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Scope of Work – Attachment A

Metro RFP No 10-1648-RC

METRO 2010-2012 DIGITAL ORTHOPHOTOS

A. **Objective**

Provide Metro and Portland area governments with natural color and false color infrared orthorectified digital imagery for urban and rural areas, at two scales. Urban images will be delivered at six-inch pixel resolution; rural at one foot. Metro is also requesting a three-inch price as an option. Natural color imagery for both areas will also be delivered at various resampled resolutions. Final products will be on portable hard drive in multiple GeoTIFF formats with accompanying world files. Metro and local governments will incorporate these data into their GIS databases. Similar flights will be repeated in summer 2011 and winter 2012.

Supporting information is available on Metro's FTP site:

- Area of interest (shapefiles and PDF)
- Base map layers (shapefiles)
- Survey control points
- DTM sample
- LiDAR samples
- To access this information, go to: ftp://ftp.metro-region.org/dist/drc/photo10.

Additional alternative options not specified in this RFP will be considered if they meet or exceed the project objective at competitive rates. However, Contractor must bid on required items specified in the quote sheet.

This RFP will result in a two and one-half-year contract. Following the 2010 flight and product delivery, Metro may terminate this agreement by giving Contractor seven days prior written notice of intent to terminate, as specified in the Personal Services Agreement.

B. **Area of interest**

1. The contractor will provide imagery for the Portland area as delineated by map and shapefile on Metro's FTP site. The PLSS sections that are shown on the map are summarized on the following table.
2. Actual sections ordered may vary from those shown on the Area of Interest map. If so, contract price will be negotiated based on actual square miles ordered. All areas will be tiled as shown on the Area of Interest map.

	Description	Sections
2010		
Area 1	Urban consortium (6 in)	602
Area 2	Rural consortium (1 ft)	367
Area 3	Multnomah County rural (1 ft)	137
Area 4	Multnomah/Bull Run (1ft)	105
Area 5	Clackamas/Bull Run (1ft)	112
Area 6	Scappoose	20
Area 7	Newberg	39
2010 Total		1,382
2011		
Area 1	Urban Consortium (6 in)	605
2011 total		605
2012 –Leaf Off		
Area 1	Urban Consortium (6 in and 3 in option)	605
2012 total		605

C. **Projection**

Horizontal - Oregon State Plane North, international feet, NAD 1983/91 (HARN). Vertical - Orthometric NAVD88 (in international feet)

D. **Flight planning**.

Contractor shall submit a final flight plan in format readable by ArcGIS 9.x prior to the actual flight, delineating the proposed flight lines, exposure stations, and control point locations. The flight plan shall cover sufficient geography outside the project area to guarantee accurate and complete delivery of the orthophotos required by this contract.

E. **Survey Control**

The contractor will be responsible for collecting or establishing the required ground control. Contractor will determine the required minimum ground targets and assure that they are marked prior to the flight. Metro has provided information on the FTP site about locations that were used in previous flights, some of which are photo-identifiable. Survey work in previous years was completed by OrionGPS, 503-359-1688, jdputnam@oriongps.com. Please indicate the number of points to be used, their accuracy, and include the cost of pre-marking in your proposal.

F. **Licensing of surveyors and photogrammetrists**

Oregon State Law states that practice of photogrammetric mapping without registration is prohibited. (ORS 672.028). A person may not practice photogrammetric mapping in this state unless the person is registered and has a valid

certificate to practice land surveying, engineering or photogrammetric mapping issued under ORS 672.002 to 672.325. In addition, for work done in the State of Oregon, new control needs to be established by a surveyor licensed in the State of Oregon. Photogrammetrists are allowed to premark and use existing control and to use air-borne GPS (which also has to be tied to existing control). Photogrammetrists are prohibited from setting or measuring any new points. See the OSBEELS web site, www.osbeels.org to review relevant statutes and rules.

G. **Aerial image capture**

The contractor will capture the area of interest, as delineated on the Area of Interest map, with a digital camera controlled with airborne GPS to meet the resolutions and accuracies shown in the table below:

	Resolution	GSD	Map scale	NMAS horizontal accuracy
Area 1	6 inch	5.5 in. or better	1"=100'	90% within 3.33 ft or better
Areas 2-7	1 ft	11 in. or better	1"=200'	90% within 6.66 ft or better

Contractor must use industry-standard digital sensor technology and all the accompanying technologies and methods associated with this technology. The camera system must be capable of producing natural color 3-band and color infrared band imagery products at high resolution, from a single flight mission. The raw images must result in orthos which are in 4-band TIFF format at 8-bits per band. Please indicate your proposed GSD, flying elevations, camera model and camera specifications.

