CALHOUN COUNTY, SOUTH CAROLINA

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Request for Proposal
For
Countywide Digital Orthophoto Imagery Base Mapping

Released December 2nd 2013

I. PURPOSE AND INTENT

It is the desire of Calhoun County, South Carolina to obtain digital orthophoto imagery to support their mapping projects in accordance with the attached specifications. In addition to information requested in the specifications, all proposals should include contractor's previous experience on similar projects (with references); **proof of a license to practice photogrammetric surveying in South Carolina**; equipment and personnel to be utilized; and proof of bondability. This information shall also be provided for any subcontractor to be employed for this project. A statement must be included in the proposal indicating that all work will be performed in the United States of America. The proposal shall also specify any exceptions to or deviations from the attached specifications.

Optional Items (Section VI): If the natural color orthophotography will be collected with a camera capable of collecting 4-band orthoimagery, specify in Section VI "Optional Items" what the cost would be for the delivery of 4-band orthoimagery instead of 3-band imagery.

- Project duration will be specified in Section V. The contractor shall include a sample contract with the proposal. For the purpose of this proposal, the total number of orthophotos shall be **228** of which **153** will be at a scale of 1": 400', **75** at a scale of 1": 200', and **0** will be at a scale of 1":100". The attached county index map entitled "Calhoun County Flight Map Option 1" indicates approximate locations for orthophotos at all delivery scales. For existing horizontal control that is suitable for GPS in and near the County see attached DEM. A Lidar flight is also now available at http://www.dnr.sc.gov/GIS/lidarstatus.html.

Any contractual modifications to these specifications and/or any deviation from these specifications (unless specifically authorized in writing by the contracting officer or an authorized representative thereof), shall be sufficient cause for rejection of any part or all of the work performed.

The County will maintain GIS capability using mapping software compatible with the state-mapping program. All deliverables shall be compatible and operational within the County's current system, and shall be deemed unacceptable until compatibility is assured.

The County is also anxious to consider new technology that would provide cost effective alternative methods for obtaining comparable output products and accuracies.

II. PROJECT PROCEDURES AND REQUIREMENTS

A. GENERAL. For the purpose of this project, a digital orthoimage is a digital image, which has the properties of an orthographic projection. It is developed from a vertically oriented perspective aerial image by differential rectification so that the image displacements caused by camera tilt and terrain relief are removed. Imagery rectified from oblique imagery will not be acceptable for this project. Digital cameras must be used for this project. The raw digital image file must be digitally rectified to an orthographic projection by processing each image pixel through the appropriate photogrammetric equations. This process requires as input, control points acquired through ground surveys and developed in aerotriangulation; camera orientation parameters; and a Digital Terrain Model (DTM) or a Digital Elevation Model (DEM). To avoid confusion, the following definitions will apply:

1. Digital Terrain Model (DTM) - a rigorous data model which incorporates mass elevation points, spot elevations and breaklines at significant terrain breaks at a density level sufficient to support planimetric mapping and contour generation. In this case planimetric mapping accuracy must be 4 feet RMSE or better (based on ASPRS Standard for Large Scale Mapping). The testing of the geospatial positional accuracy will conform to the NSDI Geospatial Positioning Accuracy Standards, Section 3.2 Table Part 3: Standards for Spatial Data Accuracy (FGDC–STD–007.3–1998).

2. Digital Elevation Model (DEM) - a less rigorous data model to be used for the purpose of creating a digital orthoimage which will support planimetric mapping accuracy of 4 feet RMSE or better (based on ASPRS Standard for Large Scale Mapping) when compared to image identifiable ground control points.

