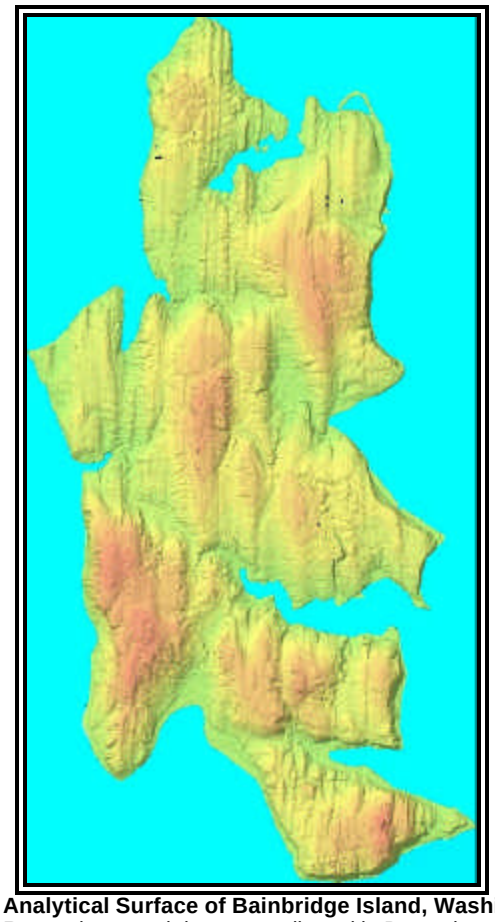
Puget Sound LiDAR Consortium



Analytical Surface of Bainbridge Island, Washington
Remotely sensed data was collected in December, 1996 and January, 1997 by Airborne Laser Mapping, Inc., using LiDAR technology

City of Seattle
Kitsap County
Kitsap Public Utility District
National Aeronautics and Space Administration
Puget Sound Regional Council
United States Geological Survey

Request For Proposal (RFP)

for

LiDAR Data acquistion in the Puget Lowland of Washington State

January, 2000

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LiDAR Data acquisition in the Puget Lowland of Washington State

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I. INTRODUCTION

A. Definitions

Words, terms and/or acronyms used in this Request for Proposal are defined as follows:

COS	The City of Seattle.
KC	Kitsap County
KPUD	Kitsap Public Utility District
PSRC	Puget Sound Regional Council
USGS	United States Geological Survey
NASA	National Aeronautical and Space Administration
Consortium	Cooperative arrangement between organizations including The City of Seattle, Kitsap County, Kitsap Public Utility District, Puget Sound Regional Council, United States Geological Survey and the National Aeronautical and Space Administration
Contractor	The firm proposing to be the prime Contractor for this work.
Subcontractor	Firm(s) designated by the Contractor to perform specific Functions in the proposed response.
DEM	Digital Elevation Model.
GIS	Geographic Information System
HARN	Washington State High Accuracy Reference Network
FEMA	Federal Emergency Management Agency
RFP	Request For Proposal.
LiDAR	For the purposes of this RFP, LIDAR is defined as an airborne laser system, flown aboard rotary or fixed-wing aircraft, that is used to acquire x, y, and z coordinates of terrain and terrain features that are both manmade and naturally occurring. LIDAR systems consist of an airborne Global Positioning System (GPS) with attendant GPS base station(s), Inertial Measuring Unit (IMU), and light-emitting

	scanning laser. The system measures ranges from the scanning laser to terrain surfaces within a scan width beneath the aircraft. Scan widths will vary, depending on mission purpose, weather conditions, desired point density and spacing, geometry of the system's oscillating or rotating mirrors, and other factors. The time it takes for the emitted light (LIDAR return) to reach the earth's surface and reflect back to the onboard LIDAR detector is measured to determine the range to ground. The other two components of LIDAR systems are the airborne GPS, which ascertains the in-flight three-dimensional position of the sensor, and the IMU, which delivers precise information about the attitude of the sensor.
WSP	Washington State Plane Coordinate System, North Zone
NAD83(91)	North American Datum of 1983, 1991 adjustment
NAVD88	North American Vertical Datum of 1988
GPS	Global Positioning System
PDOP	Position Dilution of Precision
FAA	Federal Aviation Administration
NSSDA	National Standard for Spatial Data Accuracy
FGCS	Federal Geodetic Control Subcommittee

