

# **EVALUATING THE GEOMETRIC ACCURACY OF QUICKBIRD IMAGERY: A USERS PERSPECTIVE**

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## **ABSTRACT**

This project evaluated the accuracy of a standard image bundle of Digital Globe's QuickBird data acquired January 4, 2003 of the city of Nacogdoches, Texas by calculating the individual as well as average Euclidian distance between QuickBird's assessed UTM location and the GPS derived real world UTM location at selected sites stratified systematically throughout Nacogdoches.

**Key Words: QuickBird, Accuracy, Geometric**

## INTRODUCTION

Starting in July 1972 with the launch of the first Landsat MSS satellite in a sun synchronous orbit, the ability to quantify, qualify, map and monitor earth's resources from a space based platform on a routine basis was initiated (Campbell 2002). One of the primary uses of satellite based remotely sensed data was to classify a digital image into its respective land cover types. The traditional approach of converting a digital image into a land cover map consists of a five step sequential process; image acquisition, radiometric correction, geometric correction, image classification and accuracy assessment (Campbell 2002, Jensen 2005). Geometric correction, the third step in the process of converting a digital image into a land cover map, is the process of projecting image data onto a flat plane to conform to a map projection.

Traditionally, most remote sensing specialists have followed the classical approach when creating a land cover map using poor and mid spatial resolution sensors including Landsat MSS, TM and ETM+. With the launch of DigitalGlobe's QuickBird 2 satellite on October 18, 2001, which has the highest spatial resolution satellite imagery available to date with 60 centimeter panchromatic and 2.4 meter multispectral data respectively, the ability to use high spatial resolution imagery from satellite platforms to obtain fine spatial resolution data about the earth's surface became apparent (Clark et al. 2004, Niu et al. 2004). A QuickBird purchased standard image bundle, which consists of both the panchromatic and multispectral image data for a coincident geographic location, is designed for users with spatial science expertise and come referenced to a user defined cartographic projection.

With the advent of high spatial resolution satellite imagery provided in a user defined cartographic projection, users in the remote sensing community have started using on-screen

digitizing to create large scale land cover maps using high spatial resolution imagery, thus bypassing the geometric correction process inherent in traditional land cover classification methodology. A QuickBird standard image bundle has a stated Root Mean Square Error (RMSE) of 14.0 meters exclusive of terrain distortions. The inherent stated RMSE of 14.0 meters in any purchased QuickBird standard image bundle will affect the ability of the user to derive spatially referenced products including on-screen digitized point, line and polygon vector maps. This study evaluated the geometric accuracy of DigitalGlobe's user defined standard image bundle product as an independent identity when compared to its stated RMSE of 14.0 meters.

## **METHODS**

A QuickBird standard image bundle with an image acquisition date of January 4, 2003 encompassing the city of Nacogdoches, Texas was purchased from DigitalGlobe. Nacogdoches, the county seat for Nacogdoches County in east Texas, encompasses 7386 hectares typified by minimal topographic variability within its city limits, with a minimum elevation of 74 meters, a high point of 152 meters and an average elevation of 111 meters. The standard image bundle, including both the 60 centimeter panchromatic and 2.4 meter multispectral data, were purchased in Geotiff format and were requested to be projected to the UTM coordinate system, zone 15, NAD83 (Figure 1).

To identify ground locations to evaluate the geometric accuracy of the QuickBird data, the city of Nacogdoches was stratified into 64 equi-sized squares. Within each square, real world features that could easily be located on the ground and in the corresponding QuickBird

