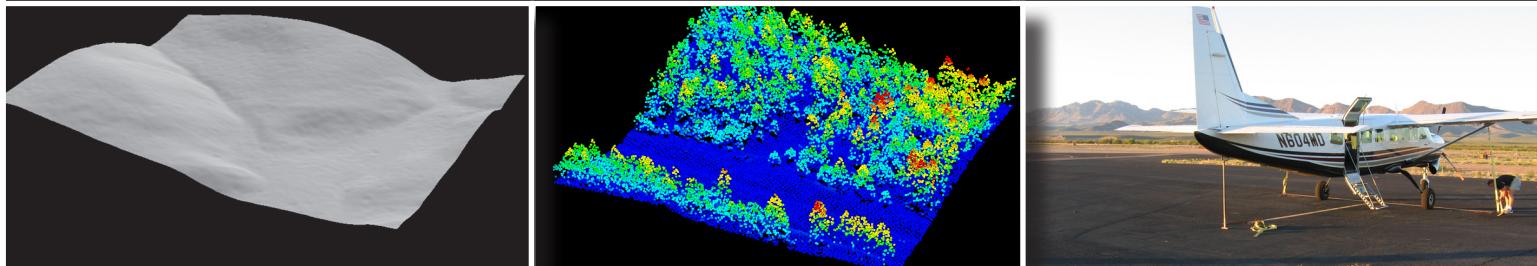


PRACTICAL LIDAR-ACQUISITION CONSIDERATIONS FOR FORESTRY APPLICATIONS

October 2008

RSAC-0111-Brief1



Abstract

Several federal agencies need terrain and vegetation data that include vertical as well as positional information (Haugerud and others 2007). This data can be topographic but can also include information about the height of objects on the ground such as buildings, other types of infrastructure, and trees. Lidar (light detection and ranging) data can provide this information.

Lidar technology has evolved quickly since the late 1990s; therefore, acquisition requirements have changed to keep pace with this relatively new remote sensing data source. Several government agencies have formed consortia with academic and research institutions to share costs.

The goal of this document is to 1) make lidar users aware of the specifications that have been developed by the Puget Sound Lidar Consortium (PSLC) and the Oregon Lidar Consortium (OLC) for areas with heavy forest cover; 2) describe typical products that can be created using lidar data; and 3) make recommendations for developing specifications for acquiring lidar for natural-resource applications. An example of a lidar specification for a forestry application on the Coronado National Forest is included in the appendix.

Key Words

lidar, lidar acquisition, forest structure, mapping

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Table of Contents

Abstract
Acknowledgments.
Introduction	1
Overview of Lidar Technology.	1
Lidar Awareness.	1
Lidar Contract Specifications	2
Information to Include in a Contract with a Lidar Vendor	2
Minimum Lidar-Acquisition Requirements for Forestry Applications . .	4
Balancing Costs with Data Requirements.	4
Conclusion.	6
References and URLs	7
Appendix A: Example of an Expired Request for Quotation.	8

Introduction

Federal agencies such as the United States Geological Survey (USGS), USDA Forest Service (FS) and the Bureau of Land management (BLM), need terrain and vegetation data that include vertical measurements (Z) in addition to positional (XY) information (Haugerud and others 2007). This vertical component can be just topographic (elevation) but can also include information about the height of objects on the ground such as buildings, and other kinds of infrastructure, and trees. Lidar (light detection and ranging) data can provide the XYZ information, because its technology has evolved quickly since the late 1990s (Goetz and others 2006).

As happens with any evolving technology, acquisition specifications for lidar must keep changing to keep pace with this relatively new remote sensing data source. Several government agencies have formed consortia with academic and research institutions to share costs.

This document has three goals:

- to make lidar users aware of the updated specifications that have been developed by some of these consortia, particularly the Puget Sound Lidar Consortium (PSLC) and the Oregon Lidar consortium (OLC), for areas with heavy forest cover;
- To describe typical products that can be created from lidar data; and
- To make general recommendations about the way to apply these specifications accurately and appropriately.

These lidar-acquisition specifications are in the public domain. Information about the PSLC and OLC can be found at the following Web sites:

- PSLC: <http://pugetsoundlidar.ess.washington.edu/> (accessed February 6, 2009).
- OLC: <http://www.oregongeology.org/sub/projects/olc/default.htm> (accessed February 6, 2009).

Overview of Lidar Technology

There are several types of airborne lidar systems; this report focuses on the most common terrain-mapping system—discrete-return, small-footprint lidar with a typical laser-beam diameter in the range of 0.2—1.0 m. Discrete-return airborne lidar systems were developed over the last 15 years for the specific purpose of mapping terrain (Wehr and Lohr 1999). Lidar systems combine a laser range finder, GPS unit, inertial measurement unit (IMU), and high-precision clocks, all mounted in an aircraft. The system sends out near-infrared laser pulses and measures the time until it receives a return signal. The two-way travel distance from the laser to the ground and back is calculated based on precise timing and the speed of light. The position of the sensor is recorded by the onboard GPS and IMU. The resulting dataset is a “point cloud” of XYZ coordinates. In areas where vegetation is present, the outgoing pulse often generates multiple returns; some energy beams will be reflected by upper and lower foliage layers, and the rest will penetrate to and be reflected by the ground (Reutebuch and others 2005; Goetz, and others 2006).

Lidar Awareness

Lidar data can be used for a variety of projects. As with aerial photography, the data-acquisition parameters are influenced by the intended application. The most commonly derived products from a lidar point cloud are the following (Reutebuch and others 2005):

- **Ground surface model:** a high spatial-resolution bare-earth model representing the elevations of the surface topography.
- **Canopy surface model:** objects such as trees, buildings, and infrastructure are superimposed on the topography. In areas where the top of the vegetation data points generates the surface information, the result is a canopy surface model, which contains information about the elevation of the vegetation.
- **Canopy height model:** the crucial information required concerns the vegetation height. Which can be derived by subtracting the ground surface model from the canopy surface one.
- **Intensity image:** besides measuring time, most sensors can also determine how much energy in the originating infrared pulse returns to the sensor. This is called intensity data, which can then be processed into a high-resolution image corresponding to a noncalibrated infrared reflection that is like an orthophoto.

Knowing the way that lidar specifications affect the information in lidar data is useful for a variety of reasons. It allows planners to gauge whether existing lidar data will fulfill particular project needs. In addition, it facilitates informed discussion and negotiation with vendors prior to acquiring lidar data. Loosening certain specifications may have minimal impact on the utility of the lidar data but may still significantly decrease the acquisition costs.

The Federal Emergency Management Agency (FEMA) has been involved in several of the ongoing or recently completed statewide lidar acquisitions. Unfortunately for vegetation mapping, several of these surveys only generated

bare-earth ground models. When both the first and the last returns are available, the lidar data may be more useful, but often the pulse density is not sufficient for many vegetation projects. Likewise, intermediate returns are not commonly available.

FEMA acquired data generate up-to-date flood-zone elevation models that possess better topographic detail than what was previously available from existing 10-meter USGS digital elevation models (DEMs). Capturing last returns is the minimal information required to generate these models and is less expensive than collecting the typically higher-density lidar data necessary for vegetation mapping. Little forestry information other than a digital terrain model can be derived from FEMA's last-return lidar data. When first returns are also included in the lidar data, generalized canopy surface models can be created and the canopy height can be derived from them. The nominal density of 1 pulse per 1.5 square meters satisfies FEMA's data needs to generate a topographic model in relatively open terrain. Areas with dense vegetation cover, like the Pacific Northwest, require higher density collections (1 to 6 pulses per square meter is typical) to increase the likelihood that enough pulses will reach the surface to produce an accurate ground surface model. Neither of these two FEMA requirements—density and last/first return—is good enough to be used in the majority of forestry applications which require a higher pulse density and additional intermediate returns to characterize midcanopy structure.

