

# Exhibit A

[JSON](#) | [SOAP](#) | [WMS](#)

## DE\_Imagery/DE\_Imagery\_1926 (ImageServer)

**View In:** [ArcGIS JavaScript](#) [ArcGIS Online map viewer](#) [Google Earth](#) [ArcMap](#)

**View Footprint In:** [ArcGIS Online map viewer](#)

**Service Description:** 1926 Orthoimagery

**Name:** DE\_Imagery/DE\_Imagery\_1926

**Description:** 1926 Orthoimagery

**Single Fused Map Cache:** false

**Extent:**

XMin: -8430415.7461  
YMin: 4638325.046223002  
XMax: -8351358.0209213495  
YMax: 4840375.584600002  
Spatial Reference: 102100 (3857)

**Initial Extent:**

XMin: -8430415.7461  
YMin: 4638325.046223002  
XMax: -8351358.0209213495  
YMax: 4840375.584600002  
Spatial Reference: 102100 (3857)

**Full Extent:**

XMin: -8430415.7461  
YMin: 4638325.046223002  
XMax: -8351358.0209213495  
YMax: 4840375.584600002  
Spatial Reference: 102100 (3857)

**Pixel Size X:** 0.5754130499999974

**Pixel Size Y:** 0.5754130500000001

**Band Count:** 1

**Pixel Type:** U8

**RasterFunction Infos:** N/A

**Mensuration Capabilities:** None

**Has Histograms:** true

**Has Colormap:** false

**Has Multi Dimensions :** false

**Rendering Rule:****Min Scale:** 0**Max Scale:** 0**Copyright Text:****Service Data Type:** esriImageServiceDataTypeProcessed**Min Values:** 0**Max Values:** 249**Mean Values:** 27.889076645753818**Standard Deviation Values:** 53.40029288924784**Object ID Field:** OBJECTID**Fields:**

- OBJECTID ( *type: esriFieldTypeOID , alias: OBJECTID* )
- NAME ( *type: esriFieldTypeString , alias: NAME , length: 200* )
- MINPS ( *type: esriFieldTypeDouble , alias: MINPS* )
- MAXPS ( *type: esriFieldTypeDouble , alias: MAXPS* )
- LOWPS ( *type: esriFieldTypeDouble , alias: LOWPS* )
- HIGHPS ( *type: esriFieldTypeDouble , alias: HIGHPS* )
- CATEGORY ( *type: esriFieldTypeInteger , alias: CATEGORY , Coded Values: [0: Unknown] , [1: Primary] , [2: Overview] , ...5 more...* )
- TAG ( *type: esriFieldTypeString , alias: TAG , length: 100* )
- GROUPNAME ( *type: esriFieldTypeString , alias: GROUPNAME , length: 100* )
- PRODUCTNAME ( *type: esriFieldTypeString , alias: PRODUCTNAME , length: 100* )
- CENTERX ( *type: esriFieldTypeDouble , alias: CENTERX* )
- CENTERY ( *type: esriFieldTypeDouble , alias: CENTERY* )
- ZORDER ( *type: esriFieldTypeInteger , alias: ZORDER* )
- SHAPE ( *type: esriFieldTypeGeometry , alias: SHAPE* )

**Default Mosaic Method:** ByAttribute**Allowed Mosaic Methods:** ByAttribute,NorthWest,Center,LockRaster,Nadir,Viewpoint,Seamline,None**SortField:** LowPS**SortValue:** 0**Mosaic Operator:** First**Default Compression Quality:** 75**Default Resampling Method:** Bilinear**Max Record Count:** 1000**Max Image Height:** 500000**Max Image Width:** 500000**Max Download Image Count:** 20**Max Mosaic Image Count:** 20

**Allow Raster Function:** true

**Allow Compute TiePoints:** false

**Supports Statistics:** true

**Supports Advanced Queries:** true

**Use StandardizedQueries:** true

**Raster Type Infos:**

Name: Raster Dataset

Description: Supports all ArcGIS Raster Datasets

Help:

**Has Raster Attribute Table:** false

**Edit Fields Info:** null

**Ownership Based AccessControl For Rasters:** null

**Child Resources:** [Info](#) [Histograms](#) [Key Properties](#) [Legend](#) [MultiDimensionalInfo](#)  
[rasterFunctionInfos](#)

**Supported Operations:** [Export Image](#) [Query](#) [Identify](#) [Compute Histograms](#) [Compute Statistics](#)  
[Histograms](#) [Get Samples](#) [Compute Class Statistics](#)

# Exhibit B



## Overview

Aerial Imagery, also known as orthophotography, is hosted by FirstMap as an image service. The image services are available for users on the state network and the general public.