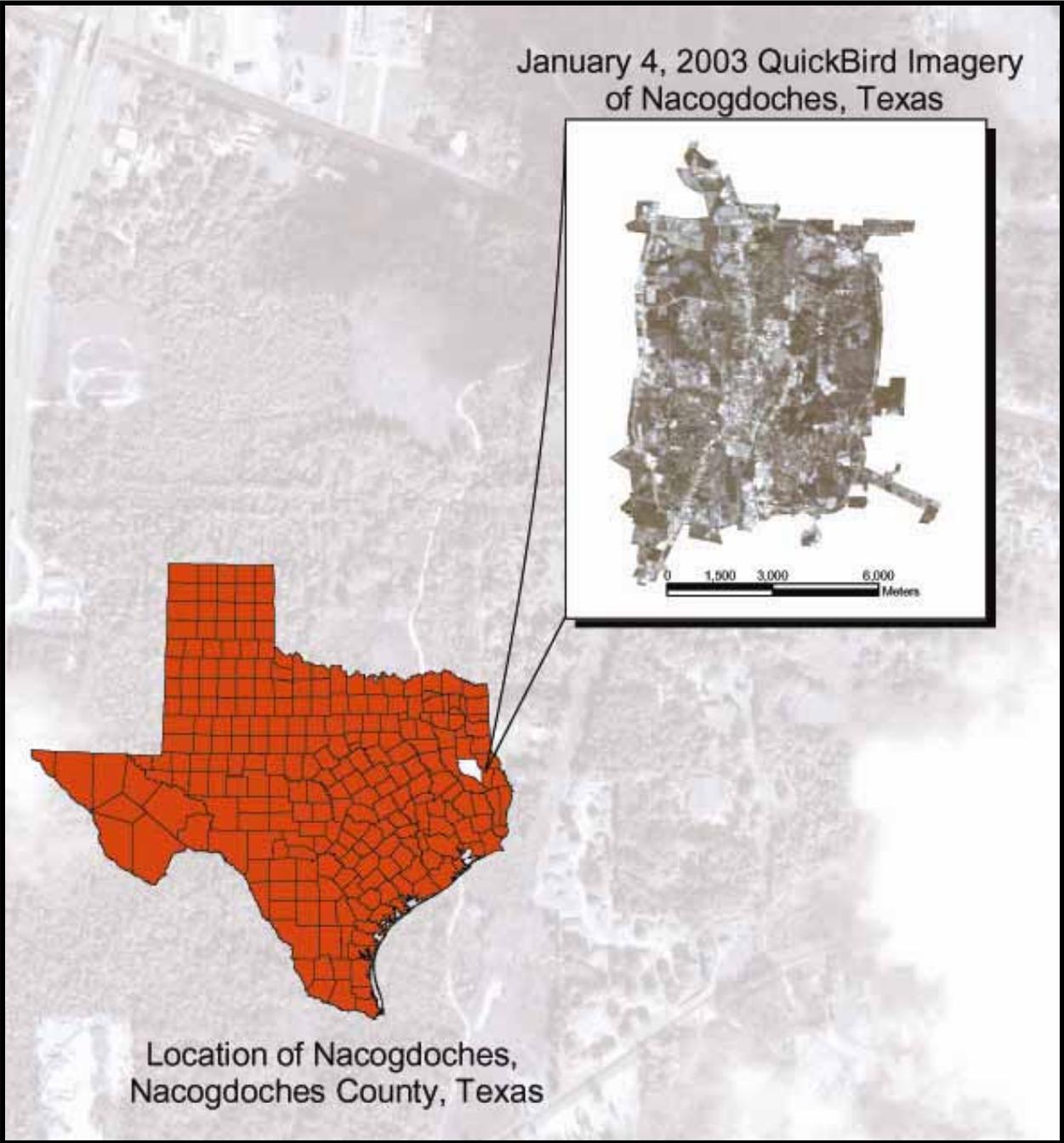


Figure 1. Location of City of Nacogdoches, Texas.

image were identified. Traffic lines within the city limits were identified as the preferred surface feature to compare QuickBird identified traffic line coordinates versus each traffic lines real world coordinates since traffic lines can be seen clearly on QuickBird's high spatial resolution imagery, are easily accessible on the ground and do not change over time.

Thirty-three individual traffic line locations were located within the city limits for analysis. The predetermined QuickBird UTM Easting and Northing coordinates of all 33 traffic line locations were obtained by on-screen digitizing their locations ERDAS Imagine (1997). Real world UTM Easting and Northing coordinates of all 33 traffic line locations were obtained in situ with a Trimble ProXRS GPS unit (Figure 2). All traffic line digitized UTM Easting and Northing coordinates and their corresponding GPS collected UTM Easting and Northing coordinates were compiled and evaluated to ascertain the difference between QuickBird's identified UTM coordinates and its GPS derived UTM coordinates. The average Euclidian distance between the purchased QuickBird UTM coordinates and the GPS identified UTM coordinates, identified by calculating the straight line distance between on-screen digitized traffic lines and their corresponding GPS identified locations, was calculated. To evaluate the geometric accuracy of the purchased QuickBird standard image bundle, the average Euclidian distance or error in the purchased QuickBird image bundle was compared with DigitalGlobe's stated RMSE of 14.0 meters for their standard image bundle to ascertain if data fell within expected RMSE for "off the shelf" standard imagery.