3. Additional weight will be given to proposals that will yield a planimetric accuracy of 3.0 feet RMSE or better.

B. CONTROL. It shall be the responsibility of the Contractor to specify where image identifiable control points will be required. Upon request, the South Carolina Geodetic Survey could supply the coordinates and ground based photography to make identification possible for these points in the digital imagery. Airborne GPS (AGPS) is required for horizontal control densification in support of orthoimage production. Horizontal reference for the project will be **NAD 1983/2011**, S.C. Single Zone State Plane Coordinate System, with the **International Foot** (1 foot = 0.3048 meters "exactly") being used in all conversions. Vertical reference shall be **NAVD 1988**.

C. AERIAL PHOTOGRAPHY.

1. Conditions during Photography. It shall be the responsibility of the Contractor to obtain snow-free and leaf-free aerial photography between February 1, 2014 and March 15, 2014. Photography shall be undertaken when skies are clear, free from excessive smoke or haze, and well-defined images can be resolved. The ground shall be free from standing water, and/or snow. Photography shall be flown only during that portion of the day when the sun is 30 degrees or more above the horizon.

2. Digital Camera. A modern digital aerial camera certified by the USGS is required for the purpose of this project. Digital camera performance, resolution, calibration and metric accuracy must meet or exceed the mapping specifications as stated for 6-inch focal length precision aerial film cameras. The final product obtained from digital camera imagery must be free of any distortions or inaccuracies.

3. Flight Lines. The orientation of flight lines is left up to the contractor; however additional weight will be given for a proposal that use a single orientation (it is recognized that the aircraft may fly in both directions along the chosen orientation). Mosaicking portions of multiple images to create a single digital orthoimage covering 10,000' by 10,000' on the ground will be permitted, particularly if building lean can be eliminated. All proposals shall include a flight line layout for the project on a copy of the attached index map, or equivalent. It is realized that sheet centered imagery may not be economically realized or in the State's best interest when utilizing a digital camera, however, the final product obtained from digital camera imagery must be free of any distortions or inaccuracies

4. The flying altitude shall be determined to obtain 1.0 foot resolution directly from the image for imagery at a scale of 1"= 400', 0.5 foot resolution directly from the image for imagery at a scale of 1"= 200', and 0.25 foot resolution directly from the image for imagery at a scale of 1"= 100'.

5. Re-flights. All re-flights will be at the expense of the Contractor.

D. ANALYTICAL AERIAL TRIANGULATION

Densification and extension of field control will be permitted by fully analytical aerial triangulation (FAAT) methods and/or softcopy methods that employs qualified operator supervision at all times during the measuring process. The Contractor shall submit a step-by-step narrative of his methodology (including equipment to be used) with the proposal. Full auto-correlation during aerial triangulation may be used however; the results must be verified and sealed by a licensed South Carolina Photogrammetric Surveyor and a copy of the sealed report supplied to SCGS for inspection.

E. DTM/DEM DEVELOPMENT.

Vertical accuracy of the DTM/DEM shall be sufficient to obtain the required vertical and horizontal accuracies of the final deliverable products. The DTM/DEM shall have a combination of the following - points spaced at regular intervals along a grid; points of significant high or low elevation; and breaklines at significant terrain breaks. It is understood that density of points and the distribution and extent of breaklines is very dependent upon local terrain variations; however, it is requested that each proposal include a basic recommended procedure (minimum grid spacing and standard breaklines features) upon which the project will most likely be based. The following list details the order of preference:

1. The DTM/DEM may be derived from photogrammetric or LiDARgrammetric approaches. If a photogrammetric approach is utilized the DTM/DEM shall be captured by an experienced instrument operator using fully analytical optical photogrammetric stereo plotters and/or softcopy instrumentation and techniques capable of achieving required accuracies. If a LiDARgrammetric approach is utilized the source data and processing techniques must be commensurate with the required accuracies. Each proposal shall include the specific equipment to be utilized in DTM/DEM capture as well as resumes of specific instrument operators to be assigned to the project (not simply a list of all equipment and all personnel).

2. A previously derived DTM/DEM accurate enough to meet required planimetric accuracy.

3. A DTM/DEM captured wholly or in part from autocorrelation may be utilized for this project; however, the contractor will provide a written and sealed statement by a licensed South Carolina Photogrammetric Surveyor attesting to the accuracy of the DTM/DEM.