Private (State Network) imagery is published using the Delaware State Plane projection. Public imagery is published using the Web Mercator projection.

The image services can be accessed using the links below.

Private (State Network) URL:

[https://firstmap.dti.state.de.us/arcgis/rest/services/DE\\_Imagery\\_SP](https://firstmap.dti.state.de.us/arcgis/rest/services/DE_Imagery_SP)

Public (Public Internet) URL:

[https://firstmap.delaware.gov/arcgis/rest/services/DE\\_Imagery](https://firstmap.delaware.gov/arcgis/rest/services/DE_Imagery)

Both sets of imagery are cached at the scale levels listed below.

State Plane	Web Mercator
1:8,000,000	1:9,244,649
1:4,000,000	1:4,622,324
1:2,000,000	1:2,311,162
1:1,000,000	1:1,155,581
1:500,000	1:577,791
1:250,000	1:288,895
1:125,000	1:144,448
1:64,000	1:72,224
1:32,000	1:36,112
1:16,000	1:18,056
1:8,000	1:9,028
1:4,000	1:4,514
1:2,000	1:2,257
1:1,000	1:1,128

The image service layer can be added to ArcGIS Desktop, where a limited number of tiles can be downloaded for analysis.

Users who need the full set of imagery for detailed analysis and processing should contact the FirstMap team at [FirstMap@state.de.us](mailto:FirstMap@state.de.us).

1926

**Summary**

Delaware 1926 Orthophotography

**Description**

Resolution:

Band: 1-band:

**Credit**

USDA Agricultural Stabilization and Conservation Service

**Usage**

Public Domain Information, with citation to Delaware Archives, National Archives and Agricultural Stabilization and Conservation Service for the photography

1937

**Summary**

Delaware 1937 Orthophotography

**Description**

Resolution: 1.0 Meter

Band: 1-band: Panchromatic

USDA Agricultural Adjustment Administration  
Black and White  
Scanned and georectified using ERDAS Imagine  
Flying height 40,000 feet, 6-inch focal length camera  
Scale: 1:20,000  
SRS: NAD83 HARN Delaware State Plane meters

These are scanned images from aerial photography flown in 1937/38 by the Agricultural Stabilization and Conservation Service, maintained by the National Archives. These images are presented as individual tiles, county-wide and state-wide mosaics. Initial purpose was to provide base for digitizing Historic Forest Cover in Delaware. The data set could be used for other similar change analyses.

1. Heads-up digitizing was used to create ground control points on the 1937 Images using the 1997 Imagery as a reference. Every attempt was made to create GCPs at a standard scale of 1:3,000, however, due to photo quality this was not always possible. The scanned images were then registered to those points. The ground control points were stored for each image tile along with the RMS error from the registration process. See the included tutorial file for more detail on the registration process. This document was used for training and reference by staff members doing the processing.
2. Registered images (1937 Corrected) were subsetted (i.e. cropped) to remove

photograph borders, fiducial marks, and distorted edges. 3. Image subsets (1937 Sub) were grouped together by county and combined into image mosaics.

**Credit**

USDA Agricultural Stabilization and Conservation Service

**Usage**

Public Domain Information, with citation to Delaware Archives, National Archives and Agricultural Stabilization and Conservation Service for the photography

**1954**

**Summary**

Delaware 1954 Aerial Photography

**Description**

Resolution: 1.0 Meter  
Band: 1-band: Panchromatic

USDA Agricultural and Commodity Stabilization Service  
Black and White  
Scanned and georectified using ERDAS Imagine  
Flying height 40,000 feet, 6-inch focal length camera  
SRS: NAD83 HARN Delaware State Plane meters  
Scale: 1:20,000

These are scanned images from aerial photography flown in 1954 by the Agricultural Stabilization and Conservation Service. The images are presented as a statewide mosaic. This aerial photography was scanned and georectified to provide a historic look at Delaware.