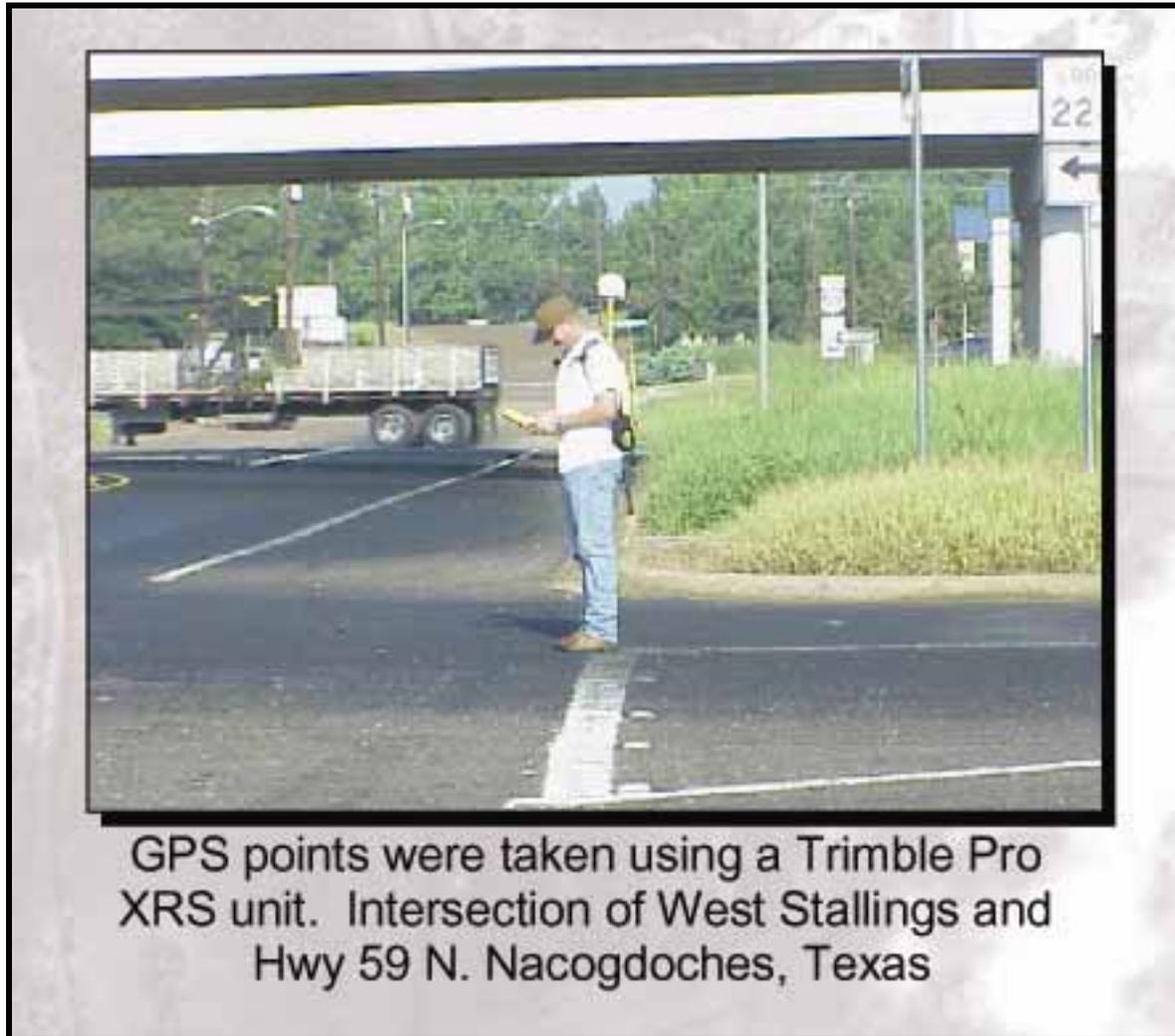


Figure 2. Collecting real world UTM Easting and Northing coordinates.