B. Project Background

The consortium is entering into this project to acquire airborne LiDAR mapping data in the Puget Lowland of Washington State. The data will be used for a variety of purposes including updating topographic maps, hydrologic modeling, transportation routing, and assessment of natural hazards. The size of the area to be mapped is dependent on acquisition costs but is approximately 2000 sq km. The data is to be acquired no later than the middle of March, 2000 to take advantage of leaf-off conditions. Land cover in the mapping area varies from heavily urbanized to densely forested, and the topography varies from flat lying to rugged and steeply sloped. Buildings as tall as 300 m in the downtown Seattle area will be mapped. The forest cover includes mixed deciduous and conifer stands and pure conifer stands. Data products are to include digital elevation models (DEMs) of the 'bald earth' ground surface and of the upper-most surface defined by vegetation cover, buildings, and other structures.

II. SCOPE OF WORK

A. Deliverables

a. Pre-Flight Deliverables

Prior to data collection, the contractor must submit:

(1) A map showing the study area boundaries and planned flight path, at a medium scale (1:50,000) or small scale (1:100,000). Map shall identify which GPS ground control points are used as base stations on particular flight path's and areas (see section IIC(4)).

(2) Data sheets documenting vertical & horizontal accuracy of selected GPS base points.

(3) Documentation specifying altitude, airspeed, scan angle, scan rate, LiDAR pulse rates, receiver return mode, and other flight and equipment information deemed appropriate, and

(4) A plot of PDOP as a function of time during the data collection period indicating times when data will not be acquired due to high PDOP.

b. Post-Project Deliverables

Following a schedule detailed in Section IIB, the contractor must submit:

(1) Time-stamp, (ie. Date and time of acquisition indicated so as to uniquely identify each laser shot), x,y,z geolocation of all acquired laser returns with x and y position in US Survey Feet referenced to the Washington State Plane Coordinate System, North Zone, NAD83, 1991 Adjustment, and z reported in Feet both as ellipsoid (WGS-84) and orthometric (NAVD-88) elevations derived from the National Geodetic Survey Geoid Model Geoid99 available from the NGS at: www.ngs.noaa.gov/GEOID/GEOID99/geoid99.html
(2) x,y,z geolocation of laser returns identified to be returns from the ground surface, with time-stamp, to the same specifications noted in IIB(1).
(3) DEM gridded at 6ft easting and northing postings of the ground surface orthometric elevations derived using triangulated irregular network (TIN) processing and referenced to Washington State Plane Coordinates as noted in IIB(1),
(4) Shaded relief rendition of the 6ft, ground surface DEM as paper maps at 1:12,000 scale referenced to Washington State Plane Coordinates as noted in IIB(1). The maps shall show greyscale hillshade with illumination from the south at a 45 degree inclination. Digital files shall also be provided on CD in HP-RTL pre-ripped format.

(5) x,y,z geolocation of laser returns identified to be returns from the upper-most surface (i.e., First-return from canopy and structure tops, ground where there is no vegetation or structures), with time stamp to the same specifications noted in IIB(1).
(6) DEM gridded at 6ft easting and northing postings of the upper-most surface orthometric elevations derived using TIN processing and referenced to Washington State Plane Coordinates as noted in IIB(1).
(7) Time-stamped GPS aircraft x,y,z trajectory with x and y referenced to WSP easting and northing and with quality metrics such as, but not necessarily limited to, the PDOP and estimated RMS error at each GPS epoch, and
(8) Final reports documenting system calibration, instrument acquisition parameters, GPS ground control, data processing procedures, and validation of data quality demonstrating that specifications in IID have been met.

Additional deliverables, if available, shall include:
(9) return energy amplitude for all acquired laser shots, included with data in deliverable (1), (2) and (5), and
an image gridded at 6ft easting and northing postings of the return energy amplitude derived using triangulated irregular network (TIN) processing and referenced to Washington State Plane Coordinates as noted in IIB(1).
(10) cross-track scan angle for all acquired laser shots, included with data in deliverables (1), (2), and (5).

