CO# 19-2019

PURCHASE AGREEMENT
FOR
PHOTOGRAMMETRIC PRODUCTS & SERVICES

THIS AGREEMENT dated the 17th day of January 2019 is made between Boone County, Missouri, a political subdivision of the State of Missouri through the Boone County Commission, herein "County" and **Surdex Corporation,** herein "Vendor."

IN CONSIDERATION of the parties performance of the respective obligations contained herein, the parties agree as follows:

1. ***Contract Documents*** - This agreement shall consist of this Purchase Agreement for Photogrammetric Products & Services, Project Assessment Quotation (PAQ) Request number **48-16NOV18,** State of Missouri Contract CS170285002 as amended, the Vendor's proposal response dated November 15, 2018, clarification dated November 19, 2018, the Round #2 to PAQ Request #48-16NOV18 response dated December 14, 2018, and e-mail clarification dated 11/19/2018 and 12/11/2018 as executed and sent by **Tim Donze** on behalf of the Vendor. All such documents shall constitute the contract documents which are incorporated herein by reference. Service or product data, specification and literature submitted with the proposal response may be permanently maintained in the County Purchasing Office contract file for this proposal if not attached. In the event of conflict between any of the foregoing documents this Purchase Agreement, Project Assessment Quotation (PAQ) Request number **48-16NOV18,** and the State of Missouri Contract CS170285002 as amended, prevail and control over the Vendor's proposal response.

2. ***Purchase*** – Part One, Scenario Four Orthophotography 6" Resolution for the following named counties: Boone County, Chariton County, Howard County, and Moniteau County shall be awarded for a total project area of 2,349 square miles. Included in the award is 4.8 square miles of 3" Resolution Orthophotography for the University of Missouri. The per square mile pricing presented in Part One, Option Two is also awarded. Also included in the award is Part Two, Option 1, 0.7M County LIDAR – bare earth and hydro flatten to USGS specification for Boone County that includes the University of Missouri campus.

Pursuant to paragraph 1.3 of PAQ Request 48-16NOV18, each participating entity will be making its individual award. Each entity shall write its own separate agreement with Surdex Corporation based on pricing submitted to PAQ Request # 48-16NOV18 and including Round #2. Surdex Corporation shall invoice each entity separately; each entity shall be responsible for paying Surdex Corporation directly.

This is the **Boone County** award which shall be priced as follows:

- Item 4.2.5: $70.00 per square mile, firm and fixed applied to a total flight area for Boone County of 691 miles;
- Total firm and fixed price for Orthophotography for Boone County: $48,370.00 which shall include Color-IR (item 4.2.4.4) and Ground Control (item 4.2.4.5) at no additional charge;
- Item 4.2.4.6 for digital file format MrSID photomosaic: $500.00 per mosaic after the first mosaic which is provided free of charge;
- Item 4.2.6 for LiDAR at $120,000.00, firm and fixed.

3. ***Delivery*** – Vendor agrees to deliver products and/or services no later than six (6) months after imagery collection and as otherwise specified in the Vendor's response (see Boone Co. 2019 Project Schedule). Delivery shall be to the Boone County GIS Department, Attn: Nathan Mattox, 801 E. Walnut, Rm. 220, Columbia, MO 65201.

4. ***Billing and Payment*** - All billing for Boone County shall be invoiced to the Boone County GIS Department and billings may only include the prices listed in the vendor's proposal response. No additional fees for labor or taxes shall be included as additional charges in excess of the charges in the Vendor's proposal response to the specifications. The County agrees to pay all invoices within thirty days of receipt. In the event of a billing dispute, the County reserves the right to withhold payment on the disputed amount; in the event the billing dispute is resolved in favor of the Vendor,

the County agrees to pay interest at a rate of 9% per annum on disputed amounts withheld commencing from the last date that payment was due.

5. ***Binding Effect*** - This agreement shall be binding upon the parties hereto and their successors and assigns for so long as this agreement remains in full force and effect.

6. ***Entire Agreement*** - This agreement constitutes the entire agreement between the parties and supersedes any prior negotiations, written or verbal, and any other bid or bid specification or contractual agreement. This agreement may only be amended by a signed writing executed with the same formality as this agreement.

7. ***Termination*** - This agreement may be terminated by the County upon thirty days advance written notice for any of the following reasons or under any of the following circumstances:

a. County may terminate this agreement due to material breach of any term or condition of this agreement, or
b. County may terminate this agreement if in the opinion of the Boone County Commission if delivery of products are delayed or products delivered are not in conformity with bidding specifications or variances authorized by County, or
c. If appropriations are not made available and budgeted for any calendar year.

IN WITNESS WHEREOF the parties through their duly authorized representatives have executed this agreement on the day and year first above written.

SURDEX CORPORATION

DocuSigned by:
by Ronald C Hoffmann
A19894F22E6742B...
title President

BOONE COUNTY, MISSOURI

by: Boone County Commission

DocuSigned by:
Daniel K. Atwill
BA4B934CED6E4EB...
Daniel K. Atwill, Presiding Commissioner

APPROVED AS TO FORM:

DocuSigned by:
Ron Sweet
36E0A0DDB0A0445...
County Counselor

ATTEST:

DocuSigned by:
Brianna L Lennon by MT
70B2D2936BF3403...
Brianna L. Lennon, County Clerk

In accordance with RSMo 50.660, I hereby certify that a sufficient unencumbered appropriation balance exists and is available to satisfy the obligation(s) arising from this contract. (Note: Certification of this contract is not required if the terms of this contract do not create a measurable county obligation at this time.)

DocuSigned by:
June Pitchford, by Caryn Ginter
BB2C324D8B450...
Signature

1/11/2019
Date

2010-71100 - $168,870.00
Appropriation Account

STANDARD CONTRACT TERMS AND CONDITIONS - BOONE COUNTY, MISSOURI

1. Contractor shall comply with all applicable federal, state, and local laws and failure to do so, in County's sole discretion, shall give County the right to terminate this Contract.

2. Prices shall include all charges for packing, delivery, installation, etc., (unless otherwise specified) to the Boone County Department.