When lidar data acquired for utility-corridor management (e.g., power-transmission lines) are available to the forester, the specifications, such as 20-plus pulses per square meter, are often higher than what is required for many forestry applications. Vertical accuracy requirements that satisfy transportation and engineering needs

may also be more than forestry studies require. High accuracy requirements can be cost effective for high value projects but may become prohibitively expensive for larger areas. Often one must consider practical trade-offs between the accuracy and volume of the lidar data when forestry applications must cover the potentially large land areas associated with national forests.

Lidar Contract Specifications

This section provides specific information about acquiring lidar data and the way the specified parameters can affect the final products and costs. Specifically, the objectives are to do the following:

1. List the information and items to include in a contract with a lidar vendor,
2. Provide minimum requirement information for forestry applications, and
3. Provide recommendations that will help balance cost against data needs.

Information to Include in a Contract with a Lidar Vendor

The first thing is to decide what the vendor needs to know to fulfill the client's data requirements in the best possible way and determine what the vendor and client should discuss to optimize cooperation. In addition to typical specifications for lidar acquisition, it is important to list items that should be included with the contract to acquaint the vendor with project-specific issues, for example, providing a map of the area; communicating conditions that may restrict acquisition times, such as weather or leaf fall; and determining if flight or airspace is restricted. Special care needs to be taken to word the specifications to eliminate ambiguity.

Table 1 lists minimum lidar data-acquisition specifications for topographic surveys and vegetation mapping following the general guidelines listed here. Most lidar contract specifications should include these items:

- The location of the acquisition area, including a narrative, maps, and shape file(s)
- A description of applications that will use the data
- Potential problems the vendor needs to be aware of, such as flight-restricted areas
- The lidar survey specifications (the client knows what is required; the vendor knows the capabilities and limitations of the equipment)
 - Instrument and aircraft specifications
 - Data-acquisition parameters
 - Accuracy specifications
 - Completeness of the data set
 - Spatial reference framework (datum, projections, units)
 - Deliverables (including optional ones)
 - Formats and data organization (consistent file names, accessible file formats),
- Time frame for data acquisition and delivery
- Contact information between vendor/client
- Insurance/liability clauses
- Contract nullification conditions
- Data ownership

Table 1—Example of minimum lidar data-acquisition specification guidelines for two projects: topographic mapping in open terrain and mapping and/or vegetation characterization in dense cover (McGaughey and others 2006, Reutebuch and McGaughey 2008)

Topographic mapping in relatively open terrain (medium-resolution ground model: ≥ 2-meter grid)		a. Vegetation characterization b. Topographic mapping with dense vegetation cover or for high-resolution ground model (< 1-meter grid)
Scan angle	≤ ± 20° of nadir	≤ ± 13° of nadir
Flying height (m)*	2,200	1,200
Pulse repetition frequency**	10 to 70 kHz	30 kHz to > 100 kHz
Ground beam footprint	< 100 cm	Narrow setting, ≤ 30 cm
Swath width*	1,600 m	500 > – < 800 m
Nominal aggregate pulse density (per sq. meter)	0.3–1	a. 3 to 8 b. > 4 (for some applications > 8)
Returns per pulse	Last	Minimum 2 (first [surface model] and last [for ground model]) > 4 for vegetation and structure modeling
Time of year	Leaf-off without snow cover	Depends on the project; no snow cover
Horizontal accuracy	25 cm	0.5 m
Swath-to-swath vertical accuracy	10 cm	15 cm
Vertical accuracy (in open areas)	15 cm	50 cm absolute accuracy; relative accuracy can be more important

* These two parameters are influenced by aircraft and project requirements. They are interdependent as well as dependent on minimum scan angle and more. The values in the table are general guidelines only. Discussion between vendor and client will set the best values for these parameters.

** Changes as instrument technology improves

Note: acquisition specification requirements for high-precision lidar measurements may surpass those for projects involving vegetation or dense cover.

An example of the items listed in an actual lidar-acquisition contract appears in Appendix 1. These specifications were derived from ones developed by the PSLC and the OLC. These consortia have more than 10 years of cooperative experience in acquiring lidar data. More details about the specifications can be found on the following Web sites:

- for the PSLC http://pugetsoundlidar.ess.washington.edu/PSLC_specifications.pdf (accessed February 6, 2009) and
- for the OLC (USGS, Washington Dept. of Natural Resources, Oregon Dept. of Geology and Mineral Industries and Dept. of Forestry, Puget Sound Regional Council,

BLM and FS) http://www.oregongeology.com/sub/projects/olc/proposed_PNW_lidar_spec.pdf (accessed February 6, 2009).

The specifications posted on these two sites were developed in accordance with forestry needs in the Pacific Northwest based on 2007 market conditions. Because of the Puget Sound area's dense

vegetation cover and the young geological terrain, the data requirements for the region are conservative. The recommendations developed by the OLC contain concise details about GPS procedures, the data-tiling scheme, the return classification, and information that should be contained in the metadata. The canopy lidar-acquisition specifications for the Pinaleño Mountains, a sky island in southern Arizona (Appendix 1), were also adapted from these two sources.

The FEMA specifications detailed at (http://www.fema.gov/plan/prevent/fhm/gs_main.shtm) (accessed Feb. 6, 2009) and outlined in Appendix A (Guidelines for Aerial Mapping and Surveying) of the document, are designed for topographic surveys. Most forestry applications will need specifications more closely aligned with the PSLC's in the areas of pulse density and number of returns.

Overall, it is best to look at the PSLC specifications as a set of guidelines for items that should be included in the contract. They are not meant to restrict the vendor, nor are they set in stone. Knowing what the data needs are and which projects the information will be used for is a first step.

Minimum Lidar-Acquisition Requirements for Forestry Applications

Table 2 lists recommended minimum specifications that embody the most important mission variables to include when contracting for lidar projects

(from Reutebuch and McGaughey 2008). These specifications are intended for forestry projects where more information is desired from the data than a ground surface model. Forest vegetation information can be based on direct elevation/height measurements, or it can be modeled from these measurements in the lidar data or the structural information contained in the multiple returns. Examples of vital forest vegetation information are stand statistics, canopy models, cover density, forest structure, and fuel-model parameters (Seielstad and Queen 2003; Andersen and others 2005; McGaughey and others 2006).

Balancing Costs with Data Requirements

Easing up on some of the specifications can provide less data over a larger area or reduce the cost of acquisition. However, less-stringent specifications also diminish the quality of the data. Reducing the project area is not always the best way to cut costs either. It can actually increase the cost. A major expense for small and midsize acquisitions is the mobilization cost of the aircraft. Mobilization is a fixed cost that becomes larger per acre as the size of the project goes down.

When not enough funding is available to cover the entire study area using certain data requirements, one solution is to divide the area into two or more blocks and prioritize them depending on objectives. The other block(s) can be included either if additional money becomes available before the acquisition

or overall costs go down (e.g., another client needs data for a project in the same geographic location or a more cost-effective vendor becomes available). In case it remains impossible to acquire data for the entire area in a single mission, the lower-priority sections may be added at a later time.

Two vendors recently estimated that 80 percent of the cost of using lidar data is in collection, as opposed to postprocessing. So one way to cut costs is to reduce the time the aircraft is flying. Timing of the mission and accuracy can also influence cost. Table 3 provides scenarios for making trade-offs to balance costs and data acquisition.

Also it is not recommended that digital imagery be acquired at the same time as lidar data. While it initially sounds counterintuitive, the cost of simultaneous collection of imagery and lidar data will most likely be greater than combining two separate flights to obtain lidar data and imagery. High-quality imagery can only be acquired during the day in cloud-free conditions, preferably at high sun angles to increase sun energy and reduce shadowing. This limitation narrows the time window that's available to fly the lidar mission. In addition, recommended altitude of the aircraft for lidar flights is often lower than optimal for obtaining imagery. When images are taken at this lower altitude, the frames are small with a lot of radial displacement from the photo centers (layover). Stitching these frames together to create an image for the project area results in an image that is not well orthorectified and can be difficult to interpret.