B. Delivery Format

The following specifications shall apply to all data deliveries

Coordinates:	Double Precision
Digital Media:	CD ROM
Digital Media Format:	Binary compressed ASCII, gzip compression format for deliverables II.A .b 1,2,5 & 7 ArcInfo Grid file in export format gzip compressed for deliverables in II.A.b 3,4,6 and 9 if applicable
Maximum File Size:	20 megabytes uncompressed
Transmittal:	Shall include listing of all filenames and applicable project area per Attachment 1
Hardcopy Media:	Paper
Hardcopy Scale:	1:12000
Number of Copies:	Seven copies of all deliverables, one for each member of the consortium listed in IVC.

C. Schedule

Field data acquisition must be completed by mid-March, prior to leaf on conditions.

Delivery Phases of products to the Consortium for Quality Control checking shall be divided into 4 areas (see attachment 1)

Area 1	USGS/NASA/PSRC Areas
Area 2	Seattle Area
Area 3	Kitsap County Area A
Area 4	Kitsap County Area B

Delivery of each of the areas is to be phased in time to provide the Consortium an opportunity to review, and accept or reject the deliverables for area sequentially, rather than delivering all deliverables at one time. The final delivery shall be made no later than 110 working days from end of data acquisition (March 15). The Consortium shall review and accept/reject products within 30 days of delivery. The contractor should propose a preferred delivery schedule.

Following a thorough Quality Control review by Consortium staff, data will be accepted or rejected-based on specifications in the RFP. If it is determined the acquired LiDAR data is insufficient to meet the RFP specifications, the contractor will be required to re-fly those areas identified as deficient between December 1, 2000 and March 15, 2001 to avoid leaf on conditions.

D. Technical Specifications

The LiDAR data shall be acquired meeting the following specifications:

(1) The average cross-track and along-track spacing of laser pulses yielding valid ranges shall be no larger than 2 m, where a valid range is considered to be to the ground or to vegetation, buildings or structures on the ground,
(2) The cross-track and along-track spacing at the 90% frequency of occurrence of laser pulses yielding valid ranges shall be no larger than 4 m,
(3) The laser ranging data shall be acquired using a LiDAR system that collects first and last returns, or multiple returns, for each laser pulse,
(4) Data collection will not be conducted while there is snow cover on the ground nor during inclement weather conditions (high winds, rain, fog, low cloud cover) that would significantly diminish the quality of the data, and
(5) Geodetic GPS Base Station locations shall be control points in the Washington State High Accuracy Reference Network (HARN) on points with Orthometric heights determined by differential leveling. The contractor shall provide a report of which base points were used on particular flights and areas. Information on HARN points may be obtained from the Washington State NGS Advisor:

Gary Perasso
National Geodetic Survey
5521 44th Ct SE
Lacey, WA 98503
(360) 705 7247 voice
(360) 705 6835 fax
perassg@wsdot.wa.gov

In the event there is insufficient density of HARN points in a particular area, the contractor may:

a) Utilize the Washington State DOT control network. See http://wsdot.wa.gov/monument/

b) Establish horizontal control as necessary adjusted to the HARN utilizing dual frequency receivers with surveys done to at least Third-order, Class 1 specifications as promulgated by the Federal Geodetic Control Subcommittee (FGCS). Vertical control shall be established using differential levels according to third-order Class 1 FGCS Specs. Vertical control shall be tied to NGS benchmarks on NAVD88 Datum.

(6) The ground surface DEM (Deliverable II.A.b.3) shall have vertical accuracy no larger than 30 cm root mean square error (RMSE), using the NSSDA definition where RMSE is the square root of the average of the set of squared differences between elevation values from an independent source of higher accuracy and linearly interpolated elevations in the DEM for identical points.