3. The Boone County Commission has the right to accept or reject any part or parts of all bids, to waive technicalities, and to accept the offer the County Commission considers the most advantageous to the County. Boone County reserves the right to award this bid on an item-by-item basis, or an "all or none" basis, whichever is in the best interest of the County. The Purchasing Director reserves the right, when only one bid has been received by the bid closing date, to delay the opening of bids to another date and time in order to revise specifications and/or establish further competition for the commodity or service required. The one (1) bid received will be retained unopened until the new Closing date, or at request of bidder, returned unopened for re-submittal at the new date and time of bid closing.

4. When products or materials of any particular producer or manufacturer are mentioned in our contracts, such products or materials are intended to be descriptive of type or quality and not restricted to those mentioned.

5. Do not include Federal Excise Tax or Sales and Use Taxes in billing, as law exempts the County from them.

6. The delivery date shall be stated in definite terms.

7. The County Commission reserves the right to cancel all or any part of orders if delivery is not made or work is not started as guaranteed. In case of delay, the Contractor must notify the Purchasing Department.

8. In case of default by the Contractor, the County of Boone will procure the articles or services from other sources and hold the Contractor responsible for any excess cost occasioned thereby.

9. Failure to deliver as guaranteed may disqualify Contractor from future bidding.

10. Prices must be as stated in units of quantity specified, and must be firm.

11. The County of Boone, Missouri expressly denies responsibility for, or ownership of any item purchased until same is delivered to the County and is accepted by the County.

12. The County reserves the right to award to one or multiple respondents. The County also reserves the right to not award any item or group of items if the services can be obtained from a state or other governmental entities contract under more favorable terms. The resulting contract will be considered "Non-Exclusive". The County reserves the right to purchase advertising from other vendors.

13. The County, from time to time, uses federal grant funds for the procurement of goods and services. Accordingly, the provider of goods and/or services shall comply with federal laws, rules and regulations applicable to the funds used by the County for said procurement, and contract clauses required by the federal government in such circumstances are incorporated herein by reference. These clauses can generally be found in the Federal Transit Administration's Best Practices

Procurement Manual – Appendix A. Any questions regarding the applicability of federal clauses to a particular bid should be directed to the Purchasing Department prior to bid opening.

14. In the event of a discrepancy between a unit price and an extended line item price, the unit price shall govern.

15. Should an audit of Contractor's invoices during the term of the Agreement, and any renewals thereof, indicate that the County has remitted payment on invoices that constitute an over-charging to the County above the pricing terms agreed to herein, the Contractor shall issue a refund check to the County for any over-charges within 30-days of being notified of the same.

16. **For all titled vehicles and equipment the dealer must use the actual delivery date to the County** on all transfer documents including the Certificate of Origin (COO,) Manufacturer's Statement of Origin (MSO,) Bill of Sale (BOS,) and Application for Title.

17. **Equipment and serial and model numbers -** The contractor is strongly encouraged to include equipment serial and model numbers for all amounts invoiced to the County. If equipment serial and model numbers are not provided on the face of the invoice, such information may be required by the County before issuing payment.

SCENARIO FOUR PRICING - FOR BOONE COUNTY, THE UNIVERSITY OF MISSOURI, HOWARD COUNTY, COOPER COUNTY, CHARITON COUNTY, AND MONITEAU COUNTY – 6" RESOLUTION IN ALL COUNTIES AND 3" RESOLUTION FOR THE UNIVERSITY OF MISSOURI AREA IN BOONE COUNTY

Item 4.2.4 – Orthophotography (See Attachment 4)

Option One: Orthophoto Regional Flight – Total Mileage – *Price to Total Mileage Shown*

4.2.4.1a	Cost for 4.8 sqmi - 3" Color Orthophotography	$ 6,000.00
4.2.4.2a.	Cost for 2,349 sqmi - 6" Color Orthophotography	$164,430.00
4.2.4.3a.	**Total**	**$170,430.00**

4.2.4.4. Color-IR: Included

4.2.4.5. Ground control targets: Included

4.2.4.6. Optional digital file format MrSID photomosaic: The first mosaic is free, then for each additional mosaic the price is $500.00/each.

4.2.5 Orthophotography Pricing - Continued

OPTION 2 –Per Square Mile Matrix - Alternate to Total Mileage Pricing – Price per each square mile for the indicated mileage at the indicated resolution

Item Number	Flight Range: Total Square Miles	Resolution 6"
4.2.5.1	30 to 100	$150.00 per sq mile
4.2.5.2	101 to 800	$100.00 per sq mile
4.2.5.3	801 to 2000	$80.00 per sq mile
4.2.5.4	2001 to 4000	$70.00 per square mile
4.2.5.5	4001+	$70.00 per square mile