Conditions – imagery will be captured during periods when the atmosphere is free of cloud, smoke, dust and haze. Summer flights will be generally between 10:00 am and 2:00 pm to ensure that sun angle is not less than 40 degrees. Flights will not be conducted during periods of fog, haze, dust, river flooding, or excessive cloud shadow. Snow cover is not acceptable in areas 1, 2, 6 and 7. If the imagery is deemed unacceptable, re-flights will be scheduled, overlapping the existing imagery by at least 2 stereo models.

Overlap/sidelap - nominal forward overlap of 60% (assuming frame-based camera) and lateral overlap of 30%. However, additional exposures must be captured over the urban core area to ensure that not more than 25% of roadway/transportation features are obscured.

H. **Aerial triangulation**

Contractor will use analytical aerial triangulation (AT), using established photogrammetric procedures, to establish a dense secondary network of control points throughout the project area. In Area 1 the AT result will support national map accuracy standards for 1"=100' mapping. In Areas 2 through 7 the AT result will support national map accuracy standards for 1"=200' mapping.

An aerial triangulation report shall be provided, including listing of all points used, adjusted coordinates for all control and pass points, residuals for control points, and discrepancies at ground scale for all coordinates.

I. **Digital Terrain Model**

The contractor can use the DTM that was used for the 2008 flight, a LiDAR-based DEM, or a combination of both. Both of these items can be furnished by Metro. The resulting imagery must meet or exceed national map accuracy standards shown under item I below, provided the DTM and/or LiDAR DEM provided by Metro meets or exceeds this tolerance.

DTM

Breaklines and bridges are included to depict sudden changes in terrain to the extent necessary to ensure accurate representation of visible features on orthophoto imagery produced using the DTM data set. A DTM sample is posted at ftp://ftp.metro-region.org/dist/drc/photo10.

Furnished DTMs		
	Breaklines	**Format**
Areas 1-5	Yes	ESRI file geodatabase

All improvements made to the DTM furnished by Metro shall be delivered to Metro in DGN or DWG format.

LiDAR DEM

Metro can provide a LiDAR-based three-foot DEM, tiled by USGS quad, which is based on 2004-2007 LiDAR data. Contractor can choose to use these LiDAR DEM data if they will: a) increase the accuracy of the imagery or b) lower the cost to produce the imagery. Using the LiDAR DEM is not a requirement, except that the LiDAR DEM is the only terrain source for areas 6-7.

In the proposal, please describe whether you plan to use existing DTM, LiDAR DEM or a combination, and why you are choosing that methodology. If you choose to use the LiDAR DEM, indicate whether you will supplement the DEM with breaklines. Sample LiDAR data are posted at ftp://ftp.metro-region.org/dist/drc/photo10.

J. **Orthophotography**

1. Early Orthophotos - Contractor shall provide a separate quote for providing interim imagery at ASPRS Class II accuracy specification, using on-board GPS and IMU and auto-mosaicing. Second-generation orthos may be used for this deliverable. Contractor shall use basic color balancing for these images. Images shall be delivered as three-

band natural color, compressed TIFF within 60 days of flight date, using same format and tiling specification as the final deliveries. Early orthos are desired for all three flights.

2. Final Orthophoto Description - Contractor will use only the central portion of every frame of photography for orthorectification (assuming frame-based camera). This will reduce the amount of radial displacement (building and tree lean) as well as the amount of radiometric distortions (tonal variations) inherent in aerial photographs. The result will be imagery which is much easier to tone-match and mosaic together, yielding a superior ortho data set. Special attention will be given to the treatment of bridges, overpasses, and other abrupt surface features that can cause warping or smearing of the rectified image.

   Imagery will be radiometrically controlled to compensate for varying light conditions from image to image, and/or exposure variances within a single frame of the imagery. The contractor will use image mosaicing software to mosaic each frame of photography together into a seamless image data set, with the final sheets extracted to match the map sheet layout. An operator will assess mosaic lines so as to avoid shearing buildings or other important features, feather mosaic lines across water bodies and other selected regions, and minimize the visual impact of the mosaic line. Once the final mosaic lines are in place, Contractor will process the image set and extract final tiles. In the final product, mosaic lines will be practically invisible, and multiple sheets will be displayed without the distraction of visible sheet edges.