Quality Control/Quality Assurance (QC/QA) of the LiDAR-derived data, demonstrating that the technical specifications are met, is primarily the responsibility of the contractor. The Consortium or its designee may perform additional QC/QA testing. The contractor must field verify the vertical accuracy of the ground surface DEM to ensure that the RMSE requirement is satisfied for all major ground cover categories that predominate within the project area. The main categories of ground cover that the contractor must separately evaluate and report on the DEM accuracy for shall be:

a) Bare-earth and low grass (e.g., plowed fields, lawns, golf courses);
b) High grass and crops (e.g., hay fields, corn fields, wheat fields);
c) Fully covered by coniferous trees (e.g. softwood forests);
d) Fully covered by deciduous trees (e.g. hardwoods forests); and
e) Urban areas (high, dense manmade structures).

The contractor shall evenly distribute sample points throughout the project area for each cover category and not group the sample points in a small subarea. The contractor shall also ensure that the airborne data was acquired for the sample points during times of representative PDOP conditions and not limited only to times of best PDOP conditions.

The RMSE calculated from a sample of test points will not be the RMSE of the DEM. The calculated value may be higher or it may be lower than that of the DEM. Confidence in the calculated value increases with the number of test points. If the errors (lack of accuracy) associated with the DEM are normally distributed and unbiased, the confidence in the calculated RMSE can be determined as a function of sample size. Similarly, the sample RMSE necessary to obtain 95-percent confidence that the DEM RMSE is less than 30 centimeters can also be determined as a function of sample size.

For each of the five cover categories, the contractor must test a sample of points and show the test points have an RMSE less than or equal to:

$$RMSE_{sample} \leq 30 \sqrt{\frac{(n-1) - 2.326\sqrt{n-1}}{n}}$$

where n is the number of test points in the sample.

The contractor must select a minimum of 20 test points for each of the five cover categories. For all points tested the contractor must report the location of the point (x and y position in US Survey Feet referenced to the Washington State Plane Coordinate System, North Zone, NAD83, 1991 Adjustment), its orthometric elevation from the independent source of higher accuracy (referenced to NAVD-88 datum), the method by which its elevation was independently established, the elevation at the point interpolated from the ground surface DEM (Deliverable II.A.b.3), and the cover category.

Because the definition and criterion for measuring accuracy are derived from the assumption that the test point samples come from a uniformly distributed population with zero mean, the contractor must calculate other statistics. In particular, the mean and the coefficient of skew must be calculated for each sample and reported to the Consortium. Values of the mean of the test points outside of the interval +/- 2 centimeters and/or values of the coefficient of skew outside of the interval +/- 0.5 centimeter may indicate systematic error.

III. ADMINISTRATIVE REQUIREMENTS

A. Objective of Request for Proposal (RFP)

The objective of this RFP is to provide sufficient information for qualified Contractors to submit written proposals. The RFP is not a contractual offer or commitment to purchase services.

Contractors must be bona-fide providers of the services requested using installed and operating systems open for inspection by representatives of the Consortium.

To be responsive to this request, proposals must conform to the procedures, format, and content requirements outlined in this RFP. Deviations may be grounds for disqualification.

B. Proposal Submission Deadline

An original and all copies of the RFP response must be received no later than 4:00 PM (PST) February 4, 2000 to Consortium members noted in Section IVC.

C. Addenda to the Request for Proposals

If it becomes necessary to revise any part of this RFP, an addendum will be provided to all who have been mailed or have picked-up this RFP. Respondents should contact the Consortium, following the instructions in Subsection D below, if they find inconsistencies or ambiguities. Any clarification given may become an addendum.

D. Requests for Information

Any requests for clarification or additional information regarding this RFP shall be submitted via e-mail to Ken Conradi at the following address by 4:00 PM (PST) February 2, 2000:

Ken Conradi
ken.conradi@ci.seattle.wa.us
206.684.5162 phone

All requests received prior to the deadline will be answered via e-mail and copies of the questions and answers will be forwarded to all prospective consultants who have formally requested a copy of this RFP and have provided their e-mail address.

E. Duly Authorized Signature

The original proposal must contain the signature of a duly authorized officer or agent of the company.

F. Respondent Responsibility for Proposal Costs

The Contractor shall be fully responsible for all proposal development and submission costs. The Consortium does not assume any contractual obligations as a result of the issuance of this RFP, the preparation or submission of a proposal by a Contractor, the evaluation of an accepted proposal, or the selection of any finalists.