Table 2—Important lidar mission variables

Partial List of Lidar Project Specifications in Forested Areas*	
Pulse density per sq. meter	Minimum 1 for stand-level canopy models and medium-resolution ground models (2-m grid). 4+ for individual tree-canopy measurements and high-resolution ground models (1-m grid).
Returns per pulse	Minimum 2 for canopy and ground-surface measurements. 4+ for improved mid- and low-canopy structure measurements.
Laser beam divergence	Narrow beam settings have provided better tree-height information and a higher percentage of ground returns in limited studies. Narrow beam allows higher flight altitudes.
Scan angle	±15 degrees of nadir (13 degrees recommended) or less increases ground returns in heavy forest cover, but narrower scan angles increase the number of flight lines required and costs. Because the operational mechanics of most sensors require them to slow down before they reverse scanning direction as well as a little time to speed up again, the pulse density will increase along the outer edges of the swath width. To keep the point density more evenly spaced across a swath width (and over the project area), the vendor should acquire data over a slightly wider swath width (say, for example, a few degrees wider than required) but clip these outer additional degrees on both sides from the data set. The aggregate point density should be calculated based on the data clipped to the narrow scan angle.
Swath overlap	Usually 50 percent or more sidelap on adjoining swaths, i.e., survey is designed for 100 percent double coverage at planned aircraft height above ground to reduce any possibility of data gaps. Adjacent flight lines should come from parallel opposing directions. Ideally 50 percent sidelap provides information from different scan angles for areas on or near the surface. The opposing directions can help in the flight line to flight line calibration.
Season of survey	Leaf-off in areas of significant hardwood cover and no significant snow cover result in better ground measurements but can be difficult to achieve in higher elevations. Leaf-off flight window can be very constrained by weather in the Northwest, resulting in lower probability of on-time mission success. Leaf-off also allows separation of hardwoods from conifers, but dead trees are difficult to distinguish from leaf-off hardwoods. Leaf-on for distinguishing live from dead trees. Conifer areas can be flown leaf-on, but poor visualization of hardwoods from conifers results. Leaf-on flight window is often larger, resulting in higher probability of on-time mission success.
Absolute lidar measurement accuracy	Horizontal: typically +/-0.5 to 1 m, depending on survey objectives. Vertically: typically +/-0.15 to 0.5 m, depending on survey objectives
Swath-to-swath lidar relative accuracy	Horizontal: +/-0.25 to 0.5 m, depending on survey objectives. Vertically: +/-0.10 to 0.5 m, depending on survey objectives
Lidar instrument ownership	A vendor who owns the sensor needed to meet the required specifications will be able to do so at a lower cost than one who has to subcontract with others or lease an instrument for the job.

*Adopted from the Puget Sound Lidar Consortium (PSLC)

Table 3—Potential cost-saving considerations for lidar acquisitions

Action	Consequences
Higher aircraft altitude	This produces a wider swath width, but it also increases the footprint size at or near the surface. A wide footprint is less likely to penetrate to the topographic surface where dense vegetation is present, which can result in a less-accurate bare-ground model. Also, in dissected terrain, pulses in deep valley bottoms often produce fewer returns due to atmospheric attenuation of the pulse energy.
Flying faster	This results in fewer pulses per nominal ground surface when flying height is constant. Projects emphasizing forest structure need at least 3 to 5 pulses per square meter. A topographic model may be difficult to derive in areas with very dense vegetation cover.
Increasing the scan angle	This provides a wider data swath, but along the edges of the data, fewer points will reach the ground in densely covered terrain. In open terrain, a wider scan angle has less effect on the number of ground points.
Less sidelap	Reducing sidelap to 30 percent usually guarantees there are no data gaps between flight lines, but the entire area will not be covered from two angles, which is useful to characterize individual stems. It may also be impossible to achieve high pulse densities (e.g., 4 pulses per sq. m.) in areas with only single-swath coverage.
Accuracy	Emphasizing relative accuracy over absolute accuracy is crucial. For many applications, it may be more important to calibrate data from adjacent flight lines against each other (swath-to-swath matching) than verify that the XYZ attributes of the return are within a certain specified range of real-world XYZ coordinates. This is especially true for data that will be used in tabulated applications or statistical models. However, keep in mind the need for field verification when required.
Acquisition window	Give the vendor as large a window as possible without compromising the data needs. A large acquisition window allows the vendor the opportunity to share aircraft mobilization, ferrying, and base-station setup costs across multiple projects. If leaf-on conditions are acceptable, vendors often have wider windows for acquisition and lower scheduling demands, resulting in lower bids for projects. In many mountainous areas, it is impractical to specify leaf-off conditions because snow often persists until well after leaves appear.

Conclusion

As with any technology, collecting and processing lidar data will continue to evolve. This report provides an overview of minimum data-acquisition specifications for collecting lidar data for projects requiring vegetation characterization. The report also compares acquisition specifications for vegetation characterization projects with those requiring only topographic mapping. Much of the information

provided here is condensed from various lidar consortia available in the public domain. Appendix 1 includes technical specifications for acquiring lidar data for a vegetation mapping project on the Coronado National Forest in AZ. The specifications were part of a request for proposals (RFP) resulting in a contract for acquiring lidar data over an 80,000 acre area. The resulting contract is also included. While lidar data-acquisition

specifications will continue to change, it is useful to recognize that requirements differ depending upon the application and that currently, a one-size-fits-all approach is not yet recommended for lidar data acquisition. We recommend that the potential purchasers and users of lidar data become familiar with these recommendations so that they can appropriately request and better use the resulting lidar products.

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Appendix A: Example of an Expired Request for Quotation

Lidar Canopy Mapping on the Pinaleño Mtns on the Safford District, AZ

REQUEST FOR QUOTATION (THIS IS NOT AN ORDER)		THIS RFQ <input checked="" type="checkbox"/> IS <input type="checkbox"/> IS NOT A SMALL BUSINESS SET- ASIDE			PAGE OF PAGES 1 25
1. REQUEST NO. R3-08-33	2. DATE ISSUED 6/30/08	3. REQUISITION/PURCHASE REQUEST NO.		4. CERT. FOR NAT.DEF. UNDER BDSA REG. 2 <input type="checkbox"/> AND/OR DMS REG. 1	5. RATING
5a. ISSUED BY					6. DELIVER BY (Date)
5b. FOR INFORMATION CALL (NO COLLECT CALLS) NAME <input type="checkbox"/> TELEPHONE NUMBER AREA CODE <input type="checkbox"/> NUMBER					7. DELIVERY <input type="checkbox"/> <input type="checkbox"/> FOB DESTINATION OTHER (See Schedule)
8. TO:					9. DESTINATION a. NAME OF CONSIGNEE
a. NAME c. STREET ADDRESS d. CITY		b. COMPANY e. STATE <input type="checkbox"/> f. ZIP CODE IMPORTANT: This is a request for information, and quotations furnished are not offers. If you are unable to quote, please so indicate on this form and return it to the address in BLOCK 5a. This request does not commit the Government to pay any costs incurred in the preparation of the submission of this quotation or to contract for supplies or services. Supplies are of domestic origin unless otherwise indicated by quoter. Any representations and/or certifications attached to this Request for Quotations must be completed by the quoter.			b. STREET ADDRESS c. CITY d. STATE <input type="checkbox"/> e. ZIP CODE
10. PLEASE FURNISH QUOTATIONS TO THE ISSUING OFFICE IN BLOCK 5A ON OR BEFORE CLOSE OF BUSINESS JULY 30, 2008					
11. SCHEDULE (Include applicable Federal, State and local taxes)					

ITEM NO. (a)	SUPPLIES/SERVICES (b)	QUANTITY (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)
	LiDAR CANOPY MAPPING The Contractor shall provide all equipment, labor, and materials necessary to map forest structure in the mixed-conifer and spruce-fir forests, using the LiDAR technology, on the Pinaleño Mountains of the Safford Ranger District, southwest of Safford, Arizona in accordance with the attached specifications.				
01	LiDAR Canopy Mapping	1	JOB	\$ _____	

NOTE: Additional provisions and representations are are not attached.

