

Digital Orthophoto Mosaic for Boston Harbor Islands National Recreation Area

Submitted to:

Beth Johnson, Inventory & Monitoring Coordinator
Northeast Region, National Park Service

Submitted by:

Center for Earth Observation, College of Natural Resources
North Carolina State University

DRAFT 1: March 2, 2007

Aerial Photography Acquisition and Processing

On April 30, 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 Boston Harbor Islands National Recreation Area. The following spring, on May 12, 2004, Frament acquired additional aerial photographs covering a relatively small area in the northeast portion of the park that was missed during the first mission. 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 aerial photographs, the camera calibration certificates, and a shapefile of the photo centers provided by Frament are stored in the archive that NCSU maintains for the NPS Northeast Region Inventory & Monitoring Program.

The mosaic was produced from 41 color infrared aerial photographs. Scanned .tif images of the aerial photographs were imported into ERDAS Imagine .img format. Because there were multiple flight lines with different orientations, the photographs were orthorectified in 13 separate block files (one per flight line) using a digital elevation model and mosaicked digital orthophoto quarter quadrangles as reference. Single frame orthophotographs (one for each aerial photograph) were 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.

A metadata record for the mosaic was prepared according to current Federal Geographic Data Committee standards (FGDC 1998a). Metadata were produced in Notepad and parsed using the USGS metadata compiler program (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 the mosaic is summarized in Table 1.

Accuracy Assessment

The horizontal positional accuracy of the 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 ArcMap. 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 GeoXT global positioning system (GPS) and noted mapped ground control points that were physically inaccessible. The field crew collected accuracy assessment data at 73 ground control points. The coordinate data were post processed with differential correction using Pathfinder Office V.2.90 software. Prior to calculating accuracy, seven ground control points were identified as outliers with SAS's JMP program and removed. The field-collected GPS coordinates for the remaining 66 points were compared to the coordinates obtained from the mosaic viewed in ArcMap. 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 66 ground control points within the park and surrounding area.

The horizontal positional accuracy of the mosaic is 5.87 meters which meets the Class 3 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.

Table 1. Summary of key information for the Boston Harbor Islands National Recreation Area mosaic.

Title of metadata record:	Boston Harbor Islands National Recreation Area Color Infrared Orthorectified Photomosaic – Spring (Leaf-off) (ERDAS Imagine 8.7 IMG and MrSID formats)
Publication date of mosaic (from metadata):	March 29, 2005
Date aerial photography was acquired:	April 30, 2003 (leaf-off conditions); May 12, 2004
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:	79 (41 included in mosaic)
Archive location of aerial photographs, camera calibration certificates, and shapefile of photocenters:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi
Horizontal positional accuracy of mosaic:	5.87 meters, meets Class 3 National Map Accuracy Standard
Number of ground control points upon which estimated accuracy is based:	66
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); MrSID (20:1 compression)

