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March 4, 2014

CLIENT CONTACT: Mr. Matt Edmonson
UIUC Facilities & Services, Planning Division
Physical Plant Service Building
1501 S Oak Street
Champaign, IL 61820

RE: PSSU14R19 Photogrammetry and LiDAR Services – Retainer Agreement 2014-0446

Quantum Spatial Preliminary Project Number – Acquisition of Airborne LiDAR Data for Madison County in Illinois

Dear Mr. Edmonson:

The following responds to the request for Retainer Services from Quantum Spatial, Inc. for the Illinois Height Modernization Program (ILHMP), which is managed by the Illinois State Geological Survey (ISGS). The Photogrammetry service activities response has been broken down into two separate project proposals. This submittal is for;

(1) Madison Data Acquisition: project data acquisition of Light Detection and Ranging (LiDAR) data and initial processing and data quality assurance (QA) and quality control (QC) to validate the quality of newly acquired data.

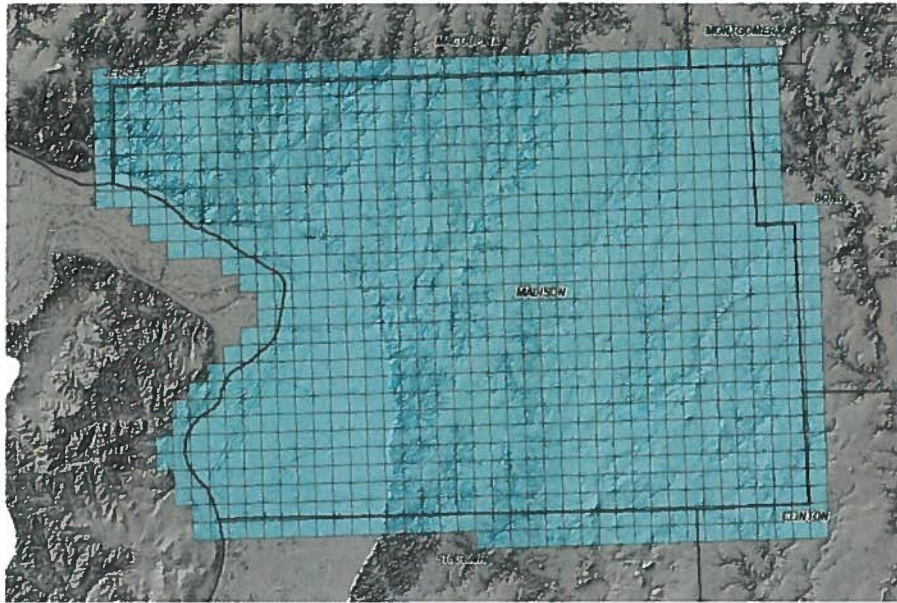
This proposal includes a detailed scope of work for the services required for acquisition, timeline for acquisition project completion, proposed staff breakdown, and proposed service fee with detailed pricing justification.

STATEMENT OF WORK:

Project Area Description

LiDAR data will be acquired for Madison County in Western Illinois which is approximately 905-square miles. Approximately ~~966~~ square miles of LiDAR will be collected including a 1 tile buffer around the project area. Project data will be collected at a nominal point spacing (NPS) of 0.70 meters, or 2 point per square meter with a 51% swath width (4 points per square meter including swath overlap). The data will be accurate to 9.25 cm RMSEz and QL2.

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The approximate project boundary was defined by the GIS data layer provided by Janet Holden of ISGS. The intention for this project is to extend beyond the county boundary by a single index tile. The project has been designed to acquire LiDAR coverage to provide complete tile coverage of the 966-square mile AOI.

LIDAR ACQUISITION SCOPE OF WORK:

The LiDAR data will be collected and post processed following the steps outlined in our original Statement of Qualifications. All collection and initial post processing will be compliant with U.S. Geological Survey National Geospatial Program LiDAR Base Specification, Version 1.0 (see <http://pubs.er.usgs.gov/publication/tm11B3>).

LiDAR data will be collected upon notice to proceed. Data will be collected cloud and fog free between the aircraft and ground. The ground will be snow free and no unusual flooding or inundation is allowed in the floodplain and upland areas. The ultimate goal for this project is to acquire the data during Spring 2014 leaf-off conditions if feasible. If weather or ground conditions impede the collection, Quantum Spatial will work with ISGS to negotiate a project delay to Fall 2014.

This project was planned using a Leica ALS70 LiDAR sensor.