13. NAME AND ADDRESS OF QUOTER			14. SIGNATURE OF PERSON AUTHORIZED TO SIGN QUOTATION		15. DATE OF QUOTATION
a. NAME OF QUOTER					
b. STREET ADDRESS			16. SIGNER		
c. COUNTY			a. NAME (Type or print)		b. TELEPHONE
d. CITY					
e. STATE	f. ZIP CODE	c. TITLE (Type or Print)			NUMBER

SECTION C—DESCRIPTION/SPECIFICATIONS/STATEMENT OF WORK

SCOPE OF CONTRACT

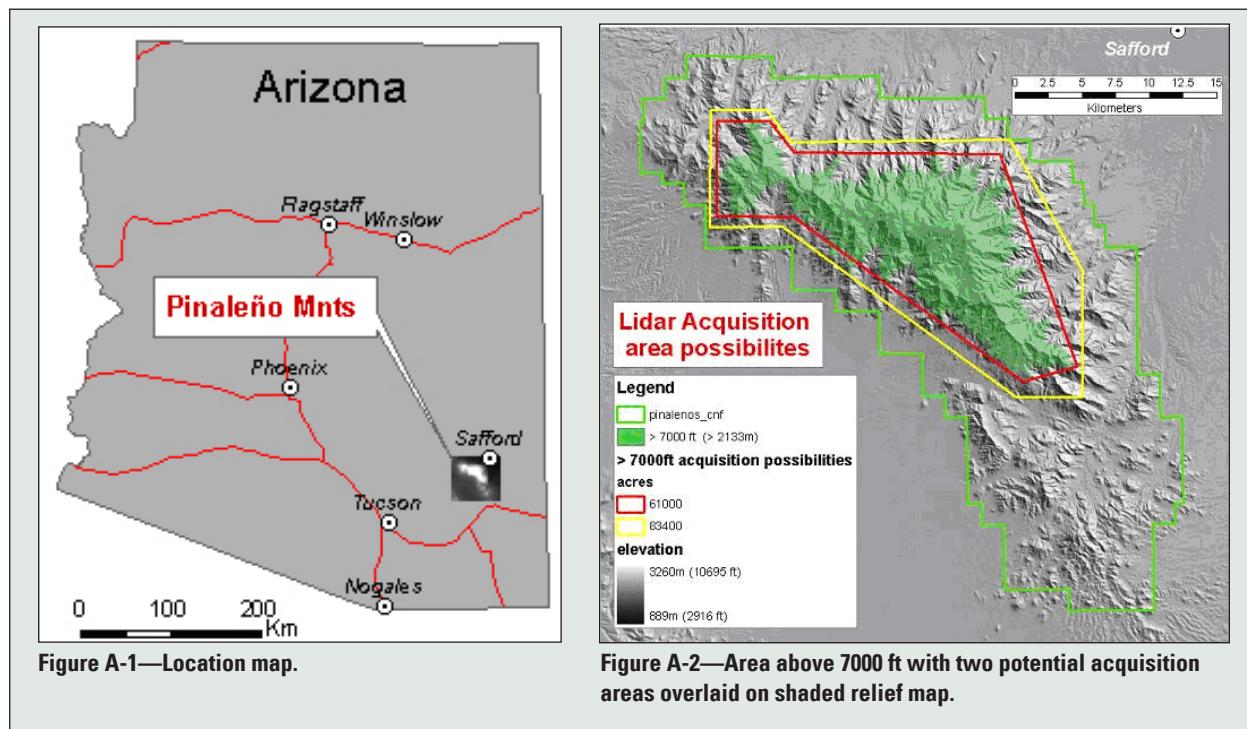
The Contractor shall provide all equipment, labor, and materials necessary to map forest structure in the mixed-conifer and spruce-fir forests, using the Light Detection and Ranging (LiDAR) technology, on the Pinaleño Mountains of the Safford Ranger District, southwest of Safford, Arizona. The data will be used to help implement and monitor an ecosystem restoration project, create a Mount Graham red squirrel habitat model and piece together likely presettlement forest characteristics based on such items as historical aspen clones and remaining patches of old growth.

TECHNICAL SPECIFICATIONS

Pinaleno Mountains lidar acquisition specs (date: 7 Feb 08):

1. Acquisition Area:

The acquisition area contains approximately the 7000+ feet elevation area of the Pinaleño Mountains sky-island southwest of Safford, Arizona on the Coronado National Forest (figures 1-3).



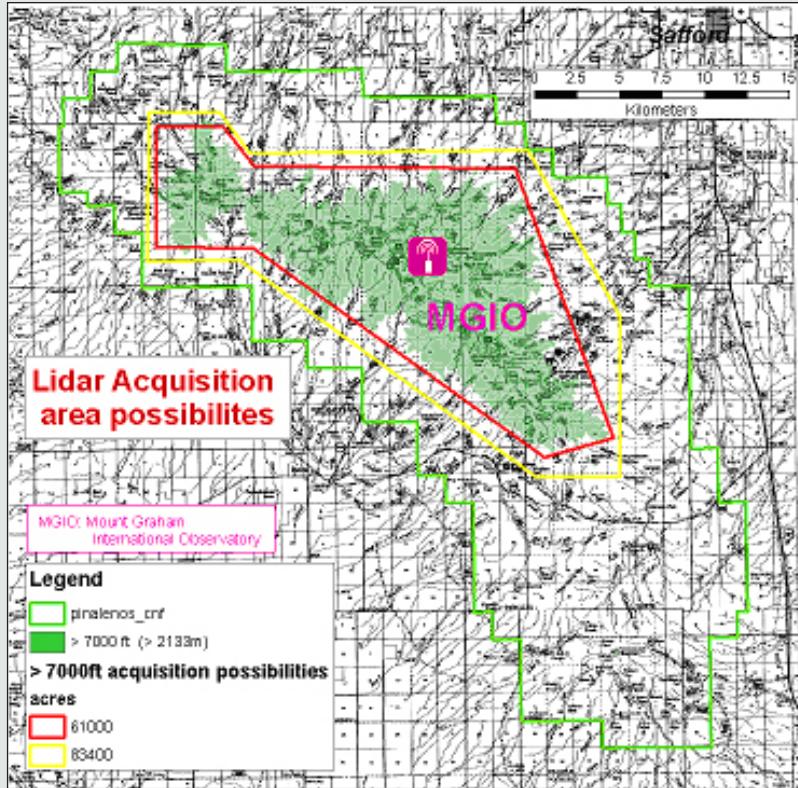


Figure A-3—Possible lidar acquisition areas overlaid on map.

2. Purpose of the study:

The data products will be mainly used for vegetation applications including canopy height model, understory vegetation information (fuels) and canopy structure. A good topographic model is also required to calculate and/or model the vegetation information.

3. Potential acquisition problems:

- Limited time of year suitable to acquire the data
- Data should be acquired during leaf-on
 - to study aspen occurrence
 - to distinguish between live and defoliated or burned trees
- The ground should be generally clear of snow with the exception of a few remaining snow banks.
 - Snow season: December to April
 - Monsoon season: (July to September)
- The area of interest is a sky-island. The elevation differences range from around 900 m (approximately 3,000 ft.) at the desert valley bottom to a max elevation of 3267 m (nearly 11,000 ft).
- The acquisition of interest corresponds to the locations above 2133 m (7,000 feet). Two bounding boxes are drawn around this area (figures A-2 and A-3).
 - The smaller red box ($\pm 61,000$ acres) contains the core study area.
 - The larger yellow bounding box corresponds to an area of 83,400 acres. The area includes lower elevation terrain where the data acquired over this terrain will be

used for primarily for modeling fuels.

- The Mount Graham International Observatory (MGIO) is at an elevation of 10,400 ft. and is 8 stories high (figure A-4). If data are acquired during the night, the pilot shall be aware of the location and height of the building.