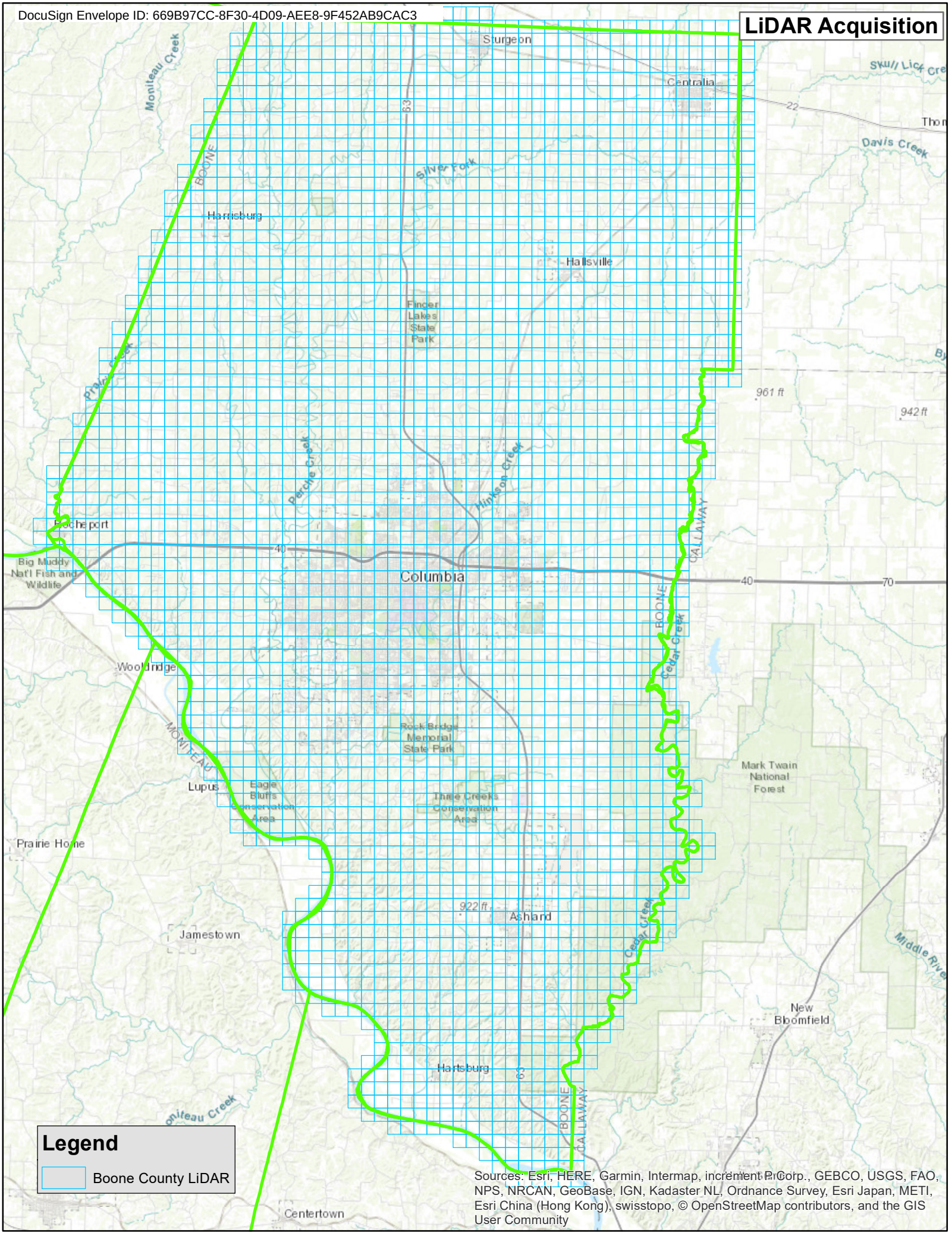
PART TWO – LiDAR PRODUCT

Item 4.2.6 –LiDAR

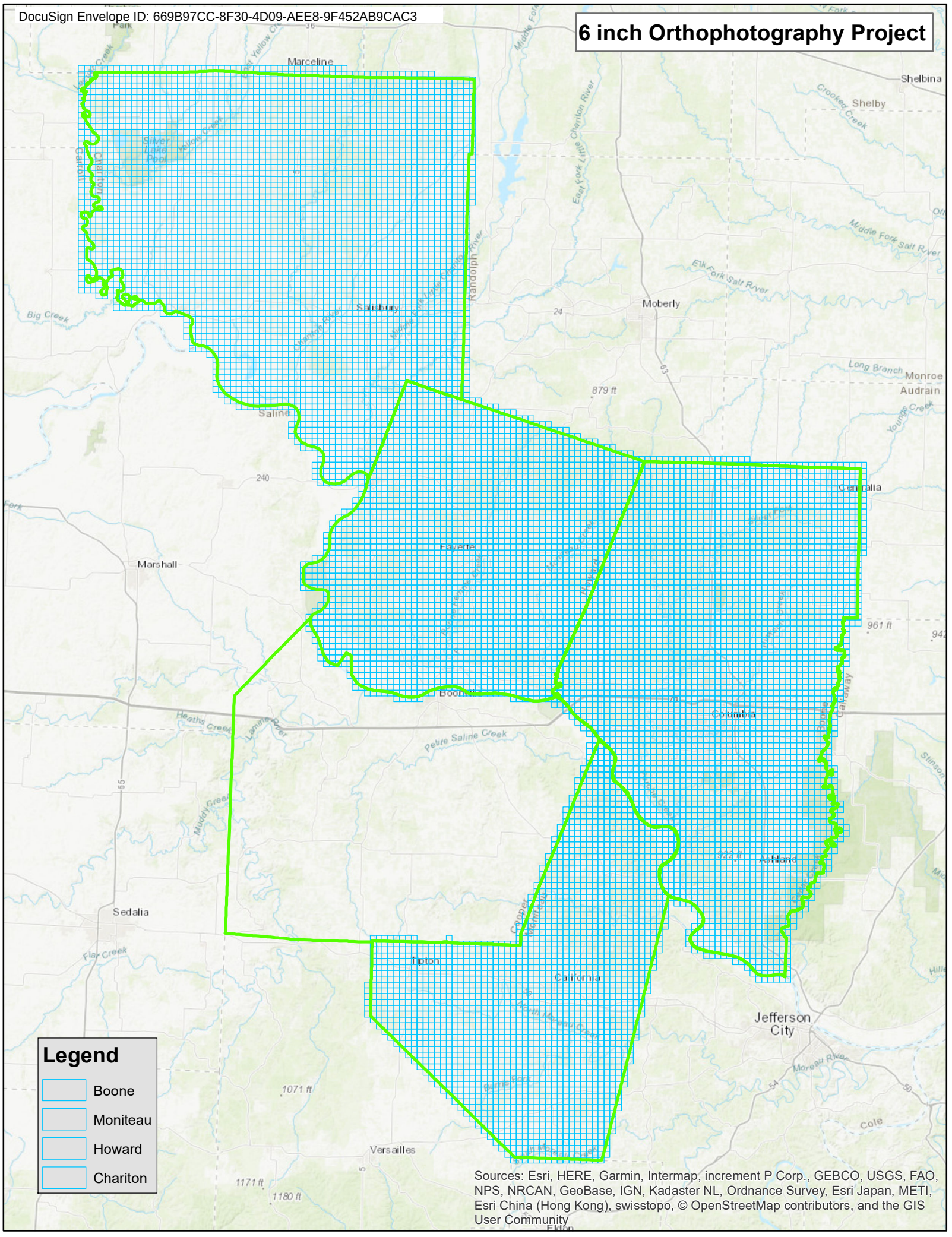
4.2.6.1. OPTION 1 – Classifying Bare-Earth LiDAR: County-wide Flight and Processing (See Attachment 5)

4.2.6.1a.	Cost for 690 sqmi- 0.7m County LiDAR (bare earth and hydro flatten to USGS spec)	$120,000.00
4.2.6.1b.	Other Additional Costs	N/A
4.2.6.1c.	**Total .7m County LiDAR**	**$120,000.00**

Document End



6 inch Orthophotography Project



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Round #2 to PAQ Request #48-16NOV18
Photogrammetric Mapping Products and Services

Boone County Purchasing
613 E. Ash Street, Room 109
Columbia, MO 65201
Liz Palazzolo, Senior Buyer
Phone: (573) 886-4392 - Fax: (573) 886-4390
Email: lpalazzolo@boonecountymo.org

BOONE COUNTY, MISSOURI

Round #2 to PAQ Request #48-16NOV18 for Photogrammetric Mapping Products and Services

Round # 1 - *Issued* **December 12, 2018**

I) **ADD** the attached PAQ Request 48-16NOV18 -Round #2 Pricing Pages for the Orthophotography Product.

