

## Statement of work for USDA-ARS Las Vegas, NV Imagery 2009

We are requesting bids for aerial imagery flown at 2 elevations at 8 sites near Las Vegas, NV. For this research project, we will be integrating field measurements with the aerial photography so we need the highest horizontal accuracy possible. Unfortunately, we cannot afford ground control targets be deployed. Please specify in your bid the greatest horizontal accuracy your company can provide in an orthorectified product without deploying targets.

### *Please include the following in your bids:*

- Bids for both scopes of work: Ortho-mosaics and Spot Photos (scope of work A) and all tasks in scope of work A plus additional cost for georeferencing the spot photos (scope of work B)
- Make and model of camera to be used
- Lens focal length
- Number of photos to be taken for each photo mosaic
- Error of x, y, and z coordinates of photo center point
- Whether airplane yaw, pitch, and roll information will be included for each photo
- A minimum horizontal accuracy is specified in the SOW for the orthorectified photomosaics (15-cm ground resolved distance images), deliverable level of accuracy will be considered when evaluating bids. Please specify the highest accuracy your company can deliver in terms of “95% of all well-defined points tested fall within \_\_\_\_m of true ground” AND if the National Map Accuracy Standards for the orthorectified photomosaics will be met.
- Footprint captured by each photomosaic (15-cm ground resolved distance images)
- Vertical accuracy and horizontal resolution of DEM generated as part of the orthorectification process
- Delivery time of all deliverables in terms of weeks after acquisition.
- Proposals will also be evaluated on the resolution of the low elevation photos (Spot Photos). Please specify the highest achievable ground resolved distance of high resolution, lower elevation photos (Spot Photos).
- Footprint captured by higher resolution, single exposure, spot photos
- Any ideas you may have for cost saving, such as combining acquisition with other projects

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## **Scope of work A**

### **IMAGERY:**

**Location:** Project located within Lake Mead National Recreation Area (Clark County NV/Mohave County AZ) and Mojave National Preserve (San Bernardino County, CA). This is a project funded by the National Park Service. Please see attached map.

**Scope of work:** 8 sites, each a 2 km by 2 km square, with wall-to-wall photomosaic coverage *plus* 32 higher resolution, low elevation, individual spot photos. Spot photos will be dispersed among the photomosaic areas. All imagery will be within the Lake Mead National Recreation Area and the Mojave National Preserve. Individual photomosaic polygons may include areas with substantial elevation relief (up to ~500' elevation change w/in a 2km by 2km square). The 8 photomosaic squares will be dispersed among two general areas (exact coordinates will be provided after contract approval):

- Northern Lake Mead: within 40 miles of Echo Bay airport within Lake Mead National Recreation area (114°27'49.967"W 36°18'45.097"N)
- Southern Lake Mead and the Mojave Preserve: within 40 miles of Searchlight Nevada (114°54'32.709"W 35°26'40.517"N).

**Acquisition window:** March 8 to April 7, 2009. Preferred acquisition dates are between March 18 and March 25, 2009. It is required that the company notifies the USDA via email of tentatively scheduled fly dates at least 2 weeks prior to acquisition. Additionally, the company needs to notify the USDA if scheduled acquisition dates change and when imagery collection has been successfully completed (contact information for three USDA personnel will be provided). Earlier notification is preferred.

**Camera type:** large format, digital mapping camera (any model except pushbroom sensor, i.e. ADS 40)

**Bands:** Red (layer 1), green (layer 2), blue (layer 3), and near-infrared (layer 4). 16 bit data in each band.

**Time of day:** within 2 hours of solar noon

**Crabbing /Drift:** should not affect more than 10% of the image width for any flight line.

**Roll or Tilt:** Exposure made with the optical axis of the camera in a vertical position is desired. Tilt of any exposure must be less than four degrees for any frame.

**Flying conditions:** Light/weather conditions should be such that collected images are clear and sharp.

**Cloud cover:** Must be delivered with less than 10% cloud cover for entire flying area.

**Camera Settings:** The camera should be set according to the lighting conditions of the day as to prevent pixel smear, sensor blooming, and under/over exposure. Ground speed and camera shutter speed must be adjusted to eliminate blurring caused by movement.

#### ***Photomosaic imagery areas:***

**Ground sampling distance:** 15cm pixel (+/- 4%)

**Forward and side lap:** As is necessary to produce orthophotomosaics

#### ***Lower elevation spot photos (no orthorectification):***

**Ground sampling distance:** Flown as low as possible to obtain as high a resolution image as possible without image smear.