Scanning The original, paper format, 9x9" aerial photographs were taken in 1954 as part of an aerial survey program. The photographs were scanned at 300 dpi on an 11x17" EPSON GT-15000 scanner, as multi-band, RGB color images. The output was written to \*.JPG files. The eastern half of Sussex County, however, was scanned as single-band, gray scale images, and the output was written to \*.TIF files. Correcting for this data mismatch is described in the mosaicking section. Georectifying All georectifying was completed in ERDAS Imagine 8.7. Please see the included tutorial for a more detailed explanation. This document was used for training and reference by staff members completing the processing. 1. Ground control points (GCPs) were created on the 1954 images using the 2002 digital orthophotography of Delaware as a reference, using the Image Geometric Correction Tool. The 2002 data was produced in False Color Infrared at a scale of 1:2,400 with a 1 foot pixel resolution. This data is also available in a single, mosaicked MrSID file and is assigned a State Plane Coordinate System and a North American Datum of 1983. In eastern Sussex County, every attempt was made to create GCPs at a standard scale of 1:3,000, however, due to photo quality this scale was not always possible. For the remainder of the state, the largest scale possible was used while still maintaining a clear, unpixelated image on the screen. 2. The scanned images



were then resampled to those points using the Display Resample Image Dialog. 3. The GCPs were stored for each image tile along with the Control Point Error from the registration process. 4. Resampled images (1954 corrected) were subsetting (i.e. cropped) to remove photograph borders, fiducial marks, and distorted edges. Mosaicking The 1954 aerial mosaic was created using ERDAS Imagine 8.7. Before the mosaic could be created, each multi-band image was reduced to a single band gray scale image, because the eastern half of Sussex County was georectified by another processor using images that were scanned as single-band, gray scale images. This was performed using ERDAS Imagine's layer stacking tool to create a new set of images containing only their first band. Once this new set of images was created the mosaic of the entire state could be processed. To complete this task, the mosaic tool from ERDAS Imagine was used and contained a feather technique for blending overlapping images. Holes in the final image of Delaware are due to misplacement of aerial photographs.

**Credit**

USDA Agricultural Stabilization and Conservation Service

**Usage**

Public Domain Information

**1961**

**Summary**

Delaware 1961 Aerial Photography

**Description:**

Resolution: 2.0 meter

Bands: 1-band: Panchromatic

USDA Agricultural Stabilization and Conservation Service (FSA)

Black and White

Scanned and georectified using ERDAS Imagine

Flying height 40,000 feet, 6-inch focal length camera

SRS: NAD83 HARN Delaware State Plane meters

Scale: 1:20,000

These are scanned images from aerial photography flown in 1960 and 1961 by the Agricultural Stabilization and Conservation Service. The images are presented as a statewide mosaic.

Scanning the original, paper format, 9x9" aerial photographs were taken in 1961 as part of an aerial survey program. The photographs were scanned at 300 dpi on an 11x17" EPSON GT-15000 scanner, as single band gray scale images. The output was written to \*.JPG files. All georectifying was completed in ERDAS Imagine 8.7. Please see the included tutorial for a more detailed explanation. This document was used for training and reference by staff members completing the processing.

1. Ground control points (GCPs) were created on the 1960/61 images using the 2002 digital orthophotography of Delaware as a reference, using the Image Geometric Correction Tool. The 2002 data was produced in False Color Infrared at a scale of 1:2,400 with a 1 foot pixel resolution. This data is also available in a single, mosaicked MrSID file and is assigned a State Plane Coordinate System and a North American Datum of 1983. In eastern Sussex County, every attempt was made to create GCPs at a standard scale of 1:3,000, however, due to photo quality this scale was not always possible. For the remainder of the state, the largest scale possible was used while still maintaining a clear, unpixelated image on the screen.
2. The scanned images were then resampled to those points using the Display Resample Image Dialog.
3. The GCPs were stored for each image tile along with the Control Point Error from the registration process.
4. Resampled images (1960/61 corrected) were subsetted (i.e. cropped) to remove photograph borders, fiducial marks, and distorted edges. Mosaicking The 1961 aerial mosaic was created using ERDAS Imagine 8.7. To complete this task, the mosaic tool from ERDAS Imagine was used and contained a feather technique for blending overlapping images. Holes in the final image of Delaware are due to misplacement of aerial photographs.