Field Survey

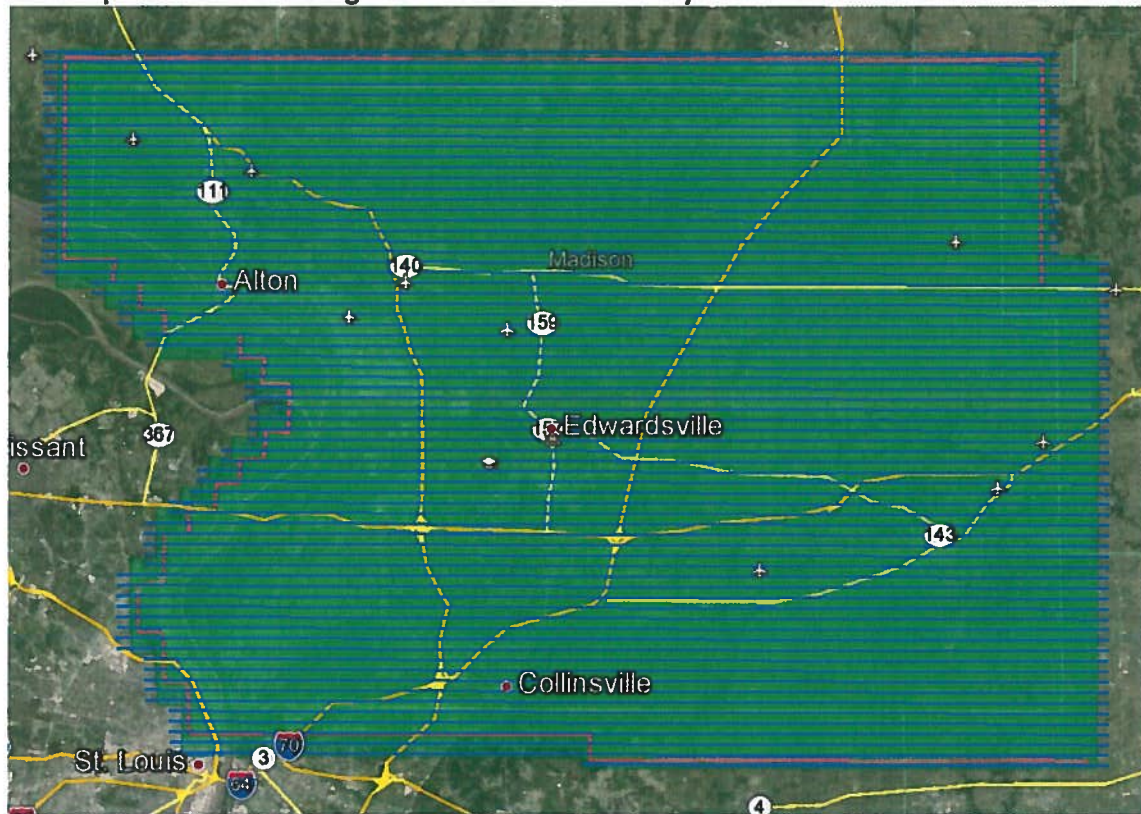
The ground base station operations will be closely coordinated and controlled, and that all aspects of data quality will be monitored throughout the production and delivery process.

Quantum Spatial will be responsible for ground control points. We will field survey approximately 30 points in open, flat areas randomly distributed throughout the project area for use as LiDAR Quality Assurance (QA), Quality Control (QC) check points. An additional 100 points shall be surveyed in each of the five vegetative classes within the Madison project area to be used as FEMA required quality test points. Points will be accurate to better than 3x the anticipated accuracy of the LiDAR data.

Quantum Spatial will provide ground survey support which includes the collection of a series of ground check points utilizing Global Positioning Surveying (GPS) methods. GPS establishes precise geodetic control points using satellites and ground-based receivers to triangulate extremely accurate geographic coordinates on the earth's surface. Survey deliverables include: survey report, ASCII file of control data, and digital photos of each checkpoint.

The horizontal and vertical datum's for this project will be, NAD-83/2011, Illinois State Plane Coordinates, West Zone, US Survey feet and NAVD-88 (Geoid 12A)

LiDAR Specifications and Flight Plan for Madison County.



<i>LiDAR Flight Preliminary Parameters – 2ppsm 51% overlap</i>	
Point Density	2 ppm (SPS) 4 ppm (DPS)
Accuracy	9.25 cm or better
Flight Altitude	6890 ft. AGL
Airspeed	Average 150 kts
Laser Repetition Rate (prf)	261 kHz
Scan Frequency	39.1 Hz
Total Scan Angle	40 °
Overlap	51 %
Swath Width	1455 m
Flight Lines	69

INITIAL LiDAR POST PROCESSING:

Data Validation

For field quality control purposes, after each flight, the LiDAR datasets are field checked for data acquisition swath coverage and as a preliminary GPS review. Both horizontal and vertical aircraft position and orientation are verified and reviewed using the flight plan to ensure proper coverage of LiDAR data. The in-office processing steps are similar to the field processing with the addition of GPS data quality reports generation. Inertial Measuring Unit (IMU) data is processed and checked for gyro bias, systematic errors, as well as positional error. The GPS trajectory of the survey aircraft is post-processed and the smoothed best estimated trajectory (SBET) is calculated combining the post-processed GPS solution with IMU and lever arm measurements.