This is issued in accordance with the Request for Project Quote Assessment #48-16NOV 18 paragraph 1.4 and is hereby incorporated into and made a part of the vendors PAQ Response. The vendor shall indicate acknowledgement by signing below:

By: _____
Liz Palazzolo, Senior Buyer
Boone County Purchasing

The vendor has examined **Round #2 to Request for PAQ #48-16NOV18- Photogrammetric Mapping Products and Services,** receipt of which is hereby acknowledged:

Company Name: Surdex Corporation

Address: 520 Spirit of St. Louis Blvd. Chesterfield, MO 63005

Phone Number: 636-368-4400 Fax Number: 636-368-4401

E-mail: TimD@surdex.com

Authorized Representative Signature: _____ Date: 12/14/2018

Authorized Representative Printed Name: Ronald C. Hoffmann

SCENARIO FOUR PRICING - FOR BOONE COUNTY, THE UNIVERSITY OF MISSOURI, HOWARD COUNTY, COOPER COUNTY, CHARITON COUNTY, AND MONITEAU COUNTY – 6" RESOLUTION IN ALL COUNTIES AND 3" RESOLUTION FOR THE UNIVERSITY OF MISSOURI AREA IN BOONE COUNTY

Item 4.2.4 – Orthophotography (See Attachment 4)

Option One: Orthophoto Regional Flight – Total Mileage – *Price to Total Mileage Shown*

4.2.4.1a	Cost for 4.8 sqmi - 3" Color Orthophotography	$ 6,000
4.2.4.2a.	Cost for 3,142 sqmi - 6" Color Orthophotography	$ 219,000
4.2.4.3a.	**Total**	**$** 225,000

If the vendor's projected flight area for the total contiguous area is different than the above, please indicate what the total area flight area is: 3,053

If the vendor's pricing changes as a result of pricing to actual flight area projections made by the vendor, then re-submit pricing above only as based on the vendor's flight area projections:

4.2.4.1b.	Cost for 4.8 sqmi - 3" Color Orthophotography	$ 6,000
4.2.4.2b.	Cost for **3,053** sqmi (Vendor to identify) - 6" Color Orthophotography	$ 213,500
4.2.4.3b.	**Total**	**$** 219,500

4.2.4.4. Color-IR (Identify Cost Below Per PAQ Participant **Or** Check Here if Cost Identified Below is the Same for All Participants: x):

Color IR - Cost is included in the ortho pricing above.

4.2.4.5. Ground control targets (Identify Cost Below Per PAQ Participant **Or** Check Here if Cost Identified Below is the Same for All Participants: X):

Ground control cost is included in the ortho pricing above.

4.2.4.6. Optional digital file format MrSID photomosaic (Identify Cost Below Per PAQ Participant **Or** Check Here if Cost Identified Below is the Same for All Participants: X):

The first Mosaic is free, then for each additional mosaic $500 per.

4.2.4.7. Other Costs (Identify Cost Below Per PAQ Participant **Or** Check Here if Cost Identified Below is the Same for All Participants: X):

Not applicable.

4.2.5 Orthophotography Pricing - Continued

OPTION 2 –Per Square Mile Matrix - Alternate to Total Mileage Pricing – Price per each square mile for the indicated mileage at the indicated resolution

Item Number	Flight Range: Total Square Miles	Resolution 6"
4.2.5.1	30 to 100	**$150**
4.2.5.2	101 to 800	**$100**
4.2.5.3	801 to 2000	**$80**
4.2.5.4	2001 to 4000	**$70**
4.2.5.5	4001+	**$70**

4.2.5.6 **Other costs** associated with per mile pricing that will be charged:

N/A

Document End

Liz Palazzolo

From: Tim Donze <timd@surdex.com>
Sent: Friday, December 14, 2018 2:55 PM
To: Liz Palazzolo
Subject: RE: Request from Boone County - Aerial Photogrammetry - Round #2 PAQ Request 48-16NOV18
Attachments: Round #2 PAQ Request 48-16NOV18_Surdex.pdf

Liz,

Attached is our reply to your recent request.

As reference here is how we calculated the revised number of square miles:

	Sq Miles
Boone	691
Howard	472
Cooper	569
Moniteau	419
Chariton	767
County Total	2918
Boone Electric	135
Total	3053

Tim Donze
Cell: (314) 422-7616
TimD@surdex.com

From: Liz Palazzolo <LPalazzolo@boonecountymo.org>
Sent: Wednesday, December 12, 2018 10:13 AM
To: Tim Donze <timd@surdex.com>
Subject: RE: Request from Boone County - Aerial Photogrammetry - Round #2 PAQ Request 48-16NOV18

Thank you

Liz Palazzolo
Senior Buyer
Boone County Purchasing
Phone: 573-886-4392
Fax: 573-886-4390
613 E. Ash, Room 109
Columbia, MO 65201

From: Tim Donze <timd@surdex.com>
Sent: Wednesday, December 12, 2018 10:01 AM

To: Liz Palazzolo <LPalazzolo@boonecountymo.org>
Subject: RE: Request from Boone County - Aerial Photogrammetry - Round #2 PAQ Request 48-16NOV18

Thank you Liz. We should be able to return this within your timeframe, noon on the 18th.