**Number of photos:** 32 single exposures dispersed among the 8 photomosaic areas.

**Metadata:**

**Camera/sensor specifications:** include all information regarding the sensor, such as the lens, lens filter(s), sensor array, shutter assembly, and other

**Camera Settings:** include focal length, exposure, aperture, shutter speed, exposure compensation, and other

**Flight lines:** time of capture, altitude of the aircraft above sea level, height of the aircraft above the ellipsoid, flight paths, heading, latitude, longitude.

**Photo center points (x,y,z)** UTM's w/ accuracy specified

**Camera calibration information:** camera certification should be detailed only to the extent necessary to demonstrate that the camera is proven to operate to manufacturer's specifications, include date of certification

**Bands:** clearly state what "color" band relates to which data layer. Example Red band is layer 1 of layer stack, Green band is layer 2 of layer stack, etc.

**Date:** Clearly state dates and times all imagery was collected, including if collection spans additional days or collection periods

**POST-PROCESSING/ORTHO RECTIFICATION (Photomosaic images only):**

**Resolution:** 15cm on the ground resolution

**Minimum Horizontal Accuracy:** 95% of all well-defined points tested fall within 1 m of true ground location.

**Digital Elevation Model (DEM):** Will be produced from overlapping stereo orthophotos and used as part of the orthorectification process.

**Vertical Accuracy of DEM:** *Please specify achievable accuracy of DEM*

**File Format RGB-IR:** Uncompressed, georeferenced tagged 16 bit image file format (GeoTIFF) and 8 bit JPEG 2000 file formats, projected in the World Geodetic System of 1984 (WGS84), using the corresponding native Universal Transverse Mercator (UTM) zone with coordinates in meters.

**File Format DEM:** Uncompressed, georeferenced tagged image file format (GeoTIFF), projected in the World Geodetic System of 1984 (WGS84), using the corresponding native Universal Transverse Mercator (UTM) zone with coordinates in meters. The vertical datum shall be North American Vertical Datum of 1988 (NAVD88).

**Delivery:** Please specify achievable delivery time in terms of weeks after acquisition.

**Deliverables from Scope of Work A**

- Unrectified products: Individual raw images (both high resolution spot photos and images used for ortho-mosaics, 15cm pixel) red, green, blue, near-infrared (RGB-IR) digital images (16 bit, TIF format).
- Orthorectified products (15cm resolution): 4 band images (RGB-IR), tiled, orthorectified photomosaics, 16 bit GeoTIFF and 8 bit JPEG 2000 format
- DEM images: orthorectified photomosaics, GeoTIFF format
- Flight plan map of mission (Shapefile)

- Footprint of areas covered with imagery (both 15 cm mosaics and high resolution spot photos) (Shapefile)
- FGDC compliant metadata in digital format for each folder (raw imagery, orthos, DEM)
- File naming and directory conventions: All products should be named and organized in a directory structure following conventions specified by the USDA (detailed instruction will be provided).
- Must be delivered within stated achievable delivery time.
- All electronic deliverables must be on shipped to the USDA on CD, DVD or harddrive

## **Scope of work B**

**Scope of work:** Includes all of the items in scope of work A *plus* georeferencing all 32 of the spot photos acquired in scope of work A. Spot photos will be georeferenced to the appropriate 15-cm ortho-mosaic acquired in scope of work A.

**Horizontal accuracy:** Accuracy of the georeferenced spot photo must be such that the root mean square error (RMSE) is no greater than 30 times the resolution (pixel size) of the spotphotos. For example, if the resolution of the spot photos was 3cm, the RMSE of the georeferenced spot photos would need to be < 90cm (relative to the 15-cm reference image).

## **Deliverables from Scope of Work B**

- All deliverables for scope of work A
- Must be delivered within stated achievable delivery time.
- All electronic deliverables must be on shipped to the USDA on CD, DVD or harddrive
- Metadata detailing georeferencing process in digital format.
- Georeferenced, 4 band (RGB-IR) of all high resolution (spot photo) images, 16 bit GeoTIFF and 8 bit JPEG 2000 format

Delivery Address, US Mail:  
Box 30003 MSC 3JER  
Las Cruces, NM 88003

Shipping Address:  
USDA-ARS Jornada Experimental Range  
2995 Knox St.  
Las Cruces, NM 88003