LiDAR MAPPING ACCURACY:

The LiDAR data collected under this proposal will meet or exceed accuracies stated below: The vertical accuracy will be less than or equal to 9.25 cm RMSE and meet USGS QL2. The surface will be suitable for 2-foot contour generation. Digital elevation data will be suitable for digital mapping, planning studies, and the development of precise topographic maps and digital elevation models.

Due to the inherent nature of LiDAR technology, the success of vegetation removal may decrease in leaf-on environments. LiDAR pulses may be naturally absorbed by water bodies or areas recently covered with asphalt or tar. These areas may result in small data voids in the DEM data.

PROJECT TEAM:

The Quantum Spatial, Inc. project team will consist of any number of qualified personnel from our pool of corporate wide personnel to fulfill the specialized requirements of the project requirements. The disciplines required to fulfill the Scope of Work are varied, thus a specific listing of personnel other than the project managers will not be known until the process is begun. Key administration, project management and production managers shall be as follows:

Jeffrey B. Stroub, Vice President – Contract Administration
Jennifer Whitacre – Assistant Contract Administrator
James Young – Wide Area Project Manager
Chris Guy – Assistant Wide Area Project Manager
Rob Merry – Geomatics Project Manager

BUDGET:

We have established a budget of \$102,193 to complete all LiDAR acquisition, field surveying, initial LiDAR data processing and QA/QC review, for the 966-square miles of proposed project area in accordance with the Scope of Work set forth by the Work Order assignment.

SCHEDULE, REPORTING, MILESTONE DESCRIPTION, and COMPLETION DATE:

Schedule

The ultimate objective for this project is to complete data acquisition during the Spring of 2014 during leaf-off vegetative conditions, followed by initial data processing and reviewed to ensure high-quality data has been acquired.

Seasonal and weather conditions dictate when acceptable acquisition can occur. Assuming acceptable weather and timely acquisition of LiDAR data, all final collection data and documentation will be submitted to the ISGS no later than June 30, 2014, if feasible. If seasonal weather conditions do not allow for a Spring collection, Quantum Spatial will work closely with ISGS to negotiate a plan for a Fall 2014 collection.

Project Reporting

Every 2 weeks Quantum Spatial will report the project progress as milestones and show the percentages of each milestone complete. ISGS will provide a 1-page form for reporting once project requirements have been agreed upon.

We will coordinate with ISGS to provide an opportunity for data quality assurance (QA) and quality control (QC) review of a pilot project area within the Madison project area.

Milestone Description and Completion Date

<i>Approximate Schedule</i>			
Milestone	Start Date	Finish Date	FEE
Notice to Proceed	3/15/14		
Mobilization	3/20/14	3/20/14	\$ 3,320
Data Acquisition	3/21/14	4/30/14	\$ 49,446
Ground Survey	3/21/14	4/30/14	\$ 22,291
Initial Data Processing/QC	5/1/14	6/15/14	\$ 27,136

966

DELIVERY ITEMS:

- 1. Unclassified LiDAR Point Cloud in LAS v1.2 file format**
 - a. LiDAR will be calibrated and georeferenced to NAVD-88, NAD-83/2011, Illinois State Plane West, US Survey feet
 - b. Data will be provided in American Society for Photogrammetry and Remote Sensing (ASPRS) Standards for LAS version 1.2
 - c. Data will be provided in the tiling index provided by ISGS.
- 2. Vertical Accuracy Assessment in .pdf format**
 - a. Report on Fundamental, Supplemental and Consolidated Vertical Accuracy
- 3. Ground Survey Check Points in ASCII file format**
 - a. Survey report to be provided that includes digital photos of each point

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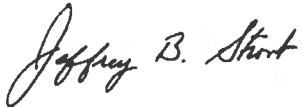
4. FGDC Compliant Metadata in .xml format

PRICING:

Pricing includes data collection, base station set up, initial post processing, ground control, and QA/QC. Neither additional fees nor reimbursable costs are expected.

TOTAL FEE note lump sum contract:	2 ppsm – 51% overlap	\$102,193
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Respectfully Submitted,



Jeffrey B. Stroub, CP, RLS, PPS, SP
Vice President Business Development

C: Jennifer Whitacre, GISP – Assistant Contract Administrator