(<http://mgpc3.as.arizona.edu/>)

The observatory shall be informed about the acquisition date and time.

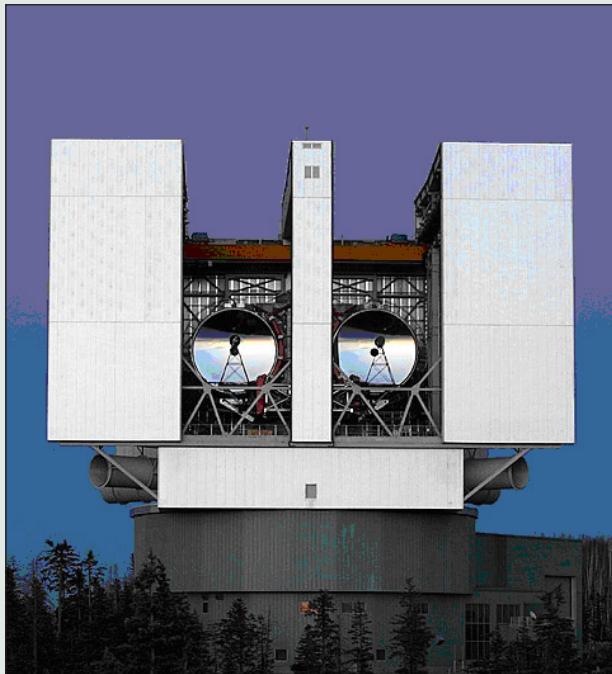


Figure A-4—Photos of the Mount Graham International Observatory (MGIO) at the University of Arizona south of Safford, Arizona.

4. Air space restrictions:

The Contractor shall check with space observatory about general restriction during day and night.

5. Data acquisition & Completeness:

The table below outlines the desired acquisition parameters. The data will be routinely evaluated for completeness.

Data acquisition	Survey Design	Minimum requirements¹
Wavelength	900-1600 nm discrete return	
Returns per pulse	Up to 4	
On-ground laser beam diameter	Approx. 25 cm Use Narrow divergence setting - if instrument allows for it	Between 10 cm and 100 cm
Scan angle	± 13 degrees	≤ ± 20 degrees
Aircraft altitude	For vendor to determine in agreement with CNF	
Aircraft speed	For vendor to determine in agreement with CNF	
Ground swath width	For vendor to determine in agreement with CNF	
Swath overlap	50% sidelap (100% overlap)	Between 30% and 50% sidelap No voids between swaths. No voids because of cloud cover or instrument failure < 20% no overlap area per project. No arbitrary 1km x 1km square with > 50% no-overlap area Baring non-reflective areas (e.g. open water, wet asphalt): <ul style="list-style-type: none"> • ≥ 85% design pulse density for entire project area • within areas of swath overlap, no 30m x 30m area with <50% design pulse density
Aggregate pulse density	3 plus pulses/m ²	
Flight line direction	Opposing	
GPS base line length	≤ 50 km	
GPS PDOP	≤3.0, ≥ 6 satellites in view	≤3.5, ≥ 6 satellites in view
Survey conditions		Leaf-on and no significant snow cover at discretion of Coronado NF

1. Local relief, turbulence, inability to maintain an exact flying height, and aircraft and instrument availability routinely lead to departures from the survey design. *Minimum requirements* listed here are the minimum acceptable under this contract.

6. Accuracy:

Accuracy	Survey design
Vertical accuracy	30 cm at 95% CI
Horizontal accuracy	Depends on flying height but at least 1m at 95% CI
Between-swath reproducibility	≤ 15 cm vertical on horizontal surfaces

7. Spatial reference framework:

Spatial reference framework

Vertical datum	NAVD 88, Geoid 03
Horizontal datum	NAD83
Projection	UTM zone 12
Units	meters

8. Deliverables:

Contractor shall provide the Deliverables no later than 60 calendar days after completion of flying.

Deliverables: data, reports, processing. media

Report of survey	Text report that describes survey methods; results; vendor's accuracy assessments, including internal consistency and absolute accuracy; and metadata (.pdf, or .doc format).
Aircraft trajectories (SBET files)	Aircraft position (easting, northing, elevation) and attitude (heading, pitch, roll) and GPS time recorded at regular intervals of 1 second or less. May include additional attributes. (ASCII text or shapefile format)
All-return point cloud	List of all valid returns. For each return: GPS week, GPS second, easting, northing, elevation, intensity, return #, retrun classification. May include additional attributes. No duplicate entries. ASCII text and LAS version 1.1 format 1/64 th USGS 7.5 minute quadrangle (0.9375 minute by 0.9375 minute tiles).
Ground point list	List of X.Y.Z coordinate of all identified ground points. ASCII text. 1/4 th USGS 7.5 minute quadrangle (0.375 minute by 0.375 minute tiles).
Ground surface model	Raster of ground surface, interpolated via triangulated irregular network from identified ground points. No unavoidable point misclassification. ESRI floating point grid, 2m or 1 m cell size, snapped to (0,0). 1/4 th USGS 7.5 minute quadrangle (0.375 minute by 0.375 minute) tiles.
First-return (highest-hit) surface model	Raster of first-return surface, cell heights are highest recorded value within that cell, voids may be filled with ground surface model ESRI floating point grid , 2m or 1m cell size, snapped to (0,0), 1/4 th USGS 7.5 minute quadrangle (0.375 minute by 0.375 minute) tiles
Surface models shall have no tiling artifacts and no gaps at tile boundaries. Areas outside survey boundary shall be coded as NoData. Internal voids (e.g. open water, shadowed areas in forest return surface) may be codes as NoData	
Intensity image	Geotiff, 1m pixel size, 1/4 th USGS 7.5 minute quadrangle (0.375 minute by 0.375 minute) tiles
Supporting shapefiles	A shapefile of the tiling tessellation (polygon feature) and a shapefile with the tracking of the individual flightlines and flightline swaths (line and polygon features)
Files shall conform to a consistent naming scheme. Files shall have consistent internal formats.	
GPS report	Report on GPS ground control processes including equipment used and location and duration of occupation of base stations
QA/QC statistics and reporting including fieldwork if any was performed	
Descriptive file list documenting the delivered files	
Deliverable media	USB hard drive

SECTION D—PACKAGING AND MARKING

{For this Solicitation, there are NO clauses in this Section}

SECTION E—INSPECTION AND ACCEPTANCE

FAR 52.252-2 Clauses Incorporated by Reference (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es): www.arnet.gov/far/

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES

52.246-1 Contractor Inspection Requirements (APR 1984)

SECTION F—DELIVERIES OR PERFORMANCE

FAR 52.252-2 Clauses Incorporated by Reference (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es): www.arnet.gov/far/

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES

1.1-15 Stop Work Order (AUG 1989)

AGAR 452.211-74 Period of Performance (FEB 1988)

The period of performance of this contract is restricted for the season (leaf on for flying). Deliverables shall be completed within 60 calendar days after completion of flying

SECTION G—CONTRACT ADMINISTRATION DATA

AGAR 452.215-73 Post Award Conference (NOV 1996)

A post award conference with the successful offeror is required. It will be scheduled within 5 days after the date of contract award. The conference will be held at Southwestern Region, 333 Broadway, Albuquerque, New Mexico.