Tim Donze
Cell: (314) 422-7616
TimD@surdex.com

From: Liz Palazzolo <LPalazzolo@boonecountymo.org>
Sent: Wednesday, December 12, 2018 9:56 AM
To: Tim Donze <timd@surdex.com>
Subject: Request from Boone County - Aerial Photogrammetry - Round #2 PAQ Request 48-16NOV18
Importance: High

Good morning: Boone County is requesting a second round of pricing for the orthography product with the provision that it has been settled that a 3"/6" resolution is wanted. I've attached additional pricing pages for your submission assuming a contiguous flight area that includes the Counties of Boone, Howard, Cooper, Chariton and Moniteau, as well as the University of Missouri.

As a matter of clarification, the County is interested in knowing if your pricing is based on what your company foresees as the total flight area to complete the project assuming all Counties participate, versus the square mileage that was published in the PAQ Request. Related, did the mileage represented in the State of Missouri's RFP (Attachment 2 of RFPS30034901700285) for Boone, Cooper, Chariton, Moniteau and Howard Counties impact any of your pricing assumptions in your PAQ Response?

The attached additional pricing pages attempt to help resolve the above questions. Please sign the cover page and return it with the requested additional pricing, and feel free to provide whatever additional detail/information may aid us in the evaluation of your PAQ Response.

The Round #2 response is due by Noon on 12/18/19 – please confirm that this time works for you because I realize that we are working in the holiday season, and schedules are busy. Thank you and let me know if you have any questions.

Liz Palazzolo
Senior Buyer
Boone County Purchasing
Phone: 573-886-4392
Fax: 573-886-4390
613 E. Ash, Room 109
Columbia, MO 65201

Liz Palazzolo

From: Tim Donze <timd@surdex.com>
Sent: Tuesday, December 11, 2018 2:46 PM
To: Liz Palazzolo
Subject: RE: Question - Request for PAQ #48-16NOV8 Boone County et al. for Aerial Photogrammetry Services

Liz,

Thanks for the note.

We appreciate your inquiry about financing for one or two of your partners. We are willing to attempt to negotiate something mutually agreeable. That said, we do not know the options on the scopes of work to be selected and the final amount that we would be financing.

I thought I'd start with explaining our typical payment schedule, then an option for consideration.

Typical Surdex timeline and billing cycle for an orthoimagery project
Acquiring the new imagery is a significant portion of our project cost, so we usually invoice 60% of the project cost after acquisition. Acquisition is usually in March to early April, so the invoice for 60% is usually sent by the end of April or so.

Upon delivery of the imagery, Surdex will invoice 30% with the client keeping a 10% retaining until they give final acceptance of the data. On a multi-county project like this I'd estimate the data to be delivery around September 1st with final acceptance and final payment in October or so.

Surdex is willing to offer an extended payment schedule to help bridge into the funding of a new fiscal year
Surdex can reduce the first invoice to 50% of the project which will be invoiced after acquisition is complete, around the end of April.

Surdex can offer to hold off invoicing the other 50% of the project cost until after the first of the year or as late as April first of 2020.

Note: This is a good faith offer in hopes of easing the fiscal burden for some of your partners. If there are unique circumstances that we are not aware of, we have an open mind and are willing to discuss further.

Something to consider
The aerial imagery firm that often offers 3 year financing is not selling an apples to apples product as ours and they also are not working under the same business model as Surdex.

The firm offering the 3 year financing package is selling a licensed set of data and their agreement is for 3 years. The firm is reusing the data for a separate line of business which provides a second revenue stream. The counties are actually helping them fund the imagery acquisition for their secondary line of business as much as the firm is helping the county with financing.

Surdex is producing this data for Boone County and their partners custom for them and it is 100% your data when we are complete. We do not resell your data or have additional revenue streams from it.

Tim Donze

Cell: (314) 422-7616
TimD@surdex.com

From: Liz Palazzolo <LPalazzolo@boonecountymo.org>
Sent: Tuesday, December 11, 2018 12:18 PM
To: Tim Donze <timd@surdex.com>
Subject: Question - Request for PAQ #48-16NOV8 Boone County et al. for Aerial Photogrammetry Services

Good afternoon: If any of the participants were to request the ability to finance their portion of the work your company does, is financing payment over two fiscal years (24 months) without interest possible for that entity? One, perhaps two participants have expressed an interest in a no-interest financing option for their portion of flight/work-product costs.

Would financing over 36-months be possible, again no interest?

Please elaborate and explain how this would work if financing is an option. Thank you

Liz Palazzolo
Senior Buyer
Boone County Purchasing
Phone: 573-886-4392
Fax: 573-886-4390
613 E. Ash, Room 109
Columbia, MO 65201

Liz Palazzolo

From: Tim Donze <timd@surdex.com>
Sent: Monday, November 19, 2018 4:19 PM
To: Liz Palazzolo
Cc: Lorie Thomas; Nathan Mattox
Subject: RE: Request for Clarification - Request for PAQ Aerial Photogrammetric Mapping Products and Services
Attachments: Surdex_Proposal_48-16NOV18_CS170285001-004_PAQ Request edit page 13.pdf

Liz,

Actually we did find one other typo that we should correct for accuracy.

This page edits page 13,

The correction is: 4.2.6.c. Total **10PPM** MU LiDAR
From the previous version of: 4.2.6.c. Total **.10PPM**

Tim Donze
Cell: (314) 422-7616
TimD@surdex.com

From: Liz Palazzolo <LPalazzolo@boonecountymo.org>
Sent: Monday, November 19, 2018 3:33 PM
To: Tim Donze <timd@surdex.com>
Cc: Lorie Thomas <loriet@surdex.com>; Nathan Mattox <NMattox@boonecountymo.org>
Subject: RE: Request for Clarification - Request for PAQ Aerial Photogrammetric Mapping Products and Services

Thanks – I did a quick check on the other scenarios and I believe this was the only change made comparing your response to the PAQ request. Please let me know otherwise.

Liz Palazzolo
Senior Buyer
Boone County Purchasing
Phone: 573-886-4392
Fax: 573-886-4390
613 E. Ash, Room 109
Columbia, MO 65201

From: Tim Donze <timd@surdex.com>
Sent: Monday, November 19, 2018 3:23 PM
To: Liz Palazzolo <LPalazzolo@boonecountymo.org>
Cc: Lorie Thomas <loriet@surdex.com>; Nathan Mattox <NMattox@boonecountymo.org>
Subject: RE: Request for Clarification - Request for PAQ Aerial Photogrammetric Mapping Products and Services

Liz,

Thank you for the note. Yes, we have a typo on 4.2.3.3. Thank you for catching this and the opportunity to correct it.