3. Leaf Off - Leaf-off imagery shall be acquired during winter 2012, weather permitting. Acquisition needs to occur prior to leaf-out, with no snow cover on the ground. This will most likely be between mid-February and late March, 2012. The specific timing for the flight will be coordinated with Metro's project manager. Photography shall not be undertaken when the sun angle is less than thirty degrees above the horizon.

4. Tiling - Each tile delivered shall be a one-square-mile PLSS section as shown on the Area of Interest map. Adjacent images will join with varying minimal overlaps as required to ensure continuity of imagery coverage

5. Image Formats - Full-resolution uncompressed image format - for each tile, Contractor will deliver two sets of four-band uncompressed 32-bit GeoTIFF format of the full resolution image with internal overviews. The bands will be in this order: R,G,B,IR. Each image will have an accompanying ESRI world file. The GeoTIFF header will also contain the projection specification. The first set will be made prior to radiometric color correction. The second set and all compressed and resampled images shall have the radiometric correction applied.

   Full-resolution compressed image format - Contractor will deliver two 3-band 5X compressed data sets with internal overviews. Images will use JPEG compression to output 5X compressed GeoTIFF files. One set will be R,G,B (natural color). The second will be CIR (G, B, IR). The images will have accompanying world files.

Resampled imagery - The full resolution natural color imagery shall be resampled to compressed three-band 5X GeoTIFF, using JPEG compression, without internal overviews. The CIR images will not be resampled. Pixel sizes will be:

- Low altitude flight - one, two, four, ten and 20 feet.
- High-altitude flight - two, four, ten and 20 feet.

These images will NOT contain internal overviews. The resampled images shall include accompanying world files.

MrSID compressed Imagery - The natural color full-resolution images shall be compressed in MrSID format, using a 10:1 compression ratio. Each MrSID file shall have an associated SDW file.

6. Media - CD-ROM, DVD or external hard drive (USB 2.0 or Firewire). Metro will furnish and ship hard drives to the contractor, at Metro's expense. An itemized packing slip shall accompany each shipment to Metro. Media shall be shipped to Metro at the contractor's expense.

7. Naming convention -Naming convention shall be <section name><resolution code>. Naming Examples:

6 inch	1s1w01u.tif – where 1s1w01 is the section number
1 ft	1s1w01v.tif
2 ft	1s1w01w.tif
4 ft	1s1w01x.tif
10 ft	1s1w01y.tif
20 ft	1s1w01z.tif

8. Pilot projects and quality control - Contractor will submit one block of nine orthoimage section tiles, for each resolution, to Metro for review. These images will be in final form, and will be evaluated for uniformity of illumination, color quality, color balance, horizontal accuracy and plotting quality. Metro will then notify the contractor of any adjustments needed. Upon acceptance of the pilot area orthoimagery by Metro, these images will act as a benchmark for the standard of quality to be maintained throughout the remainder of the project.

The pilot projects consist of these tiles:

For area 1			For areas 2 through 7		
1n1w13	1n1e18	1n1e17	1s4e20	1s4e21	1s4e22
1n1w24	1n1e19	1n1e20	1s4e29	1s4e28	1s4e27
1n1w25	1n1e30	1n1e29	1s4e32	1s4e33	1s4e34

It is expected that the contractor will have inspected its work prior to submission to Metro, and that only the final product will be submitted for acceptance. Metro may request images for correction up to six months after the 100% product delivery date. Any products rejected by Metro will be redone and resubmitted to Metro within three weeks. The following factors will be checked when reviewing images:

- Proper naming convention.
- GeoTIFF header and world file have correct information.
- Positional accuracy checked to "blind" survey control.
- Color, brightness and radiometric correction.
- Rectified images join correctly at seam lines.
- Center of frame used for treatment of hot spots and tall buildings.
- Above-ground features (bridges and overpasses) shown correctly, without warping.
- Seam lines practically invisible.
- Tile overlap leaves no gaps.
- Tile overlap not excessive.

K. **Metadata** – Contractor shall document the project with metadata in FGDC format that will describe all aspects of the flight, including dates, scale, altitude, camera, control, DTM, orthophoto generation and mosaicing techniques.

L. **Deliverables** - The contractor will deliver the following products for each flight:

1. Flight plan delineating flight lines, exposure stations and control points. The flight plan shall cover sufficient geography outside the project area to guarantee accurate and complete delivery of the required orthophotos. To be delivered in a format readable by ArcGIS software.