**Credit**

USDA Agricultural Stabilization and Conservation Service

**Usage**

Public Domain Information

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**1968**

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**Summary**

Delaware 1968 Aerial Photography

**Description**

Resolution: 2.0 Meter

Bands: 1-band: Panchromatic

USDA Agricultural Stabilization and Conservation Service (FSA)

Black and White

Scanned and georectified using ERDAS Imagine

Flying height 40,000 feet, 6-inch focal length camera

SRS: NAD83 HARN Delaware State Plane meters

Scale: 1:20,000

These are scanned images from aerial photography flown in 1968 by the Agricultural Stabilization and Conservation Service. The images are presented as a statewide mosaic. This aerial photography was scanned and geo rectified to provide a historic look at Delaware.

Scanning The original, paper format, 9x9" aerial photographs were taken in 1968 as part of an aerial survey program. The photographs were scanned at 300 dpi on an 11x17" EPSON GT-15000 scanner, as single band grayscale images. The output was written to \*.JPG files. Georectifying All georectifying was completed in ERDAS Imagine 8.7. Please see the included tutorial for a more detailed explanation. This document was used for training and reference by staff members completing the processing. 1. Ground control points (GCPs) were created on the 1968 images using the 2002 digital orthophotography of Delaware as a reference, using the Image Geometric Correction Tool. The 2002 data was produced in False Color Infrared at a scale of 1/ 2,400 with a 1 foot pixel resolution. This data is also available in a single, mosaicked MrSID file and is assigned a State Plane Coordinate System and a North American Datum of 1983. In eastern Sussex County, every attempt was made to create GCPs at a standard scale of 1:3,000, however, due to photo quality this scale was not always possible. For the remainder of the state, the largest scale possible was used while still maintaining a clear, unpixelated image on the screen. 2. The scanned images were then resampled to those points using the Display Resample Image Dialog. 3. The GCPs were stored for each image tile along with the Control Point Error from the registration process. 4. Resampled images (1968 corrected) were subsetting (i.e. cropped) to remove photograph borders, fiducial marks, and distorted edges. Mosaicking The 1968 aerial mosaic was created using ERDAS Imagine 8.7. To complete this task, the mosaic tool from ERDAS Imagine was used and contained a feather technique for blending overlapping images. Holes in the final image of Delaware are due to misplacement of aerial photographs

**Credit**

USDA Agricultural Stabilization and Conservation Service

**Usage**

Public Domain Information, with citation to Agricultural Stabilization and Conservation Service for the photography

**1992****Summary**

Delaware 1992 Orthophotography

**Description**

Resolution: 1.0 Meter

Bands: 3-band: G, R, NIR

DeIDOT

Delivered as 172 Quarter-quads.

Each tile is 137 MB (TIF).

Scale: 1:12,000

SRS: NAD83 State Plane meters

The State of Delaware contracted with PhotoScience Inc. to develop 1-meter resolution color-infrared digital ortho-photos for the entire state. PhotoScience Inc. became Earth Data International. For more detailed information about the source data, contact

EarthData (<http://www.earthdata.com>). Airphotos were taken in March, 1992 at a 1:12000 scale, digitized and georeferenced to Delaware State Plane coordinates (meters, North American Datum 1983).

Airphotos were taken in March, 1992, digitized and georeferenced to Delaware State Plane coordinates (meters, North American Datum 1983, based on GRS 1980 spheroid). The source data are 140 MB 24-bit color files for each of the 172 quarter-quads in Delaware.

