Digital Orthophoto Mosaic for
Saratoga National Historical Park

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February 27, 2007

Aerial Photography Acquisition and Processing

Two sets of digital orthophotography were used in the vegetation mapping process: a digital orthophoto mosaic of the battlefield area that is referred to as the Saratoga-Battlefield mosaic and digital orthophotography of the Schuyler House and Saratoga Monument areas, located approximately seven miles north of the battlefield, that is referred to as the Saratoga-Schuyler orthophotography.

Saratoga-Battlefield Mosaic

On April 28, 2003, William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH) acquired leaf-off, stereo pair 1:8,000 scale color infrared aerial photography for a digital orthophoto mosaic of the battlefield area of Saratoga National Historical Park . Frament scanned the aerial photographs at 600 dpi and delivered the scanned image files, in TIFF format, and the hard copy photographs to North Carolina State University (NCSU). The photographs, the camera calibration certificate, and a shapefile of photo centers provided by Frament are stored in the archive that NCSU maintains for the NPS Northeast Region Inventory and Monitoring Program.

The Saratoga-Battlefield mosaic was produced from 23 color infrared aerial photographs. Scanned .tif images of the aerial photographs were imported into ERDAS IMAGINE .img format where a photo block was created using a U.S. Geological Survey (USGS) digital elevation model and digital orthophoto quarter quadrangles as reference. In preparation for this step, the digital elevation model was resampled from 30 meters to 10 meters and the digital orthophoto quarter quadrangles were mosaicked. The photo block was manipulated until it could be triangulated with a root mean square error of less than 1. Single frame orthophotos (one for each aerial photograph) were then generated within IMAGINE and exported to .lan format. The .lan files were imported into ER Mapper's native (.ers) format and ER Mapper was used to define cutlines, color balance and mosaic the images, generate band interleaved by line (.bil) image and header files for the mosaic, and convert the .bil image to IMAGINE .img format. The

.img image was compressed using MrSID software with a 20:1 compression ratio. The final mosaic, in both .img and MrSID formats, is stored in the NCSU archive.

Metadata for the Saratoga-Battlefield mosaic was prepared in accordance with the current Federal Geographic Data Committee standards (FGDC 1998a). Metadata were produced in notepad and parsed using the USGS metadata compiler (USGS 2004). After all errors and omissions identified by the parser were corrected, the metadata compiler was used to generate final TXT, HTML, and XML versions of the metadata record which are stored in the NCSU archive. Key information for this mosaic is summarized in Table 1.

Saratoga-Schuyler Orthophotography

Chas. H. Sells, Inc. acquired 1:12,000 true-color aerial photography of the Schuyler House and Saratoga Monument portions of Saratoga National Historic Park on May 3, 2000. The aerial negatives were scanned at 25 microns (1,016 DPI) and the images were rectified on a KLT/DSP softcopy photogrammetric imaging system. The rectification process involved registering the image to a digital elevation model. The final rectified images have a pixel resolution of one foot. Key information for this orthophotography is summarized in Table 2.

Positional Accuracy Assessment of the Saratoga-Battlefield Mosaic

The horizontal positional accuracy of the Saratoga-Main Unit mosaic was assessed using guidelines of the USGS/NPS Vegetation Mapping Program (ESRI, NCGIA, and TNC 1994). Well-defined positional accuracy ground control points were placed throughout all quadrants of the mosaic in ArcView. Ground control points and zoomed-in screenshots of each point were plotted on hard copy maps with the mosaic as a background. These maps and plots were used to locate the ground control points in the field. Field staff recorded the ground control point coordinates with a Trimble Pro XRS global positioning system (GPS) with real-time differential correction. Mapped ground control points that were physically inaccessible were also noted. The field crew collected accuracy assessment data at 43 ground control points. Prior to calculating accuracy, five ground control points were identified as outliers with SAS's JMP program and removed. The field-collected GPS coordinates for the remaining 38 points were compared to the coordinates obtained from the mosaic viewed in ArcView. Both pairs of coordinates for each point were entered into a spreadsheet in order to calculate horizontal accuracy (in meters). The accuracy calculation formula is based on root mean square error (FGDC 1998b; Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center 1999). Figure 1 shows the distribution of the ground control points within the park and surrounding area.

Positional Accuracy Assessment of the Saratoga-Schuyler Orthophotography

According to the metadata for the orthophotography, 25 photo control points were collected by conventional GPS survey methods throughout the project area which included the Battlefield, Schuyler House and Saratoga Monument units of Saratoga . These photo control points were used to insure accuracy during the aerial triangulation process. Photo control points have been checked by a Certified Photogrammetrist.

Positional Accuracy of the Saratoga-Battlefield Mosaic

The horizontal positional accuracy of the Saratoga-Battlefield mosaic is 1.65 meters, which meets the Class 1 National Map Accuracy Standard (FGDC 1998b). A copy of the spreadsheet containing the x and y coordinates for each ground control point and the accuracy calculation formula is stored in the NCSU archive.

Positional Accuracy of the Saratoga-Schuyler Orthophotography

The horizontal positional accuracy of the Saratoga-Schuyler orthophotography is 3.0 feet. Photo control was performed to meet the American Society of Photogrammetry and Remote Sensing (ASPRS) Class 1 Standard.