Our typo is in the description of the resolution. The correction changes 9" to 12" resolution for that scenario. This correction now matches your PAQ language.

Surdex has corrected the item 4.2.3.3 in the following attachment. The correction is made to this item and it should read:

- item 4.2.3.3 (Part One, Scenario Three for the "Cost for 2,334 sq mi – 12" Color Orthography" which is quoted at **$63,000.00**).

If this does not fully clarify things, let me know.

Tim Donze
Cell: (314) 422-7616
TimD@surdex.com

From: Liz Palazzolo <LPalazzolo@boonecountymo.org>
Sent: Monday, November 19, 2018 1:19 PM
To: Tim Donze <timd@surdex.com>
Cc: Lorie Thomas <loriet@surdex.com>; Nathan Mattox <NMattox@boonecountymo.org>
Subject: Request for Clarification - Request for PAQ Aerial Photogrammetric Mapping Products and Services
Importance: High

Good afternoon: Thank you for responding to Request #48-16NOV18 for the Project Assessment Quotation for Boone County et al.

Please clarify the price for item 4.2.2.3 (Part One, Scenario Two pricing for the "Cost for 2,334 sqmi – 9" Color Orthography" which is quoted as **$126,000.00**) and item 4.2.3.3 (Part One, Scenario Three for the "Cost for 2,334 sqmi – 9" Color Orthography" which is quoted at **$63,000.00**). It would appear that the two should be the same price since the service is the same, but in the interests of clarity, the County is requesting that Surdex address the two prices as a matter of clarification. If there is a need to correct the quotation for either line item, please indicate which price is the correct/intended price. Also, if indicating the correct price impacts any other related "totals" pricing, please indicate the correct total price.

Please let me know if this request is not clear. Thank you

Liz Palazzolo
Senior Buyer
Boone County Purchasing
Phone: 573-886-4392
Fax: 573-886-4390
613 E. Ash, Room 109
Columbia, MO 65201

4.2.6.2.	**OPTION 2 – Classifying Bare-Earth LiDAR: University of Missouri (See Attachment 6)**		
4.2.6.2a.	Cost for 4.8 sqmi – 0.7m LiDAR over campus (Point Cloud (all points returned), bare earth and hydro flatten to USGS spec)	$	12,000
4.2.6.2b.	Other Additional Cost_____	$	0
4.2.6.2c.	**Total .7m MU LiDAR**	**$**	**12,000**
4.2.6.3.	**OPTION 3 – Classifying Bare-Earth LiDAR: University of Missouri (See Attachment 7)**		
4.2.6.3a.	Cost for 4.8 sqmi – 4PPM QL2 LiDAR over campus (Point Cloud (all points returned), bare earth and hydro flatten to USGS spec)	$	13,500
4.2.6.3b.	Other Additional Cost_____	$	0
4.2.6.3c.	**Total 4PPM – QL2 MU LiDAR**	**$**	**13,500**
4.2.6.4.	**OPTION 4 – Classifying Bare-Earth LiDAR: University of Missouri (See Attachment 8)**		
4.2.6.4a.	Cost for 4.8 sqmi – 10PPM QL1 LiDAR over campus (Point Cloud (all points returned), bare earth and hydro flatten to USGS spec)	$	15,000
4.2.6.4b.	Other Additional Cost_____	$	0
4.2.6.4c.	**Total 10PPM MU LIDAR**	**$**	**15,000**

PART THREE – TOPOGRAPHICS AND PLANIMETRICS

4.2.7.	**TOPOGRAPHIC AND PLANIMETRICS (See Attachment 9)**		
4.2.7.1.	Cost for 4.8 sqmi Campus New 2' Contours (Attachment 8)	$	2,500
4.2.7.2.	Cost for 4.8 sqmi Roofline Elevations for MU Campus	$	4,000
4.2.7.3.	**Other cost** associated with topographics and planimetrics that will be charged:		

Item 4.2.7.1. is based on LiDAR being part of the final scope of work.

Liz Palazzolo

From: Tim Donze <timd@surdex.com>
Sent: Monday, November 19, 2018 3:23 PM
To: Liz Palazzolo
Cc: Lorie Thomas; Nathan Mattox
Subject: RE: Request for Clarification - Request for PAQ Aerial Photogrammetric Mapping Products and Services
Attachments: Surdex_Proposal_48-16NOV18_CS1AQ Request_Page_10_Revision.pdf

Liz,

Thank you for the note. Yes, we have a typo on 4.2.3.3. Thank you for catching this and the opportunity to correct it.

Our typo is in the description of the resolution. The correction changes 9" to 12" resolution for that scenario. This correction now matches your PAQ language.

Surdex has corrected the item 4.2.3.3 in the following attachment. The correction is made to this item and it should read:

- item 4.2.3.3 (Part One, Scenario Three for the "Cost for 2,334 sq mi – **12**" Color Orthography" which is quoted at **$63,000.00**).

If this does not fully clarify things, let me know.

Tim Donze
Cell: (314) 422-7616
TimD@surdex.com

From: Liz Palazzolo <LPalazzolo@boonecountymo.org>
Sent: Monday, November 19, 2018 1:19 PM
To: Tim Donze <timd@surdex.com>
Cc: Lorie Thomas <loriet@surdex.com>; Nathan Mattox <NMattox@boonecountymo.org>
Subject: Request for Clarification - Request for PAQ Aerial Photogrammetric Mapping Products and Services
Importance: High

Good afternoon: Thank you for responding to Request #48-16NOV18 for the Project Assessment Quotation for Boone County et al.

Please clarify the price for item 4.2.2.3 (Part One, Scenario Two pricing for the "Cost for 2,334 sqmi – 9" Color Orthography" which is quoted as **$126,000.00**) and item 4.2.3.3 (Part One, Scenario Three for the "Cost for 2,334 sqmi – 9" Color Orthography" which is quoted at **$63,000.00**). It would appear that the two should be the same price since the service is the same, but in the interests of clarity, the County is requesting that Surdex address the two prices as a matter of clarification. If there is a need to correct the quotation for either line item, please indicate which price is the correct/intended price. Also, if indicating the correct price impacts any other related "totals" pricing, please indicate the correct total price.