To facilitate dissemination of these data, the Spatial Analysis Lab resampled the 172 DOQ's covering the state to UTM coordinates (meters, NAD 1983) at 5-meter resolution in 8-bit color, achieving initial file size reductions of almost 99 percent. The Spatial Analysis Lab used a nearest-neighbor (i.e. center-cell selection) resampling procedure which generates a high-contrast image with some blockiness in very small features. Each transformation used four 3.75-minute-interval reference points located near the corners of each image. Each resampled image is approximately 1210 x 1510 pixels, with a 10-pixel (50-meter) border cropped out to eliminate slight edge skewness resulting from the reprojection. Images still have at least 500 meters of edge overlap. Color palettes were brightened and adjusted for improved consistency using Adobe Photoshop. Sun glare has been masked out of water pixels in most coastal images in order to correct color palettes.

Cell resolution is exactly 5 x 5 meters. The original 1992 and 1997 series have differing degrees of positional error, and thus are not perfectly congruent. Earth Data used a larger set of ground control points to geo-reference the 1997 series, so these should have better positional accuracy.

Most images were brightened and contrast-enhanced using Adobe Photoshop. To reduce file size and eliminate sun glare, large water areas are masked to black.

### **Credit**

EarthData/PhotoScience Inc.

### **Usage**

Public Domain Information

## 1997

### **Summary**

Delaware 1997 Orthophotography

### **Description**

Resolution: 1.0 Meter

Band: 1-band: Panchromatic

DeIDOT

Delivered as 172 Quarter-quads.

Each tile is 45 MB (TIF).

SRS: NAD83 State Plane meters  
Scale: 1:12,000

The State of Delaware contracted with Earth Data (formerly PhotoScience) to update the 1992 1-meter resolution color-IR digital orthophotos series for Delaware with a 1-meter resolution greyscale digital orthophoto series. The state was re-flown in March/April, 1997. The airphotos were digitized and georeferenced to Delaware State Plane coordinates (meters, North American Datum 1983, based on GRS 1980 spheroid). The source data are TIFF-format ~50 MB 8-bit greyscale files for each of the 172 quarter-quads in Delaware.

To disseminate these data on the web, the Spatial Analysis Lab (UD) resampled the 172 DOQ's covering the state to 5-meter resolution without changing projection, using a nearest-neighbor (i.e. center-cell selection) resampling procedure which generates a high-contrast image with some blockiness in very small features. Most images were brightened and contrast-enhanced using Adobe Photoshop. To reduce file size and eliminate sun glare, large water areas are masked to black. These files are distributed in JPEG format in the original DE State Plane (NAD83 meters) projection.

#### **Credit**

State of Delaware Department of Transportation and EarthData

#### **Usage**

Public Domain Information

## 2002

### **Summary**

Delaware 2002 Orthophotography

### **Description**

Resolution: 0.25 Meter  
Band: 3-band: G, R, NIR

#### EarthData

Delivered as 2010 tiles.

Each tile is 1.7km x 1.7km, 6800x6800 pixels, and 135MB (TIF).

SRS: NAD83 HARN Delaware State Plane meters

Scale: 1:2,400

This false color IR digital orthophotography, at a scale of 2,400, was produced for the State of Delaware for the purpose of statewide base mapping by EarthData International of Maryland, LLC.

Compliance with the accuracy standard was ensured by the placement of GPS ground control prior to the acquisition of aerial photography. The following checks were performed. 1. The ground control and airborne GPS data stream were validated through a fully analytical bundle aerotriangulation adjustment. The residuals of the adjustment met the required standards for accuracy which are 1 part in 10,000 of the flying height

for the horizontal position (X and Y) and 1 part in 9,000 or better of the flying height in elevation (Z). 2. The DTM data was checked against the project control. The technician visited and confirmed the accuracy of the project mass points during initial compilation. 3. Digital orthophotography was validated through an inspection of edge matching and visual inspection for image quality

Aerial photography was acquired using a flight design that included a total of 1196 exposures in 20 North-South oriented flight line. Aerial photography was exposed on Kodak CIR film 1443, emulsion number 1133012. Aerial photography was supplemented with the simultaneous acquisition of airborne GPS data, which captured the ground coordinate for the nadir point of each photograph. Aerial photography was exposed at an altitude of 11,000' above mean terrain yielding an approximate scale of 1 / 21,600.

**Credit**

EarthData International of Maryland

**Usage**

Public Domain Information

**2007****Summary**

Delaware 2007 Orthophotography

**Description**

Resolution: 0.25 Meter

Bands: 4-band: R,G,B,NIR

Sanborn

Delivered as 2010 tiles.