SECTION H—SPECIAL CONTRACT REQUIREMENTS

{For this Solicitation, there are NO clauses in this Section}

PART II—CONTRACT CLAUSES

SECTION I—CONTRACT CLAUSES

FAR 52.252-2 Clauses Incorporated by Reference (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):
www.arnet.gov/far/
www.usda.gov/procurement/policy/agar.html

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES

- 52.209-6 Protecting the Government's Interest when Subcontracting with Contractors Debarred, Suspended, or Proposed for Debarment (SEP 2006) (*Applicable if contract exceeds \$30,000*)
- 52.215-8 Order of Precedence—Uniform Contract Format (OCT 1997)
- 52.219-6 Notice of Total Small Business Set-Aside (JUN 2003)
- 52.222-3 Convict Labor (JUN 2003)
- 52.222-21 Prohibition of Segregated Facilities (FEB 1999)
- 52.222-26 Equal Opportunity (MAR 2007) (*Applicable if contract exceeds \$10,000*)
- 52.222-36 Affirmative Action for Workers with Disabilities (JUN 1998) (*Applicable if contract exceeds \$10,000*)
- 52.222-41 Service Contract Act of 1965, as Amended (JUL 2005)
- 52.222-50 Combating Trafficking in Persons (SEP 2007)
- 52.223-6 Drug-Free Workplace (MAY 2001) (*Applicable if contract is awarded to an individual*)
- 52.232-1 Payments (APR 84)
- 52.232-8 Discounts for Prompt Payment (FEB 2002)
- 52.232-11 Extras (APR 1984)
- 52.232-23 Assignment of Claims (JAN 1986)
- 52.232-25 Prompt Payment (OCT 2003)
- 52.232-33 Payment by Electronic Funds Transfer – Central Contractor Registration (OCT 2003)
- 52.233-1 Disputes (JULY 2002)
- 52.233-3 Protest After Award (AUG 1996)
- 52.233-4 Applicable Law for Breach of Contract Claim (OCT 2004)
- 52.237-2 Protection of Government Buildings, Equipment, and Vegetation (APR 1984)
- 52.243-1 Changes—Fixed-Price (AUG 1987)—Alternate I (APR 1984)
- 52.244-6 Subcontracts for Commercial Items (MAR 2007)
- 52.245-1 Property Records (JUN 2007)
- 52.249-1 Termination for Convenience of the Government (Fixed-Price) (Short Form) (APR 1984)
- 52.249-8 Default (Fixed-Price Supply and Service) (APR 1984)
- 52.253-1 Computer Generated Forms (JAN 1991)

AGRICULTURE ACQUISITION REGULATION (48 CFR CHAPTER 4) CLAUSES

452.237-70 Loss, Damage, Destruction or Repair (FEB 1988)
1.1-75 Restrictions Against Disclosure (FEB 1988)

52.204-7 Central Contractor Registration (JUL 2006)

(a) Definitions. As used in this clause—

“*Central Contractor Registration (CCR) database*” means the primary Government repository for Contractor information required for the conduct of business with the Government.

“*Data Universal Numbering System (DUNS) number*” means the 9-digit number assigned by Dun and Bradstreet, Inc. (D&B) to identify unique business entities.

“*Data Universal Numbering System+4 (DUNS+4) number*” means the DUNS number means the number assigned by D&B plus a 4-character suffix that may be assigned by a business concern. (D&B has no affiliation with this 4-character suffix.) This 4-character suffix may be assigned at the discretion of the business concern to establish additional CCR records for identifying alternative Electronic Funds Transfer (EFT) accounts (see the FAR at Subpart 32.11) for the same parent concern.

“*Registered in the CCR database*” means that—

- (1) The Contractor has entered all mandatory information, including the DUNS number or the DUNS+4 number, into the CCR database; and
- (2) The Government has validated all mandatory data fields, to include validation of the Taxpayer Identification Number (TIN) with the Internal Revenue Service (IRS), and has marked the record “Active”. The Contractor will be required to provide consent for TIN validation to the Government as a part of the CCR registration process.

(b)

- (1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee shall be registered in the CCR database prior to award, during performance, and through final payment of any contract, basic agreement, basic ordering agreement, or blanket purchasing agreement resulting from this solicitation.
- (2) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation “DUNS” or “DUNS+4” followed by the DUNS or DUNS+4 number that identifies the offeror’s name and address exactly as stated in the offer. The DUNS number will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(c) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one.

(1) An offeror may obtain a DUNS number—

- (i) If located within the United States, by calling Dun and Bradstreet at 1-866-705-5711 or via the Internet at <http://www.dnb.com>; or
- (ii) If located outside the United States, by contacting the local Dun and Bradstreet office.

(2) The offeror should be prepared to provide the following information:

- (i) Company legal business name.
- (ii) Tradestyle, doing business, or other name by which your entity is commonly recognized.
- (iii) Company physical street address, city, state and Zip Code.
- (iv) Company mailing address, city, state and Zip Code (if separate from physical).
- (v) Company telephone number.
- (vi) Date the company was started.
- (vii) Number of employees at your location.
- (viii) Chief executive officer/key manager.
- (ix) Line of business (industry).
- (x) Company Headquarters name and address (reporting relationship within your entity).

(d) If the Offeror does not become registered in the CCR database in the time prescribed by the Contracting Officer, the Contracting Officer will proceed to award to the next otherwise successful registered Offeror.

(e) Processing time, which normally takes 48 hours, should be taken into consideration when registering. Offerors who are not registered should consider applying for registration immediately upon receipt of this solicitation.

(f) The Contractor is responsible for the accuracy and completeness of the data within the CCR database, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to review and update on an annual basis from the date of initial registration or subsequent updates its information in the CCR database to ensure it is current,

accurate and complete. Updating information in the CCR does not alter the terms and conditions of this contract and is not a substitute for a properly executed contractual document.

(g)

(1)

(i) If a Contractor has legally changed its business name, “doing business as” name, or division name (whichever is shown on the contract), or has transferred the assets used in performing the contract, but has not completed the necessary requirements regarding novation and change-of-name agreements in Subpart 42.12, the Contractor shall provide the responsible Contracting Officer a minimum of one business day’s written notification of its intention to:

- (A) Change the name in the CCR database;
- (B) Comply with the requirements of Subpart 42.12 of the FAR;
- (C) Agree in writing to the timeline and procedures specified by the responsible Contracting Officer. The Contractor must provide with the notification sufficient documentation to support the legally changed name.

(ii) If the Contractor fails to comply with the requirements of paragraph (g)(1)(i) of this clause, or fails to perform the agreement at paragraph (g)(1)(i)(C) of this clause, and, in the absence of a properly executed novation or change-of-name agreement, the CCR information that shows the Contractor to be other than the Contractor indicated in the contract will be considered to be incorrect information within the meaning of the “Suspension of Payment” paragraph of the electronic funds transfer (EFT) clause of this contract.

(2) The Contractor shall not change the name or address for EFT payments or manual payments, as appropriate, in the CCR record to reflect an assignee for the purpose of assignment of claims (see FAR Subpart 32.8, Assignment of Claims). Assignees shall be separately registered in the CCR database. Information provided to the Contractor’s CCR record that indicates payments, including those made by EFT, to an ultimate recipient other than that Contractor will be considered to be incorrect information within the meaning of the “Suspension of payment” paragraph of the EFT clause of this contract.

(h) Offerors and Contractors may obtain information on registration and annual confirmation requirements via the Internet at <http://www.ccr.gov> or by calling 1-888-227-2423, or 269-961-5757.

PART III—LIST OF DOCUMENTS, EXHIBITS, AND OTHER ATTACHMENTS

SECTION J—LIST OF ATTACHMENTS

Wage Determination 1995-0222, Revision No. 26

3 pages

WD 95-0222 (Rev.-26) was first posted on www.wdol.gov on 06/03/2008
Aerial Photographers/Seeding/Spraying

REGISTER OF WAGE DETERMINATIONS UNDER ³ U.S. DEPARTMENT OF LABOR
THE SERVICE CONTRACT ACT ³ EMPLOYMENT STANDARDS ADMINISTRATION
By direction of the Secretary of Labor ³ WAGE AND HOUR DIVISION
³ WASHINGTON, D.C. 20210
³
³

Shirley F. Ebbesen Division of Wage ³ Wage Determination No: 1995-0222
Director Determinations ³ Revision No: 26
³ Date Of Revision: 05/29/2008

Nationwide: Applicable in the continental U.S. Alaska, Puerto Rico, Hawaii and
Virgin Islands.

