biases near zero.

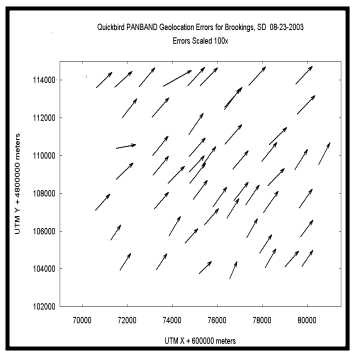
Results

	Panchromatic Band						
Date	Mean Northing Error	Mean Easting Error	Mean Error	Northing RMSE	Easting RMSE	RMSE	CE 90
8/23/2003	8.63	7.20	11.24	8.71	7.35	11.39	12.67
9/15/2003	9.01	13.86	16.53	9.03	13.88	16.55	17.40
10/21/2003	7.70	9.47	12.20	7.74	9.56	12.30	13.62
Aug 23, Ortho	0.71	5.47	5.52	1.31	5.75	5.89	7.97

CE90 Plot (Aug 23, 2003)



Vector Plot (Aug 23)



Conclusions

- Geometric accuracy of the QuickBird Standard and Orthorectified products met NASA Scientific Data Purchase specifications.
- Pointing errors were consistently biased in one particular direction (North-East) in 2003.
- Accuracy improved in 2003 posing a maximum of 18m CE90 compared to 28m CE90 in 2002.
- The Brookings site provided excellent conditions for geometric verification because of its relatively flat terrain.