Please let me know if this request is not clear. Thank you

Liz Palazzolo
Senior Buyer
Boone County Purchasing
Phone: 573-886-4392
Fax: 573-886-4390
613 E. Ash, Room 109
Columbia, MO 65201

4.2.2.8. Other Cost (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: ___X___)

Not applicable.

SCENARIO THREE PRICING - FOR BOONE COUNTY, THE UNIVERSITY OF MISSOURI, HOWARD COUNTY AND COOPER COUNTY – LOW RESOLUTION

Item 4.2.3 - Orthophotography (See Attachment 3)

Option One: Orthophoto Regional Flight - Total Mileage

4.2.3.1.	Cost for 4.8 sqmi - 3" Color Orthophotography	$ 6,000
4.2.3.2a.	Cost for 808 sqmi - 6" Color Orthophotography	$ 68,500
	Or	
4.2.3.2b.	Cost for 943 sqmi - 6" Color Orthophotography - Additional area is contiguous to Boone County	$ 80,000
4.2.3.3.	Cost for 2,334 sqmi – 12" Color Orthophotography	$ 63,000
4.2.3.4a	**Total**	**$ 137,500**
4.2.3.4b.	**Total with additional area**	**$ 149,000**

4.2.3.5. Color-IR (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: ___X___)

Color-IR cost is included in the ortho pricing above.

4.2.3.6. Ground control targets (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: ___X___)

Ground Control cost is included in the ortho pricing above.

4.2.3.7. Optional digital file formats MrSID photomosaic (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: ___X___)

The first Mosaic is free, then for each additional mosaic $500 per.

4.2.3.8. Other Cost (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: ___X___)

Not applicable.

Liz Palazzolo

From: Liz Palazzolo
Sent: Monday, November 19, 2018 1:19 PM
To: Tim Donze
Cc: 'Lorie Thomas'; Nathan Mattox
Subject: Request for Clarification - Request for PAQ Aerial Photogrammetric Mapping Products and Services

Importance: High

Tracking:

Recipient	Delivery
Tim Donze	
'Lorie Thomas'	
Nathan Mattox	Delivered: 11/19/2018 1:19 PM

Good afternoon: Thank you for responding to Request #48-16NOV18 for the Project Assessment Quotation for Boone County et al.

Please clarify the price for item 4.2.2.3 (Part One, Scenario Two pricing for the "Cost for 2,334 sqmi – 9" Color Orthography" which is quoted as **$126,000.00**) and item 4.2.3.3 (Part One, Scenario Three for the "Cost for 2,334 sqmi – 9" Color Orthography" which is quoted at **$63,000.00**). It would appear that the two should be the same price since the service is the same, but in the interests of clarity, the County is requesting that Surdex address the two prices as a matter of clarification. If there is a need to correct the quotation for either line item, please indicate which price is the correct/intended price. Also, if indicating the correct price impacts any other related "totals" pricing, please indicate the correct total price.

Please let me know if this request is not clear. Thank you

Liz Palazzolo
Senior Buyer
Boone County Purchasing
Phone: 573-886-4392
Fax: 573-886-4390
613 E. Ash, Room 109
Columbia, MO 65201

PROPOSAL

E-mail Submission: lpalazzolo@boonecountvmo.org

Request for Proposal

#48-16NOV18 - PROJECT ASSESSMENT QUOTATION (PAQ)

STATE OF MISSOURI CONTRACTS CS170285001-004 FOR PHOTOGRAMMETRIC MAPPING PRODUCTS & SERVICES

Submittal Deadline: 11-16-2018, 2:00 P.M. CST

Submitted To: **Boone County Purchasing Department**

613 E. Ash Street, Room 109
Columbia, Missouri 65201-4460
Tel: (573) 886-4392

Submitted By: **Surdex Corporation**

Selection Contact: **Tim Donze**
Vice President, Business Development
Direct: (314) 422-7616 | Office: (636) 368-4424
E-mail: timd@surdex.com
520 Spirit of St. Louis Blvd.
Chesterfield, MO 63305

www.surdex.com

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Table of Contents

Cover Letter

November 16, 2018

Liz Palazzolo
Senior Buyer
Boone County Purchasing Department
613 E. Ash Street, Room 109
Columbia, Missouri 65201-4460

Dear Ms. Palazzolo:

On behalf of our Team, Surdex is pleased to provide this fully-compliant response to the Project Assessment Quotation "#48-16NOV18 PAQ, County of Boone, Missouri" under the State of Missouri Contract CS170285001-004, Photogrammetric Products and Services.

Surdex brings numerous advantages to this project:

- Our Chesterfield, Missouri headquarters is less than 100 miles from the project area, providing quick response for field and aerial acquisition operations, as well as availability to our staff and facilities at any point during the project.
- Only US Labor will be used on this project. Nearly all of the acquisition and processing will be performed with Missouri labor, bolstering the State's employment and tax base.
- We have performed numerous projects in the State of Missouri at the State, Federal, and Local government level and are familiar with weather conditions and ground cover. This includes the Boone County and Partners project in 2015.
- Our state-of-the-art Leica ADS100 digital pushbroom cameras are ideally suited for orthoimagery projects as well as planimetric and topographic mapping. Surdex's five ADS100 systems will be available for your project. These are the same cameras used on your 2015 project.
- Newly added since our last project is a new feature that gives access through a web service to provide early access to preliminary orthoimagery. This data will not be perfect, but it will allow the partners the ability to use the imagery within weeks of completing flight vs waiting for final delivery to begin using the imagery.
- We have provided LiDAR acquisition and processing for large areas of the State of Missouri over the last several years and bring the necessary expertise to perform on this project. We have upgraded our LiDAR systems to the Optek Galaxies since 2015 and look forward to updating and improving the quality of your elevation data. As LiDAR technology improves, so does the data we produce with it.
- We bring more than sufficient resource capacity to acquire and process the orthoimagery, LiDAR, planimetric, and topographic products for this project.
- We have a wealth of experience in "doing the job right" and have a strong reputation for delivering successful projects on time and providing superior customer service in the process.
- We treat our clients as partners, allowing us to overcome unexpected challenges by keeping our clients in the loop at all times to ensure issues are resolved in an efficient and wise manner.
- For ground survey operations, our Team includes two firms identified on our Missouri State contract: EFK and David Mason & Associates of St. Louis (MoDOT Certified DBE).