G. Economy of Proposal

Proposals should be prepared simply and economically and give a straightforward and concise description of the Contractor's capabilities to satisfy the requirements of the project. Special bindings, colored displays, etc., are not necessary. Emphasis should be placed on completeness and clarity of content.

H. Substantive Proposals

The Contractor's duly authorized officer or agent shall certify in writing that:

- The Contractor's proposal is genuine; not made in the interest of, or on behalf of, any undisclosed person, firm, or corporation; and is not submitted in conformity with and agreement of rules of any group, association, organization, or corporation.
- The Contractor has not directly or indirectly induced or solicited any other proposer to put in a false or sham proposal.

- The Contractor has not solicited or induced any other person, firm, or corporation to refrain from proposing.
- The Contractor has not sought by collusion to obtain for himself/herself any advantage over any other proposer or the Consortium.

I. Proposal Changes or Withdrawal

A proposer may withdraw or modify its proposal any time before the proposal due date by a written request, signed in the same manner and by the same person who signed the proposal.

J. Acceptance of Request for Proposal Content

Provision of the RFP and the contents of the successful response are considered available for inclusion in final contractual obligations. The Consortium retains the option of canceling the award or selecting another offer or if the successful Contractor fails to accept such obligations.

K. Contractor Qualifications

Contractors must submit evidence that they have relevant past experience and have previously delivered services similar to the ones required. Each firm may also be required to show that it has satisfactorily performed similar work in the past and that no claims of any kind are pending against such work. No proposal will be accepted from a firm that is engaged in any work that would impair its ability to perform or finance this work.

L. Estimate of costs

Respondents shall provide an estimated cost breakdown to perform all work requested in this RFP. Final cost will be negotiated with the selected contractor. In the event an agreement on cost cannot be negotiated, the Consortium reserves the right to negotiate with an alternative contractor.

M. Right to Reject Proposals

The Consortium reserves the right to reject any and all proposals and to waive any formality in proposals received, to accept or reject any or all the items in the proposal, and award the contract in whole or in part if it is deemed in the Consortium's best interest.

N. Subconsulting and Equipment Purchases Responsibility

Proposals must indicate all items of work or service that will be performed by sub-contractors and identify the sub-contractors and service they will perform.

Proposals shall also describe the subconsulting organization and the contractual arrangements made therewith. All sub-contractors will be subject to approval by the Consortium. The selected Contractor will also furnish the corporate or company name and the names of officers or principals of said companies proposed as sub-contractors. The Consortium will consider the selected Contractor to be soley responsible in all contractual matters, including payment of any and all changes resulting from sub-contractor contracts.

The selected Contractor shall cause appropriate provision of its proposal to be inserted in all ensuing subcontracts to ensure fulfillment of all contractual provisions by sub-contractors.

The Consortium will hold the selected Contractor directly responsible for the quality, integrity, and delivery of all product deliverables specified in this RFP

O. Access Agreements

The Contractor shall provide written notification to the Consortium on the number and locations of ground control points used in this project. The contractor shall determine land ownership encompassing those locations and as required, obtain site access permission. The contractor shall notify landowners and coordinate with the appropriate personnel prior to on-site or over-site activities. The contractor shall be solely responsible for the requisite filing of flight plans and obtaining appropriate permissions from the FAA and other agencies as necessary.

P. Complete Services/Products

The selected Contractor shall be required to:

- Furnish all tools, equipment, supplies, supervision, transportation, and other accessories, services and facilities.

- Furnish all materials, supplies, and equipment specified and required to be incorporated in, and form a permanent part of, the completed work.
- Provide and perform all necessary labor.

- Allow the Consortium to inspect the Contractors facilities and equipment.

- Execute and complete all specified work with due diligence, in accordance with good technical practice and the requirements, stipulations, provisions, and conditions of this RFP and the resultant contract.

R. Non-Washington Corporations

If a contract or subcontract is awarded to a non-Washington corporation, such corporation shall obtain authorization to do business in the State of Washington prior to final execution.

The laws of the State of Washington shall govern the contract executed between the selected Contractor and the Consortium, and any interpretations or constructions thereof. Further, the place of performance and transaction of business shall be deemed to be the County of Kitsap, State of Washington; in the event of litigation, the exclusive venue and place of jurisdiction shall be the Superior Court for Kitsap County, Washington.