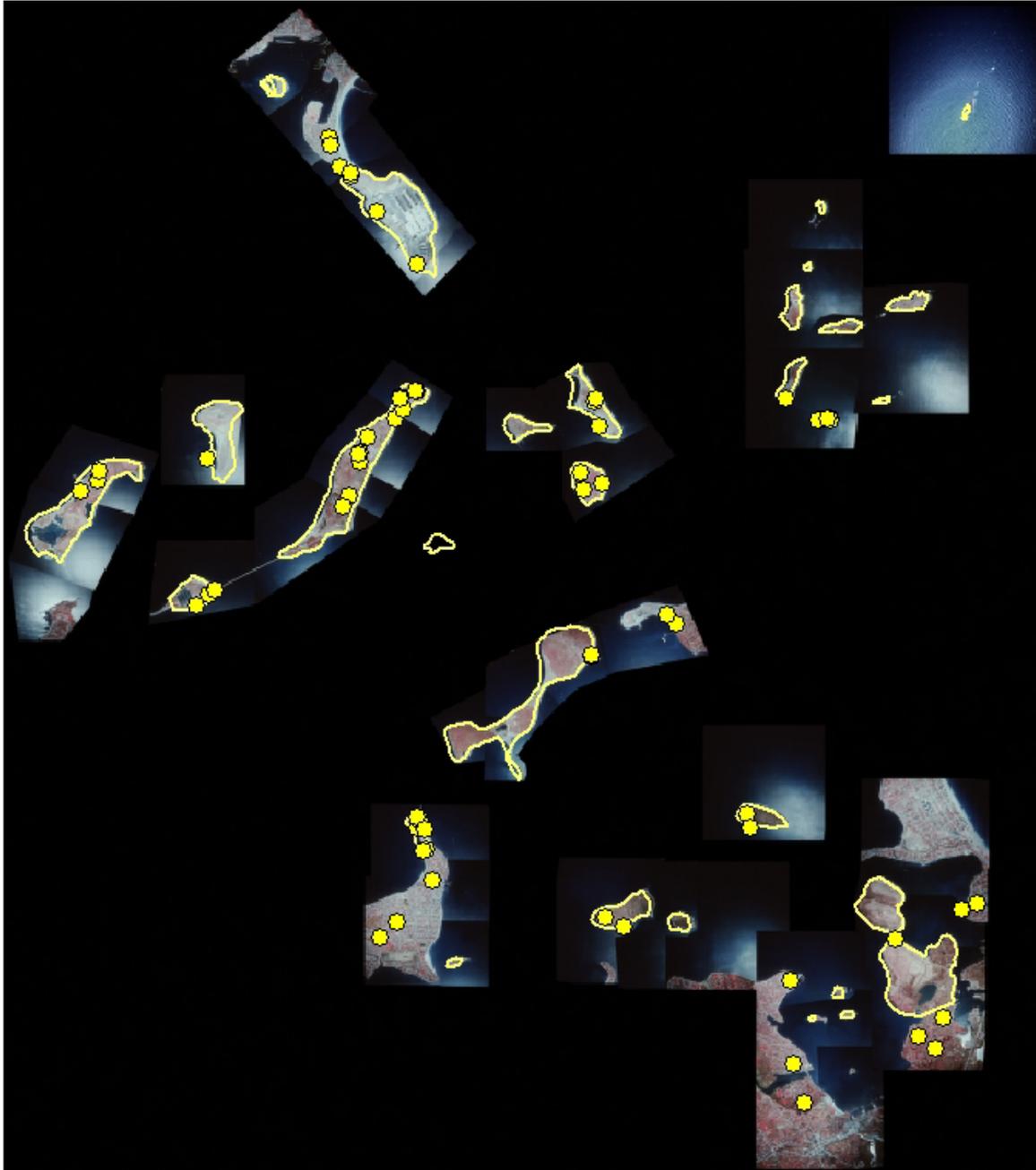


Figure 1. Ground control points used to calculate horizontal positional accuracy of the Boston Harbor Islands National Recreation Area mosaic.

Literature Cited

Environmental Systems Research Institute (ESRI), National Center for Geographic Information and Analysis (NCGIA), and The Nature Conservancy (TNC). November 1994. Accuracy assessment procedures, NBS/NPS Vegetation Mapping Program. Retrieved October 2001 from <http://biology.usgs.gov/npsveg/aa/aa.html>.

Federal Geographic Data Committee (FGDC). 1998a. Content standard for digital geospatial metadata (FGDC-STD-001-1998). Retrieved October 2001 from <http://www.fgdc.gov/metadata/constan.html>

Federal Geographic Data Committee (FGDC). 1998b. Geospatial positioning accuracy standards, Part 3: National Standard for Spatial Data Accuracy. (FGDC-STD-007.3-1998). Retrieved October 2001 from http://www.fgdc.gov/standards/status/sub1_3.html

Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center. October 1999. Positional accuracy handbook, using the National Standard for Spatial Data Accuracy to measure and report geographic data quality. Retrieved October 2001 from: <http://server.admin.state.mn.us/resource.html?Id=1852>.

United States Geological Survey (USGS). 2004. Tools for creation of formal metadata, a compiler for formal metadata. Retrieved June 2004 from <http://geology.usgs.gov/tools/metadata/tools/doc/mp.html>.