Fringe Benefits Required Follow the Occupational Listing

Employed on U.S. Government contracts for aerial photographer, aerial seeding,
aerial spraying, transportation of personnel and cargo, fire reconnaissance,
administrative flying, fire detection, air taxi mail service, and other flying
services.

OCCUPATION CODE - TITLE	MINIMUM WAGE RATE
31010 - Airplane Pilot	23.62
(not set) - First Officer (Co-Pilot)	21.51
(not set) - Aerial Photographer	11.80
EXCEPT SCHEDULED AIRLINE TRANSPORTATION AND LARGE MULTI-ENGINE AIRCRAFT SUCH AS THE B-727, DC-8, AND THE DC-9.	

ALL OCCUPATIONS LISTED ABOVE RECEIVE THE FOLLOWING BENEFITS:

HEALTH & WELFARE: \$3.24 per hour or \$129.60 per week or \$561.60 per month

VACATION: 2 weeks paid vacation after 1 year of service with a contractor or
successor; 3 weeks after 5 years, and 4 weeks after 15 years. Length of service
includes the whole span of continuous service with the present contractor or
successor, wherever employed, and with the predecessor contractors in the
performance of similar work at the same Federal facility. (Reg. 29 CFR 4.173)

HOLIDAYS: A minimum of ten paid holidays per year, New Year's Day, Martin Luther
King Jr's Birthday, Washington's Birthday, Memorial Day, Independence Day, Labor
Day, Columbus Day, Veterans' Day, Thanksgiving Day, and Christmas Day. (A
contractor may substitute for any of the named holidays another day off with pay
in accordance with a plan communicated to the employees involved.) (See 29 CFR
4174)

VACATION (Hawaii): 2 weeks paid vacation after 1 year of service with a
contractor or successor; 3 weeks after 10 years, and 4 weeks after 15 years.
Length of service includes the whole span of continuous service with the present
contractor or successor, wherever employed, and with the predecessor contractors
in the performance of similar work at the same Federal facility. (Reg. 29 CFR
4.173)

HEALTH & WELFARE (Hawaii): \$1.37 per hour, or \$54.80 per week, or \$237.47 per
month hour for all employees on whose behalf the contractor provides health care
benefits pursuant to the Hawaii prepaid Health Care Act. For those employees who
are not receiving health care benefits mandated by the Hawaii prepaid Health
Care Act, the new health and welfare benefit rate will be \$3.24 per hour.

HAZARDOUS PAY DIFFERENTIAL: An 8 percent differential is applicable to employees employed in a position that represents a high degree of hazard when working with or in close proximity to ordnance, explosives, and incendiary materials. This includes work such as screening, blending, dying, mixing, and pressing of sensitive ordnance, explosives, and pyrotechnic compositions such as lead azide, black powder and photoflash powder. All dry-house activities involving propellants or explosives. Demilitarization, modification, renovation, demolition, and maintenance operations on sensitive ordnance, explosives and incendiary materials. All operations involving regrading and cleaning of artillery ranges.

A 4 percent differential is applicable to employees employed in a position that represents a low degree of hazard when working with, or in close proximity to ordnance, (or employees possibly adjacent to) explosives and incendiary materials which involves potential injury such as laceration of hands, face, or arms of the employee engaged in the operation, irritation of the skin, minor burns and the like; minimal damage to immediate or adjacent work area or equipment being used. All operations involving, unloading, storage, and hauling of ordnance, explosive, and incendiary ordnance material other than small arms ammunition. These differentials are only applicable to work that has been specifically designated by the agency for ordnance, explosives, and incendiary material differential pay.

** UNIFORM ALLOWANCE **

If employees are required to wear uniforms in the performance of this contract (either by the terms of the Government contract, by the employer, by the state or local law, etc.), the cost of furnishing such uniforms and maintaining (by laundering or dry cleaning) such uniforms is an expense that may not be borne by an employee where such cost reduces the hourly rate below that required by the wage determination. The Department of Labor will accept payment in accordance with the following standards as compliance:

The contractor or subcontractor is required to furnish all employees with an adequate number of uniforms without cost or to reimburse employees for the actual cost of the uniforms. In addition, where uniform cleaning and maintenance is made the responsibility of the employee, all contractors and subcontractors subject to this wage determination shall (in the absence of a bona fide collective bargaining agreement providing for a different amount, or the furnishing of contrary affirmative proof as to the actual cost), reimburse all employees for such cleaning and maintenance at a rate of \$3.35 per week (or \$.67 cents per day). However, in those instances where the uniforms furnished are made of "wash and wear" materials, may be routinely washed and dried with other personal garments, and do not require any special treatment such as dry cleaning, daily washing, or commercial laundering in order to meet the cleanliness or appearance standards set by the terms of the Government contract, by the contractor, by law, or by the nature of the work, there is no requirement that employees be reimbursed for uniform maintenance costs.

The duties of employees under job titles listed are those described in the "Service Contract Act Directory of Occupations", Fifth Edition, April 2006, unless otherwise indicated. Copies of the Directory are available on the Internet. A links to the Directory may be found on the WHD home page at <http://www.dol.gov/esa/whd/> or through the Wage Determinations On-Line (WDOL) Web site at <http://wdol.gov/>.

REQUEST FOR AUTHORIZATION OF ADDITIONAL CLASSIFICATION AND WAGE RATE {Standard Form 1444 (SF 1444)}

Conformance Process:

The contracting officer shall require that any class of service employee which is not listed herein and which is to be employed under the contract (i.e., the work to be performed is not performed by any classification listed in the wage determination), be classified by the contractor so as to provide a reasonable relationship (i.e., appropriate level of skill comparison) between such unlisted classifications and the classifications listed in the wage determination. Such

conformed classes of employees shall be paid the monetary wages and furnished the fringe benefits as are determined. Such conforming process shall be initiated by the contractor prior to the performance of contract work by such unlisted class(es) of employees. The conformed classification, wage rate, and/or fringe benefits shall be retroactive to the commencement date of the contract. (See Section 4.6 (C) (vi)) When multiple wage determinations are included in a contract, a separate SF 1444 should be prepared for each wage determination to which a class(es) is to be conformed.

The process for preparing a conformance request is as follows:

- 1) When preparing the bid, the contractor identifies the need for a conformed occupation(s) and computes a proposed rate(s).
- 2) After contract award, the contractor prepares a written report listing in order proposed classification title(s), a Federal grade equivalency (FGE) for each proposed classification(s), job description(s), and rationale for proposed wage rate(s), including information regarding the agreement or disagreement of the authorized representative of the employees involved, or where there is no authorized representative, the employees themselves. This report should be submitted to the contracting officer no later than 30 days after such unlisted class(es) of employees performs any contract work.
- 3) The contracting officer reviews the proposed action and promptly submits a report of the action, together with the agency's recommendations and pertinent information including the position of the contractor and the employees, to the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, for review. (See section 4.6(b)(2) of Regulations 29 CFR Part 4).
- 4) Within 30 days of receipt, the Wage and Hour Division approves, modifies, or disapproves the action via transmittal to the agency contracting officer, or notifies the contracting officer that additional time will be required to process the request.
- 5) The contracting officer transmits the Wage and Hour decision to the contractor.
- 6) The contractor informs the affected employees.

Information required by the Regulations must be submitted on SF 1444 or bond paper.

When preparing a conformance request, the "Service Contract Act Directory of Occupations" (the Directory) should be used to compare job definitions to insure that duties requested are not performed by a classification already listed in the wage determination. Remember, it is not the job title, but the required tasks that determine whether a class is included in an established wage determination. Conformances may not be used to artificially split, combine, or subdivide classifications listed in the wage determination.

**** OCCUPATIONS NOT INCLUDED IN THE SCA DIRECTORY OF OCCUPATIONS ****

Aerial Photographer

The aerial photographer must be skilled in reading flight maps, capable of assisting the pilot to adhere to flight lines, be able to level and operate a cartographic camera and its auxiliary equipment mounted in the aircraft so that the photographs that are taken will have the required forward lap and side lap for use in photogrammetric mapping equipment, and possess a working knowledge of aerial films and camera filters to insure proper exposure of the films.