S. Invoicing and Payment Schedule

Products deliverable under the agreement shall be submitted to the Consortium according to a schedule to be agreed upon with the Consortium. Upon acceptance of each product submission by the Consortium, the Contractor may submit invoices for payments in accordance with a schedule to be negotiated.

Invoices shall be submitted to:

Jerry Harless, GIS Manager
Kitsap County
614 Division Street MS 36
Port Orchard, WA 98366-4682

T. Insurance Requirements

The selected Contractor will be required to provide proof of insurance, and to have the County of Kitsap, State of Washington named as additional insured on their General Liability Insurance policy. Specific insurance coverage and amounts will be determined during negotiations.

U. Ownership of Data

All products, data, information, findings and documents prepared or obtained under the terms of this RFP shall become the exclusive property of the Consortium.

IV. SELECTION / CONTRACTING PROCESS AND ESTIMATED SCHEDULE

A. Advertisement

The Consortium will advertise this in the Seattle Journal of Commerce during the week of January 17,2000. Those firms that the Consortium is aware of as providing LiDAR services will be notified via e-mail of the availability of the RFP.

B. Evaluation Criteria

All proposals will be evaluated by a Contractor Evaluation Committee (CEC) made up of qualified persons from the Consortium and others. Additional technical input may be used from an independent Consultant. Selection will be made based on technical qualifications and approach as well as overall project cost. Rating criteria will include:

- Project Cost
- Schedule to acquire and process the data
- Meeting or exceeding specific requirements in this RFP noted in Section IIC, Technical Specifications
- Relevant experience of firm in similar projects
- Relevant experience of assigned staff in similar projects
- References responses

C. Contractor Response

Proposals must be submitted directly to the following Consortium members and must be received no later than 4:00 PM (PST) February 4, 2000:

Original to

Jerry Harless, GIS Manager
Kitsap County
614 Division Street MS 36
Port Orchard, WA 98366-4682

Copies to

Greg Berghoff, GIS Manager
Kitsap Public Utility District
Attn: Greg Berghoff
P.O. Box 1989
Poulsbo WA 98370

Jay Clark, Senior GIS Analyst
Puget Sound Regional Council
1011 Western Avenue, Suite 500
Seattle, WA 98104-1035

Ken Conradi, Mapping Supervisor
City of Seattle
510 Seattle Municipal Building
Seattle, WA 98104

Dave Harding, Director, Laser Altimeter Processing Facility
NASA/Goddard Space Flight Center
Mail Code 921
Greenbelt, MD 20771
Building 33, Room F324

Samuel Johnson, Project Chief
Cascadia Earthquake Loss Products
U.S. Geological Survey, MS 966,
Box 25046, DFC
Denver, CO 80225

Craig Weaver, Pacific Northwest Regional Coordinator
Earthquake Hazard Program
U.S. Geological Survey
Geophysics Program, Box 351650
University of Washington
Seattle, WA 98195

All proposal materials submitted will automatically become the property of the Consortium, which reserves the right in its sole discretion to use without limitation any and all information, concepts, and data contained therein.

Respondents should contact only those persons specifically designated for information about the status of this procurement following proposal submission. Disregarding this directive may disqualify the proposal involved.

D. Contractor Evaluation Committee Recommendations

The CEC will use the Evaluation Criteria listed in Section IV. B. herein, to rate and rank the proposals that are found to be responsive to all major requirements of this RFP. Quality of response to each RFP point as set forth herein, will be rated, and a comparative qualitative ranking of all proposals will be developed based on a composite rating of each one.

The rating and ranking results will be reported to the members of the Consortium along with the CEC'S recommendation for selection. The Consortium shall make the final selection of the firm on or near February 11,2000.

E. Selection / Notification

After the Consortium has made the final selection, all firms submitting proposals shall be notified of the results of the selection process on or near February 16, 2000.

F. Agreement Preparation

After the contractor has been chosen and notified, Kitsap County will prepare two copies of the contractor agreement. The contractor will review and sign both originals and return both to Kitsap County. Kitsap County will sign both originals and return one to the contractor.