Each tile is 1.7km x 1.7km, 6800x6800 pixels, and 180MB (TIF).

SRS: NAD83 HARN Delaware State Plane meters

Scale: 1:2,400

This dataset contains digital 0.25 meter orthophotos of the State of Delaware at a scale of 1:2,400 in 4-band but are being served as 3-band RGB, 8-bit format from the DataMIL site. The dates for the Orthophotography missions were 3/19, 3/29, 3/30, 4/2, 4/3, 4/10, 4/14, 4/20 all in 2007.

The orthophotos can be used for many purposes including development planning, emergency planning, and other planning or mapping purposes.

ASPRS Class 1. This data has also been produced to be fully compliant with NSSDA Standards for mapping at a scale of 1:2,400. The dates for the Orthophotography missions were 3/19, 3/29, 3/30, 4/2, 4/3, 4/10, 4/14, 4/20 all in 2007.

**Credit**

Sanborn Mapping Company

**Usage**

Public Domain Information, with citation to "State of Delaware, USGS, Kent County, Sussex County, New Castle County and the City of Dover".

**2010****Summary**

USGS High Resolution Orthoimage for New Castle County, Delaware

**Description**

Resolution: 1.0 feet

Bands: 3-band: R,G,B

Joint project among USGS, DVRPC, Dept of Homeland Security (vendor was Aero-Metric, Inc) New Castle County only. Delivered in same tiling scheme as 2002 and 2007 imagery  
Each tile is 1.7km x 1.7km, 5578x5578 pixels, 91 MB (TIF).  
SRS: NAD83 Delaware State Plane meters (projected from PA UTM)  
Scale: 1:25,404

This task order consists of digital orthophoto production covering New Castle County, Delaware. This data depicts geographic features on the surface of the earth.

Radiometry is verified by visual inspection of the digital orthophoto. Slight systematic radiometric differences may exist between adjacent orthoimage files; these are due primarily to differences in source image capture dates and sun angles along flight lines. These differences can be observed in an image's general lightness or darkness when it is compared to adjacent orthoimage file coverages. Tonal balancing may be performed over a group of images during the mosaicking process which may serve to lighten or darken adjacent images for better color tone matching.

GeoTIFFs conform to the specifications set forth by the USGS for production of orthophotos in the Task Order Number G10PD00660.

Orthoimages are visually inspected for completeness to ensure that no gaps or image misplacements exist within and between adjacent images. These images are derived by mosaicking multiple images to ensure complete coverage. Source imagery is cloud free.

Ortho image horizontal positional accuracy shall not exceed 4.9 feet at the 95% confidence level as defined and tested using NSSDA standards.

The horizontal accuracy of the orthorectified images is mainly determined by the quality of the DEM. The elevation data was provided by the commission through the USGS, along with LiDAR data provided by NOAA and USGS NED for Delaware buffer areas. Since Airborne GPS/IMU data was used there are no pugs available for measuring. All photo identifiable checkpoints were measured and compared to the surveyed checkpoints to determine the RMSE. All rectified chip overlap was checked for mismatch. All final tiles were checked visually for edge matching.



The DMC images were aerotriangulated to support digital ortho image production for the Delaware Valley Regional Planning Commission project area. Airborne GPS and ground check point data was provided by AERO-METRIC, Inc. The project was referenced to the North American Datum of 1983 (NAD83), State Plane Coordinate System 1983, Pennsylvania South Zone horizontally and to the North American Vertical Datum of 1988 (NAVD88) vertically. Units were in U.S. survey feet. The DMC images, ABGPS data, and ground check point data were used as inputs to the Zeiss/Intergraph ImageStation Automatic Triangulation (ISAT) softcopy program. ISAT correlated image points and aerotriangulated the block of images to create exposure station exterior orientations. All ground points were manually measured on the imagery. These points were included in the aerotriangulation adjustments for absolute ground location verification. The scale of the aerial photos was 1:25,404. The photography was exposed between 3/27/10 and 4/23/10. Rectification was done using the aerotriangulation data, raw DMC images, and DVRPC provided elevation data. These rectified images were used to draw seamlines. The images were then dodged. The dodged rectified images were mosaicked, balanced, and cut into image tiles. These tiles were viewed and artifacts were removed as well as other edits performed. Then the edited tiles were reprojected from UTM to DE-SPCS, mosaicked together and the final tiles were cut out. The final tiles were QC'd before generating the MrSID tiles and mosaic.