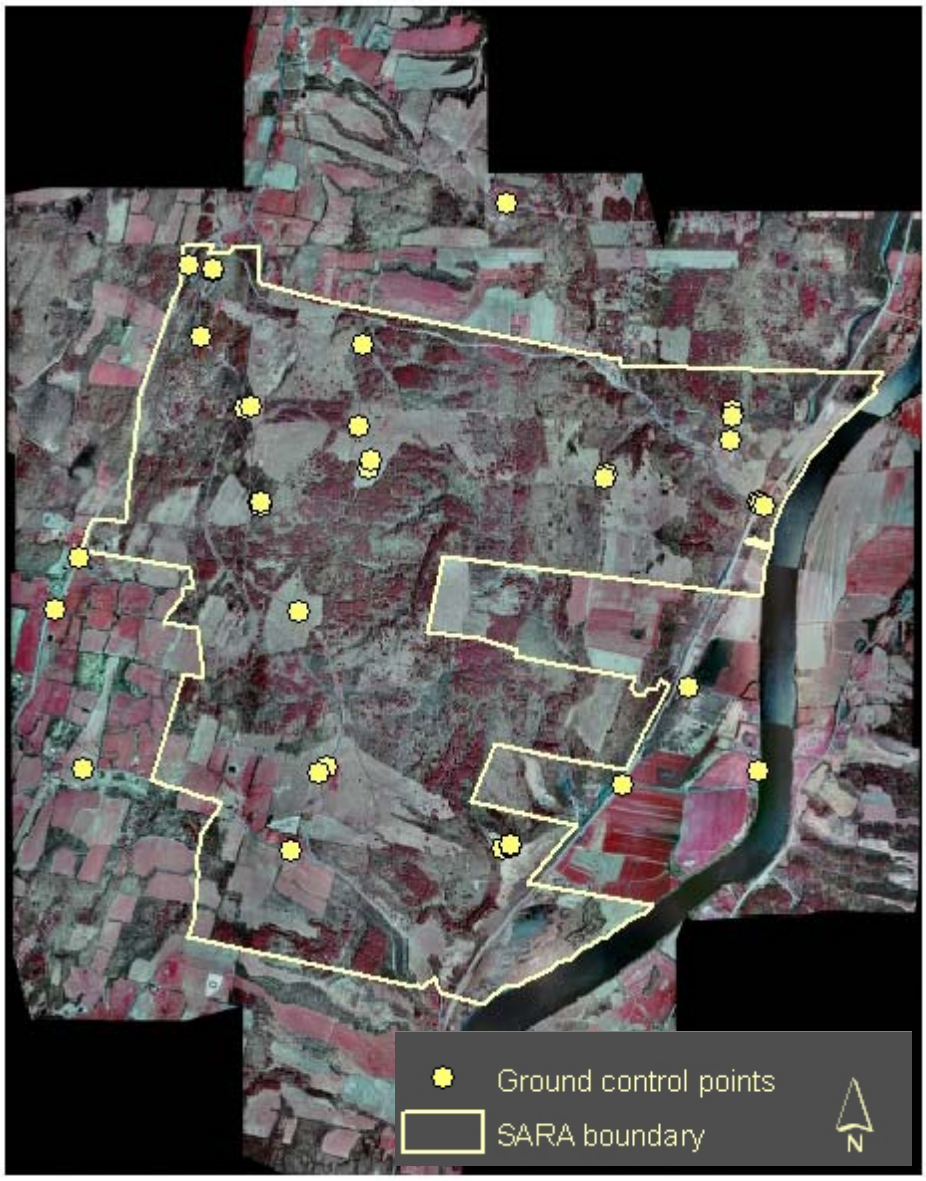
Table 1. Summary of key information for the Saratoga-Battlefield mosaic.

Title of metadata record:	Saratoga National Historical Park Color Infrared Orthorectified Photomosaic - Leaf-off (ERDAS IMAGINE 8.7 .img and MrSID formats)
Publication date of mosaic (from metadata):	September 22, 2004
Date aerial photography was acquired:	April 28, 2003
Vendor that provided aerial photography:	William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH)
Scale of photography:	1:8,000
Type of photography:	Color infrared, stereo pairs
Number of aerial photographs delivered:	27 (23 included in mosaic)
Archive location of aerial photographs, camera calibration certificate, and shapefile of photo centers:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi
Horizontal positional accuracy of mosaic:	1.65 meters, meets Class 1 National Map Accuracy Standard
Number of ground control points upon which estimated accuracy is based:	38
Method of calculating positional accuracy:	Root mean square error
Archive location of mosaic and metadata:	North Carolina State University, Center for Earth Observation
Formats of archived mosaic:	.img (uncompressed) and MrSID (20:1 compression)

Table 2. Summary of key information for the Saratoga-Schuyler Orthophotography.

Title of metadata record:	Digital Orthophotography Project of Saratoga National Historical Park, 2000
Publication date of orthophotos (from metadata):	November 8, 2000
Date aerial photography was acquired:	May 3, 2000
Vendor that provided aerial photography:	Chas. H. Sells, Inc. (90 Worcester Road, Charlton, MA 01507)
Scale of photography:	1:12,000
Type of photography:	True color
Scanning specifications:	25 microns (1016 DPI)
Horizontal positional accuracy of orthophotos:	3 feet
Number of ground control points upon which estimated accuracy is based:	25 (includes Battlefield, Schuyler and Monument units)
Archive location of orthophotography and metadata:	Saratoga National Historical Park
Format of archived orthophotography:	TIFF

Figure 1. Ground control points used to calculate horizontal positional accuracy of the Saratoga National Historical Park (SARA) Battlefield mosaic.



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