First Officer (Co-Pilot)

Is second in command of commercial airplane and its crew while transporting passengers, mail, or other cargo on scheduled or nonscheduled flights. Assists or relieves an airline captain in operating the controls of an airplane; monitoring flight and engine instruments; and maintaining air-to-ground communications.

PART IV—REPRESENTATIONS AND INSTRUCTIONS

SECTION K—REPRESENTATIONS, CERTIFICATIONS, AND OTHER STATEMENTS OF OFFERORS OR RESPONDENTS

AGAR 452.219-70 SIZE STANDARD AND NAICS CODE INFORMATION (JANUARY 2005)

The North American Industrial classification System Code(s) and business size standard(s) describing the products and/or services to be acquired under this solicitation are listed below:

Contract line item(s):	<u>ALL</u>
—NAICS Code	<u>541360</u>
—Size Standard	<u>\$4.5</u>

The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

52.204-8 ANNUAL REPRESENTATIONS AND CERTIFICATIONS (JAN 2006)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is
541360.

(2) The small business size standard is \$4.5.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b)(1) If the clause at 52.204-7, Central Contractor Registration, is included in this solicitation, paragraph (c) of this provision applies.

(2) If the clause at 52.204-7 is not included in this solicitation, and the offeror is currently registered in CCR, and has completed the ORCA electronically, the offeror may choose to use paragraph (c) of this provision instead of completing the corresponding individual representations and certifications in the solicitation. The offeror shall indicate which option applies by checking one of the following boxes:

[] (i) Paragraph (c) applies.

[] (ii) Paragraph (c) does not apply and the offeror has completed the individual representations and certifications in the solicitation.

(c) The offeror has completed the annual representations and certifications electronically via the Online Representations and Certifications Application (ORCA) website at <http://orca.bpn.gov>. After reviewing the ORCA database information, the offeror verifies by submission of the offer that the representations and certifications currently posted electronically have been entered or updated within the last 12 months, are current, accurate, complete, and applicable to this solicitation (including the business size standard applicable to the NAICS code referenced for this solicitation), as of the date of this offer and are incorporated in this offer by reference (see FAR 4.1201); except for the changes identified below [offeror to insert changes, identifying change by clause number, title, date]. These amended representation(s) and/or certification(s) are also incorporated in this offer and are current, accurate, and complete as of the date of this offer.

FAR Clause #	Title	Date	Change
_____	_____	_____	_____

Any changes provided by the offeror are applicable to this solicitation only, and do not result in an update to the representations and certifications posted on ORCA.

FAR 52.219-28 Post-Award Small Business Program Rerepresentation. (June 2007)

(a) Definitions. As used in this clause—

Long-term contract means a contract of more than five years in duration, including options. However, the term does not include contracts that exceed five years in duration because the period of performance has been extended for a cumulative period not to exceed six months under the clause at 52.217-8, Option to Extend Services, or other appropriate authority.

Small business concern means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR part 121 and the size standard in paragraph (c) of this clause.

(b) If the Contractor represented that it was a small business concern prior to award of this contract, the Contractor shall rerepresent its size status according to paragraph (e) of this clause or, if applicable, paragraph (g) of this clause, upon the occurrence of any of the following:

(1) Within 30 days after execution of a novation agreement or within 30 days after modification of the contract to include this clause, if the novation agreement was executed prior to inclusion of this clause in the contract.

- (2) Within 30 days after a merger or acquisition that does not require a novation or within 30 days after modification of the contract to include this clause, if the merger or acquisition occurred prior to inclusion of this clause in the contract.
- (3) For long-term contracts—
- (i) Within 60 to 120 days prior to the end of the fifth year of the contract; and
 - (ii) Within 60 to 120 days prior to the exercise date specified in the contract for any option thereafter.
- (c) The Contractor shall rerepresent its size status in accordance with the size standard in effect at the time of this rerepresentation that corresponds to the North American Industry Classification System (NAICS) code assigned to this contract. The small business size standard corresponding to this NAICS code can be found at <http://www.sba.gov/services/contractingopportunities/sizestandardstopics/>.
- (d) The small business size standard for a Contractor providing a product which it does not manufacture itself, for a contract other than a construction or service contract, is 500 employees.
- (e) Except as provided in paragraph (g) of this clause, the Contractor shall make the rerepresentation required by paragraph (b) of this clause by validating or updating all its representations in the Online Representations and Certifications Application and its data in the Central Contractor Registration, as necessary, to ensure they reflect current status. The Contractor shall notify the contracting office by e-mail, or otherwise in writing, that the data have been validated or updated, and provide the date of the validation or update.
- (f) If the Contractor represented that it was other than a small business concern prior to award of this contract, the Contractor may, but is not required to, take the actions required by paragraphs (e) or (g) of this clause.
- (g) If the Contractor does not have representations and certifications in ORCA, or does not have a representation in ORCA for the NAICS code applicable to this contract, the Contractor is required to complete the following rerepresentation and submit it to the contracting office, along with the contract number and the date on which the rerepresentation was completed:
- The Contractor represents that it () is, () is not a small business concern under NAICS Code _____ assigned to contract number _____.
- [Contractor to sign and date and insert authorized signer's name and title].

SECTION L—INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS OR RESPONDENTS

FAR 52.252-1 **Solicitation Provisions Incorporated by Reference (FEB 1998)**

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

www.arnet.gov/far/

www.usda.gov/procurement/policy/agar.html

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

52.215-1 Instructions to Offerors—Competitive Acquisition (JAN 2004)
52.237-1 Site Visit (APR 1984)

AGRICULTURE ACQUISITION REGULATIONS (48 CFR CHAPTER 4) CLAUSES

452.204-70 Inquiries (FEB 1988)

FAR 52.215-5 Facsimile Proposals (OCT 1997)

- (a) *Definition.* “Facsimile proposal,” as used in this provision, means a proposal, revision or modification of a proposal, or withdrawal of a proposal that is transmitted to and received by the Government via facsimile machine.
- (b) Offerors may submit facsimile proposals as responses to this solicitation. Facsimile proposals are subject to the same rules as paper proposals.
- (c) The telephone number of receiving facsimile equipment is:
- (d) If any portion of a facsimile proposal received by the Contracting Officer is unreadable to the degree that conformance to the essential requirements of the solicitation cannot be ascertained from the document—
 - (1) The Contracting Officer immediately shall notify the offeror and permit the offeror to resubmit the proposal.

(2) The method and time for resubmission shall be prescribed by the Contracting Officer after consultation with the offeror; and

(3) The resubmission shall be considered as if it were received at the date and time of the original unreadable submission for the purpose of determining timelines, provided the offeror complies with the time and format requirements for resubmission prescribed by the Contracting Officer.

(e) The Government reserves the right to make award solely on the facsimile proposal. However, if requested to do so by the Contracting Officer, the apparently successful offeror promptly shall submit the complete original signed proposal.

SECTION M—EVALUATION FACTORS FOR AWARD

AWARD DETERMINATION

Award will be made to the offer(s) whose proposal is considered to the best value to the Government, price and other factors considered. The Government intends to award this contract without discussions.

Proposals will be evaluated based on the following factors. The sum of the non-cost evaluation factors, listed under the Technical Proposal, are approximately equal to the cost evaluation factor listed under the Price Proposal.

EVALUATION FACTORS

A. Price Proposal

Furnish price for all services and materials to complete the work described herein, including appropriate taxes, on the Request for Quotation form as “One Job”. No additional information will be necessary to determine reasonableness of price.

B. Technical Proposal

1. Past Performance—consisting of; timeliness of performance, quality of service, and business relations.
2. Prior Experience—identify previous and ongoing projects that are similar with the type of work required by this solicitation, specifically LiDAR data collection and processing for forest canopy modeling and assessment.
3. Qualifications—capability to accomplish the tasks identified.

Submit your proposal addressing the Evaluation Factors shown above.