Natural color orthoimagery is organized in three color bands or channels which represent the red, green, and blue portions of the spectrum. Each image pixel is assigned a triplet of numeric values, one for each color band. Numeric values range from 0 to 255. Areas where data is incomplete due to lack of full image coverage are represented with the numeric value of 0.

**Credit**

Aero-Metric, Inc.

**Usage**

Public Domain Information with citation of the U.S. Geological Survey for products derived from these data.

2012

**Summary**

Delaware 2012 Orthophotography

**Description**

Resolution: 0.3 Meters

Bands: 4-band: R,G,B, NIR

Sanborn

Delivered as 2010 tiles, same tiling scheme as 2002 imagery

Each tile is 1.7km x 1.7km, 5667x5667 pixels, ~133 MB (TIF).

SRS: NAD83 HARN Delaware State Plane meters

Scale: 1:2,400



This data set consists of 0.3-meter pixel resolution (approximately 1-foot), 4-band true color and near infrared (R, G, B, IR) orthoimages covering New Castle, Kent and Sussex Counties in Delaware. An orthoimage is remotely sensed image data in which displacement of features in the image caused by terrain relief and sensor orientation have been mathematically removed. Orthoimagery combines the image characteristics of a photography with the geometric qualities of a map. The design accuracy is estimated not to exceed 1.52 meters NSSDA 95% confidence (0.88-meters Root Mean Squared (RMSE) Error XY (0.62 meter RMSE X or Y). Each orthoimage provides imagery over a 1700-meter by 1700-meter block on the ground. There is no image overlap between adjacent files. The projected coordinate system is Delaware State Plane Coordinate System Meters. </abstract><purpose> The data depicts geographic features on the surface of the earth. It was created to provide easily accessible geospatial data which is readily available to enhance the capability of Federal, State, and local users. This data also supports The National Map. </purpose><supplinf> The project consists of an area of approximately 474 square miles covering the county of New Castle in Delaware. A total of 508 4-band true color and near infrared (R, G, B, IR) orthos were produced to cover this area. The bounding coordinates provided within the Spatial Domain Section represents a rectangle covering the total area in which the project is located.

Radiometry is verified by visual inspection of the digital orthophoto. Slight systematic radiometric differences may exist between adjacent orthoimage files; these are due primarily to differences in source image capture dates and sun angles along flight lines. These differences can be observed in an image's general lightness or darkness when it is compared to adjacent orthoimage file coverages. Tonal balancing may be performed over a group of images during the mosaicking process which may serve to lighten or darken adjacent images for better color tone matching.

All GeoTIFF tagged data and image file sizes are validated using commercial GIS software to ensure proper loading before being archived. This validation procedure ensures correct physical format and field values for tagged elements. Seamlines and tile edges are visually inspected. Seamlines mismatches are not corrected unless the overall displacement exceeds one meter.

Orthoimages are visually inspected for completeness to ensure that no gaps or image misplacements exist within and between adjacent images. These images are derived by mosaicking multiple images to ensure complete coverage. Source imagery is cloud free. Photography was flown during leaf-off in deciduous vegetation regions.

The horizontal positional accuracy and the assurance of that accuracy depend, in part, on the accuracy of the data inputs to the rectification process. The location of existing photoidentifiable ground control and aerotriangulation points were evaluated on the Geotiff image and compared with their ground values in order to determine an overall accuracy for each test block of orthoimages within the project. After image coordinate measurement was completed for each block, an RMSE for the diagonal error was calculated for the orthoimages within the block. This value is an estimate of the horizontal accuracy of the tile expressed in meters.