F. RECTIFICATION.

1. The rectification process shall involve the solution of the appropriate photogrammetric equations for each pixel in the output image. It will not be permissible to solve photogrammetric equations at anchor points and then warp the content of the original image between the anchor points.

2. The interpolation (or resampling) of intensity values from the input image to the output image shall be accomplished using the cubic convolution algorithm or equivalent - use of nearest neighbor will not be acceptable.

G. IMAGE QUALITY/RADIOMETRY.

1. Two hundred and fifty-six (256) tonal levels ranging from 0 (black) to 255 (white) of image brightness shall be represented. All intermediate values shall represent continuous tone varying uniformly from black to white. There shall be no areas of an orthophoto where the process was incomplete due to image gaps or lack of data.

2. Image quality of the finished digital orthophoto shall be consistent with the requirements in Section II.C.4.

3. All digital orthophotos shall be radiometrically adjusted as necessary so that adjacent digital orthophotos can be displayed simultaneously without an obvious visual edge seam between them. Localized adjustments of the brightness values shall be performed to minimize tonal differences between the join areas. For this adjustment, the orthophoto judged by visual inspection to have the better contrast shall be used as the reference orthophoto. Localized brightness values of the adjacent orthophoto shall be adjusted to that of the reference orthophoto. When possible and feasible, the area adjusted should be bounded by a tonal break ground feature such as a road, field line, shadow line, etc. The radiometric adjustment should not compromise the accuracy, clarity or resolution of the orthophoto.

4. Prior to undertaking full digital orthophoto production, the Contractor shall furnish the SCGS and the County with sample digital images at all scales/spatial resolutions to evaluate and accept as examples of overall image quality. The County will select one image each that will become the standard to which all subsequent digital orthophotos will be compared for acceptance/rejection relative to image quality.

H. AREAL COVERAGE.

The geographic extent of each digital orthophoto shall be as follows:

1"=400' scale	10,000' X 10,000'
1"=200' scale	5,000' X 5,000'
1"=100' scale	2,500' X 2,500'

Approximate locations of mapping are included on the attached index map of the County. The grid defined tiles will cover the entire county and beyond as needed to achieve **full tile coverage**. The digital orthophoto shall contain only the neat image area of the corresponding map unit and there shall be no image overlap between digital orthophotos.

III. DELIVERABLE PRODUCT SPECIFICATIONS

Digital Orthophotos. Negative scale of photography shall not be smaller than 1"=2,000' for the 1": 400' scale orthophotos or 1"=1,000' for the 1": 200' scale orthophotos, respectively. Digital orthophotos will be delivered to the South Carolina Geodetic Survey for quality control. They must be delivered on external USB hard drive, with the contractor being responsible for paying the shipping costs to and from the SCGS office. A final set of digital orthoimages will be delivered to the SCGS on external hard drives in .tif image format with .tfw header. Additional header information will be included in accordance with state standards (see attachment A).

DEM/DTM's. In addition to the image (.tif) and world (.tfw) files, each orthophoto delivery shall include the appropriate DEM/DTM file in .dxf or .shp format labeled with the same file name/number as the corresponding orthophoto.

IV. OWNERSHIP OF MATERIALS

All materials produced as a result of this project including, but not limited to, aerotriangulation data, terrain and elevation models, and control photographs shall become the property of the County.

The County may request that the Contractor store these materials at the Contractor's facility at no charge; however, any and all materials shall be returned to the County upon written request.

V. PROJECT SCHEDULE

A.	RFP sent to Contractors	December 2nd 2013
B.	Written Questions due	One week after A
C.	Proposals due	Two weeks after B
D.	Contractor Interviews (if necessary)	One week after C
E.	Contractor selection	One week after D
F.	Project completion	3 months from collection of photography.