2. Control – all control points collected.

3. Aerial triangulation report - including listing of all points used, adjusted coordinates for all control and pass points, residuals for control points, and discrepancies at ground scale for all coordinates.

4. Digital terrain model – updated DTM files will be delivered in ESRI file geodatabase format.

5. Early orthophoto images.

6. Two representative pilot sets of nine adjacent orthophotos in a contiguous 3 x 3 tile square, for quality review.

7. Orthophoto image files delivered according to schedule below.

8. Resampled image files delivered after the full-resolution images, according to schedule below.

9. Compressed images – to be delivered, according to schedule below.

10. Metadata in FGDC format.

11. Capture dates – A shapefile showing date/time of image capture by flight line or frame.

M. **Metro contributions**

1. DTMs
2. LiDAR-based DEM.
3. Portable hard drives for data transfers.
4. Section shapefiles for generating tiles.

N. **Schedule**

Metro's schedule follows. You may propose changes to this delivery schedule and give reasons if additional time is necessary. The contract resulting from this RFP will start July 1, 2010 and end November 30, 2012. It is Metro's intention to enforce the penalty described below.

1. Flight – imagery or photographs acquired on or before July 31, weather permitting (leaf-off flight completed before leaf-out).
2. Orthorectified images in all resolutions delivered to Metro within five months of completion of image capture.
3. Anticipated production schedule, in weeks after acquisition of the aerial images, is as follows:

Description	End of Week
QC of images complete	3
Pilot projects complete	6
Pilot projects accepted	8
Early ortho (60 days)	--
Full resolution TIFF images	16
Full resolution TIFF images accepted	18
Resamples and compressed images	20
Resamples and compressed images accepted	21

If Metro does not meet its deadline for accepting a delivery, the final deadline will be adjusted accordingly.

Penalty

A late penalty will be assessed if either of these deliveries are late:
Early ortho – 60 days following flight.
Standard orthos – five months following flight.

Metro intends to award a contract containing this late-delivery penalty statement:

"Late fees shall be assessed against the Contractor for every calendar day a delivery date is not met. The late fees shall be assessed as follow:

- Days one (1) through fifteen (15): 0.1 percent of the contract value of the particular delivery per day.
- Days sixteen (16) through thirty (30): 0.2 percent of the contract value of the particular delivery per day.
- Days thirty-one (31) through sixty (60): 0.3 percent of the contract value of the particular delivery per day."

O. **Storage** - Contractor will store raw digital files. Contractor will provide this service free of charge for a period of five years from final delivery of the orthophoto images; however, Contractor will not be held liable in the event of loss or damage.

P. **Ownership** – ownership of all products produced by the contractor will be as specified in the Sample Personal Services Agreement, part 6. Metro will grant contractor the right to commercially use, in connection with work performed for government entities any and all of the 2010-2012 Metro photogrammetric data used in the performance of this project, including without limitation controlled aerial imagery and aerial triangulation results.

Q. **Three-inch option**

Please submit cost for a three-inch resolution in addition to six-inch for the leaf-off flight. Please describe whether additional work is required on the DTM for this product.

R. **Payment schedule**

Percentage of price for a particular delivery to be paid	When
40%	acquisition of imagery
10%	delivery of early ortho and pilot project.
35%	delivery of full-resolution images
15%	delivery and acceptance of resampled images.

Metro shall pay each claim for payment within thirty (30) calendar days from receipt of a satisfactory claim for payment.

S. **Right of Refusal -** If the product does not adhere to the standards outlined in Attachment A, Metro may refuse the product with no payment or penalty.

QUOTE SHEET
METRO 2010-2012 DIGITAL ORTHOPHOTOS

Please enter prices on this form. Contractor is not required to bid on all items.

2010 Summer		
	Standard Ortho	**Early Ortho**
Area 1 six-inch	$	$
Area 2 one foot	$	$
Area 3 one foot	$	$
Area 4 one foot	$	$
Area 5 one foot	$	$
Area 6 one foot		
Area 6 six-inch option	$	$
Area 7 one foot		
Area 7 six-inch option	$	$
Total	$	$
2011 Summer		
	Standard Ortho	**Early Ortho**
Area 1 six-inch	$	$
Total	$	$
2012 Leaf Off – Collection Only		
Area 1 six-inch	$	
Area 1 three-inch option	$	
Total	$	

Additional alternative options not specified in this RFP or on this quote sheet will be considered if they meet or exceed the project objective at competitive rates. Metro may not acquire all options shown on the quote sheet.

Company: _____

Date: _____

Authorized signer: _____

Name: _____