V. PROPOSAL FORMAT AND CONTENT

To speed and simplify the proposal evaluation and to ensure that each proposal receives the same orderly review, all proposals must follow the format described in this section. Proposals shall contain all elements of information requested. Exceptions must be noted as described in Section V.B.6 below.

Proposals shall include the following sections:

I. Executive Summary

II. Administrative Questions

III. Summary of Technical Process

IV. Related Experience and References

V. Project Equipment Description

VI. Project Staff

VII. Schedule

<u>Detailed requirements and directions for preparation of each section are outlined below</u>

A. Section I: Executive Summary

In the Executive Summary, highlight the major facts and features of the Proposal, including any conclusions, assumptions, and recommendations you desire to make. The Executive Summary should be specifically designed for review by executives who may not possess a technical background. It must be no more than three pages in length.

B. Section II. Administrative Questions

Provide following information relative to your firm. Similar information must be provided for each sub-contractor.

1. Firm name and business address, including telephone number, FAX and e-mail address

2. Year established (include former firm names and year established, if applicable).

3. Type of ownership and parent company, if any.

4. Indication of whether the firm(s) is/are licensed to do business in the State of Washington.

5. Project manager's and authorized negotiator's names, mailing address, telephone number and e-mail address if different from Item 1. The authorized negotiator would be the person that is empowered to make binding commitments for the prime and its sub-contractors.

6. What exceptions are taken to the requirements of this RFP? If exceptions are taken, cite the activity involved, the exception taken and alternate language. If no exceptions are taken, so state.

7. What is the current financial status and condition of the respondent? This query will be best satisfied by submission of the prime contractor's latest annual financial statement or equivalent.

C. Section III. Summary of Technical Process

Discuss and clearly explain the methodology that your firm proposes to use to satisfactorily achieve the required results on this project. Include all aspects of survey control, data acquisition & analysis and Quality Control procedures. Describe the attributes of the data as it is to be acquired, including: laser pulse repetition rate; scan pattern, angle and rate; laser footprint diameter on the ground; number of returns per shot collected (i.e., first and last, or multiple); swath width, overlap between adjacent swaths, average and worst-case spacing of laser shots cross and along-track within a swath; number of GPS base stations used and maximum distance to a station. For first and last, or multiple returns per shot, state the minimum resolvable distance between returns. States if the amplitude of the laser return and scan angle are to be included as a part of the delivered data. List the software used to process the data, include the company name, version used and platform/operating system. Proposals that stress activities that will exceed the requirements of this project at additional costs are

not desired and will be rated negatively. This discussion should not be any longer than twelve pages.

E. Section IV: Related Experience and References

Provide a list of projects of similar magnitude and complexity that the prime Contractor has performed in the last five years. Include a brief description (no more than one page per project) of the projects. The descriptions should specify the services provided, type of terrain including vegetation, contract amount, geographic extent, accuracy or scale, and any other pertinent information. In addition, the name, address, and phone number of the client's project manager must be provided as a reference.

Submit one sample of a LiDAR product your firm has produced in similar terrain and of a similar quality level anticipated for this project. This may be in digital and/or hardcopy format.

Note any professional and technical activities in societies and institutes that are used to maintain current state of the art expertise and contribute to the betterment of standard of practice. This discussion should not exceed two pages.

F. Section V: Project Equipment Description

List all equipment, hardware, and software that your firm intends to use during the course of this project. This shall include at a minimum: Aircraft, laser equipment, IMU, GPS equipment, processing software, etc. Please indicate specifics as to availability of equipment (as a function of time) for this project, as well as compatibility of your firm's internal software to accommodate this project's requirements in terms of deliverables. This discussion should not be longer than 4 pages.

G. Section VI: Project Staff

Provide a complete project staff description in the form of a graphic organization chart, a staff summary that addresses individual roles and responsibilities, and resumes for all project participants. It is critical that Contractors commit to particular levels of individual staff members' time to be applied to work on this project. Variance from these commitments must be requested in writing from the Consortium and reviewed/approved in terms of project quality or schedule impact.

G. Section VII: Schedule

Identify any issues with meeting the schedule as outlined in section IIB

Attachment 1.