The digital imagery mission was composed of a total of 3 lifts. Imagery (1-ft, 0.3 meter GSD) was obtained at an altitude of 9,450 feet above ground level on 28 February and 6 March 2012. The missions were flown with a Leica ADS40 (Sensor Head 51 and 52)

digital camera with ABGPS and IMU. This imagery provides the data for the digital orthoimage. Imagery was acquired on the following dates - Lift Date 0103062012 06 Mar 2012 0203062012 06 Mar 2012

Horizontal and vertical control was used to establish positions and elevations for reference and correlation purposes and as input to the aerotriangulation process. Control consists of photoidentifiable surveyed ground control for ground reference. A total of 10 photoidentifiable ground control points were collected.

Airborne GPS (ABGPS) and IMU data are collected with an onboard dual frequency GPS survey unit and a corresponding IMU system in combination with the digital imagery. The GPS data provides the position of the imagery at the time of capture while the IMU system records instantaneous changes in position and attitude of the sensor. The GPS/IMU, base station, and ground control processing are an important step towards the development of accurate orthoimages.

Source Imagery - ADS40 (Sensor Head 51 and 52) Digital Camera Imagery Control - Airborne GPS/IMU supplemented with photo identifiable field control Aerotriangulation, Orthorectification - SOCET SET, ORIMA Elevation Model - USGS DEM Mosaic - OrthoVista The following describes the digital production sequence. 1. The raw ADS40 (Level-0) data and associated GPS and IMU data for each mission is downloaded from the hard drives and checked to confirm that no files have been corrupted and that all data can be successfully downloaded. 2. The GPS and IMU data are post-processed along with the base station data to produce a precise position and attitude stream for each line of imagery. Post processing uses the high frequency readouts of the IMU to verify the GPS data and to provide instantaneous positioning of each line of imagery between GPS recordings. Likewise, the IMU attitude data is corrected for bias/drift and transformed to real world coordinates by using the GPS data. This process creates Level-1 rectified imagery which is an approximately geo-positioned image. 3. The ADS40 production process uses aerial triangulation techniques to combine the short-term accuracy of the IMU with high global accuracy of GPS. In combination with the minimum required number of ground control points (GCPs), aerial triangulation delivers best fitting results on the ground. The extra information added to the system by automatic tie point measurements (APM) leads to very reliable orientation results where photogrammetric measurements serve to control IMU/GPS measurements and vice versa. 4. The results of the APM are run through a combined bundle adjustment process to further refine the measured image coordinates and the position and attitude values from IMU and GPS computed by IMU/GPS post processing. The bundle adjustment process equally compensates for systematic errors such as the misalignment between IMU and sensor axes, IMU/GPS drift, and the datum difference between IMU/GPS and ground control coordinate system. This results in a very accurate and precise determination of the parameters of exterior orientation which are later used for Orthorectification. 5. The orthorectification process uses the raw Level-0 data as the input imagery source to avoid repeated re-sampling of the imagery to yield the best possible image quality and accuracy. The raw Level-0 true color imagery is orthorectified to the DEM using the adjusted position and orientation results from the aerial triangulation phase. The orthorectified strip of imagery is called the Level-2 data. 6. The resulting images are then mosaicked and color balanced. 7. The final 1700-meter by 1700-meter tiles are clipped out and the imagery is output in uncompressed GeoTIFF format with no overlap. 8. The completed natural color digital orthophotos are checked for image quality. Minor

artifacts are corrected using Adobe Photoshop in an interactive editing session. Digital tiles are assigned final names based on Delaware tiling grid.

4-band true color and near infrared orthoimagery is organized in four bands or channels which represent the red, green, blue, and near infrared (R,G,B,IR) portions of the spectrum. Each image pixel is assigned a triplet of numeric values, one for each colorband. Numeric values range from 0 to 255. Areas where data is incomplete due to lack of full image coverage are represented with the numeric value of 0.

**Credit**

Digital Aerial Solutions, LLC

**Usage**

Public Domain Information with citation of the U.S. Geological Survey for products derived from these data.

## Hurricane Sandy 2012

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**Summary**

Delaware Hurricane Sandy 2012 Orthophotography

**Description**

Resolution:

Band: 1-band:

**Credit**

USDA Agricultural Stabilization and Conservation Service

**Usage**

Public Domain Information, with citation to Delaware Archives, National Archives and Agricultural Stabilization and Conservation Service for the photography