VI. OPTIONAL ITEMS

1) Orthophotography collected with a 4-band camera
2) Alternate collection proposal **2**, the total number of orthophotos shall be **541** of which all **541** will be at a scale of 1": 200'. The attached county index map titled "Calhoun County Flight Map Option 2" indicates approximate locations for orthophotos at all delivery scales. For existing horizontal control that is suitable for GPS in and near the County see attached DEM. An existing Lidar flight is now also available at http://www.dnr.sc.gov/GIS/lidarstatus.html
3) Alternate collection proposal **3**, may include oblique photography based upon the primary proposal option or the alternate collection proposal **2** but the total number of orthophotos shall be at least **228** of which **153** will be at a scale of 1": 400', **75** at a scale of 1": 200', and **0** will be at a scale of 1":100".
4) Inclusion of 400 scale orthophoto tile indexed as 9699 is optional at the discretion of the contractor but may not be included in cost estimates.

VII. CATEGORIES FOR SUBMITTING COSTS FOR PRIMARY PROPOSAL

Contractors will submit cost breakdowns for professional services on the project as described in the specifications. If alternative proposals are submitted, Contractors are asked to use a similar cost breakdown. For purposes of this proposal, the total number of orthophotos will be **228** with **153** at a scale of 1": 400' and **75** at a scale of 1"=200'.

PROJECT PHASE	COST
RECOVER & TARGET EXISTING CONTROL (_____) number of points	$_____
COLLECTION OF PHOTO IDENTIFIABLE POINTS (_____) number of points	$_____
AERIAL PHOTOGRAPHY	$_____

ANALYTICAL AEROTRIANGULATION	$_____
DTM/DEM CAPTURE	$_____
ORTHO RECTIFICATION & FILE GENERATION	$_____
OTHER	$_____
PERFORMANCE BOND	$_____
Collection and delivery of 4-Band	$_____
TOTAL PROJECT COST	$_____

Attachment A

South Carolina County Digital Orthophoto Projects

Header Record Format

The digital image shall be archived on a suitable storage media with informational records appended to the **TFW** file. The informational shall be written in **ASCII** nomenclature in the .tfw file. Each ITEM of information shall occupy a separate line(s).

REQUIRED INFORMATION:

ITEM	ABBREVIATION	EXAMPLE
A. County Name & State	LOCATION =	XXXXX COUNTY,SC
B. Name of firm producing the data	PROD BY =	Amblypia, Inc.
C. Coordinate system	COORD SYS =	S.C. STATE PLANE
D. Datum	DATUM =	NAD 1983/2011
E. Unit of measure	UNITS =	International Foot
F. Date of aerial photography	PHOTODATE =	03/06/14
G. Aerial camera type	CAMERA =	Wild RC-30
photography (RF)	NEG SCALE =	1:24,000
H. Final output pixel resolution	PXL RES =	1 foot
I. Horizontal accuracy (i.e. meets National Standards of Map Accuracy at this HZ scale)	HZ ACCURACY =	1:4,800
J. Source and Vertical accuracy of DEM	DEM =	*

Attachment B

South Carolina County Digital Orthophoto Projects

File Naming Convention

The 1"=400' scale digital orthophotos shall be named using the most significant digits of the southwest corner coordinates arranged in XyXy order. The millions digit of the X value is not used. For example:

X = 1234567
y = 890123

XyXy = 2839

Orthophoto Name = **2839.tif** and **2839**.tfw

The 1"=100' and 1"=200' scale digital orthophotos shall be named the same as the 1"=400' orthophoto which is falls within followed by a dash and a suffix indicating it's location within the 400 scale image. For example:

100 Scale name for southeast image = **2839-20.tif** and **2839-20**.tfw

200 Scale name for southwest image = **2839-03.tif** and **2839-03**.tfw

1"=100' Scale File Suffix

05	06	07	08
09	10	11	12
13	14	15	16
17	18	19	20

1"=200' Scale File Suffix

01	02
03	04