## RESULTS AND DISCUSSION

Results indicate that the average Euclidian distance of QuickBird's projected UTM location and its corresponding GPS collected UTM location of 5.34 meters was well within DigitalGlobe's stated RMSE positional accuracy of 14.0 meters for a standard image bundle

(Figure 3). In addition, the average Euclidian distance of QuickBird's projected UTM location and its corresponding GPS collected UTM location of 5.34 meters was also well within DigitalGlobe's stated RMSE positional accuracy of 6.2 to 15.4 meters for an orthorectified medium (1:12,000) to small scale (1:50,000) imagery product. The results indicate that the data purchased were well within the stated positional error for a standard image bundle and were acceptable given DigitalGlobe's purchase specifications.

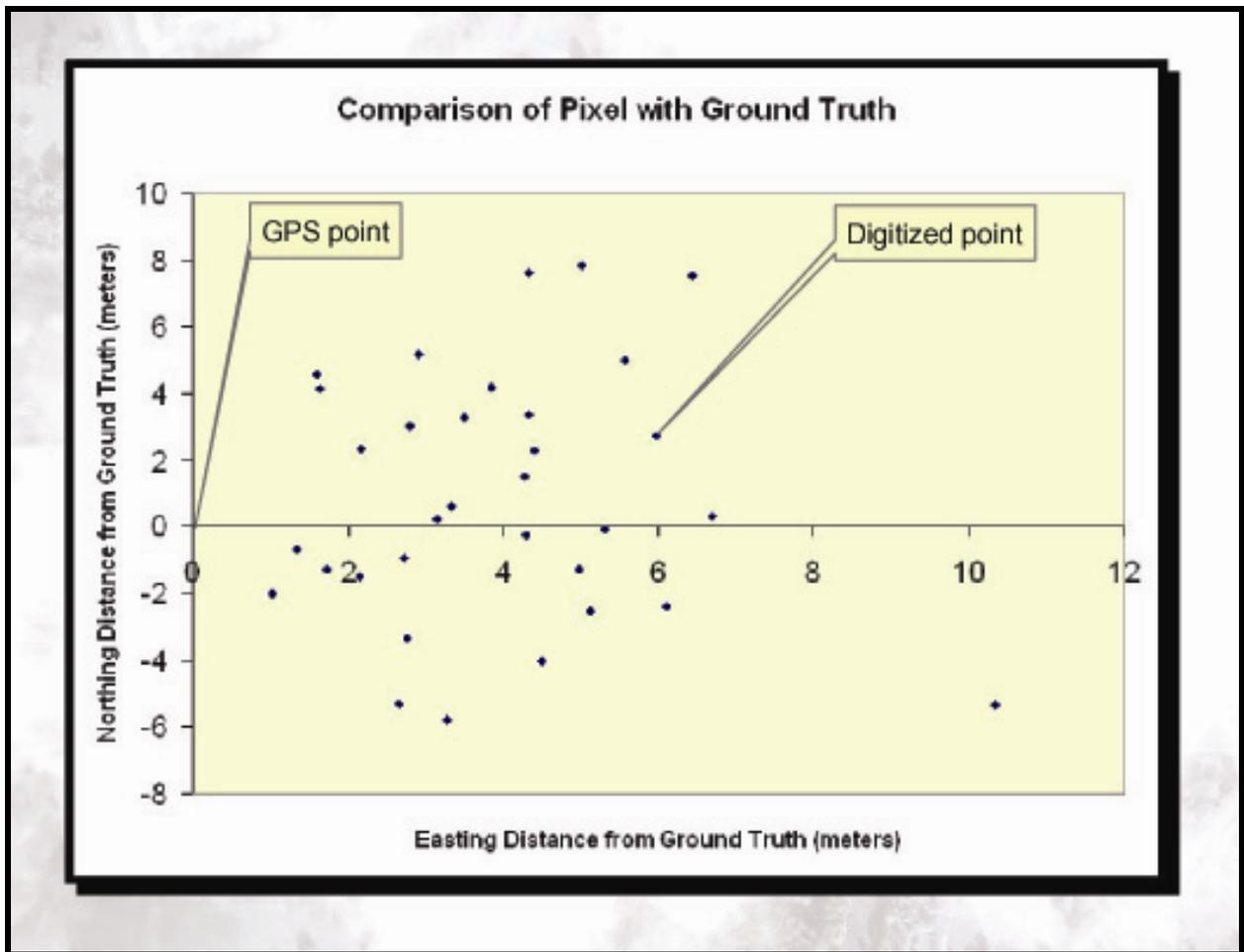


Figure 3. Comparison of QuickBird identified UTM locations with GPS identified UTM locations.

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