Surdex provides a high level of technical detail in our proposal responses so that our clients are able to assess our design and technical approach. In the case of this response, some portions of our proposal are general in nature due to a variety of options that can be selected by the Mid-Missouri partners.

- The LiDAR portion of the project has several options in terms of area and product scope and our response is thorough.
- Topographic contours are less defined and dependent upon the options selected by Mid-Missouri partners. For example, contours can be done from new LiDAR acquisition if this option is selected, but would have to be done photogrammetrically if the LiDAR option is not selected.
- Planimetric mapping (building heights) scopes are still to be determined to some degree and our treatment of these is general in nature.

Once the final project scope is more defined and the options known, Surdex would be glad to provide more detail in our methodology. Similarly, regarding delivery dates, we have given our best estimate on realistic delivery dates. The options selected for the final scope of work will likely affect the delivery dates. For instance, if LiDAR is selected, we will want to delay ortho production for the LiDAR areas to produce the new DEM before producing orthos. We will work with the partners during final scoping of the project to optimize the delivery schedule. We will do our best to work with your needs and priorities to make this a successful endeavor for everyone.

Surdex can support individual contracts written for each participating partner, if required. Surdex often has regional projects executed in this manner with more than a dozen potential partners. We also will continue to help identify and support additional potential partners joining your consortium.

We have placed a number of samples of orthoimages and LiDAR data on our ftp site for use by the reviewers of this submission. The details for the login are below. Please note that the login and password are case-sensitive.

Site: ftp.surdex.net
User: Boone
Pwd: Sdx2018

If you have any questions or comments, do not hesitate to contact me directly at any point in the evaluation process.

Sincerely,

SURDEX CORORATION

Tim Donze
Vice President Business Development, Midwest Region
Direct Tel: 314-422-7616
Email: TimD@surdex.com

PAO Response/Pricing Page

4.1 PAQ Response Page

In compliance with this PAQ Request and subject to all the conditions thereof, the PAQ Respondent agrees to furnish the services/equipment/supplies requested and proposed and certifies he/she has read, understands, and agrees to all terms, conditions, and requirements of this quotation and is authorized to contract on behalf of the Respondent named below. (Note: This form must be signed. All signatures must be original).

Company Name:	Surdex Corporation		
Address:	520 Spirit of St. Louis Blvd.		
	Chesterfield, MO 63005		
Telephone:	(636) 368-4400	Fax:	(636) 368-4401
Federal Tax ID (or Social Security#)	43-0690641		
Print Name:	Ronald C. Hoffmann	Title:	President
Signature:	R. C. Hoffmann	Date:	November 15, 2018
E-Mail Address:	RonHCorp@surdex.com		

4.2 PRICING

Pricing - Provide firm, fixed pricing as indicated on this response form to conduct photogrammetric services as outlined in Attachments One through Nine and in compliance with State of Missouri contracts CSl 70285001 through CSl 70285004, and the terms of this PAQ request.

If necessary, please attach a more detailed listing outlining all costs to perform photogrammetric services. As appropriate, items should include professional fees, materials, out of pocket expenses, sub-consultant fees and any other costs.

All pricing shall be considered firm and fixed. No other costs shall be paid to the contractor if not quoted and clearly identified in the PAQ response.

There are three parts to this PAQ Request: Part One is for Orthophotography; Part Two is for a LiDAR product; and Part Three is for a Topographies and Planimetrics product. PAO respondents must respond to all three parts.

PART ONE - ORTHOPHOTOGRAPHYPRODUCT

SCENARIO ONE PRICING: BOONE COUNTY AND THE UNIVERSITY OF MISSOURI ONLY

Item 4.2.1 - Orthophotography (See Attachment 1)

Option One: Orthophoto Regional Flight - Total Mileage

4.2.1.1.	Cost for 4.8 sqmi - 3" Color Orthophotography	$ 6,000
4.2.1.2a	Cost for 746 sqmi - 6" Color Orthophotography	$ 63,000
	Or	
4.2.1.2b.	Cost for 881 sqmi - 6" Color Orthophotography - Additional area is contiguous to Boone County	$ 74,000
4.2.1.3a	**Total**	**$ 69,000**
4.2.1.3b.	**Total with additional area**	**$ 80,000**

4.2.1.4 Color-IR Option (Identify Cost Below Per PAQ Participant **Or** Check Here if Cost Identified Below is the Same for All Participants: X)

Color-IR cost is included in the ortho pricing above.

4.2.1.5 Ground control targets (Identify Cost Below Per PAQ Participant **Or** Check Here if Cost Identified Below is the Same for All Participants:)

Ground Control cost is included in the ortho pricing above.

4.2.1.6 Optional digital file format MrSID photomosaic
(Identify Cost Below Per PAQ Participant **Or** Check Here if Cost Identified Below is the
Same for All Participants: X)

The first Mosaic is free, then for each additional mosaic $500 per.

4.2.1.7 Other Cost (Identify Cost Below Per PAQ Participant **Or** Check Here if Cost Identified Below is the Same for All Participants: X)

Not applicable.

SCENARIO TWO PRICING - FOR BOONE COUNTY, THE UNIVERSITY OF MISSOURI, CHARITON COUNTY, COOPER COUNTY, HOWARD COUNTY AND MONITEAU COUNTY – HIGH RESOLUTION

Item 4.2.2 - Orthophotography (See Attachment 3)

Option One: Orthophoto Regional Flight - Total Mileage

4.2.2.1.	Cost for 65.6 sqmi - 3" Color Orthophotography	$ 26,000
4.2.2.2a.	Cost for 746 sqmi - 6" Color Orthophotography	$ 63,000
	Or	
4.2.2.2b.	Cost for 881 sqmi - 6" Color Orthophotography - Additional area is contiguous to Boone County	$ 74,000
4.2.2.3.	Cost for 2,334 sqmi – 9" Color Orthophotography	$ 126,000
4.2.2.4a	**Total**	**$ 215,000**
4.2.2.4b.	**Total with additional area**	**$ 226,000**

4.2.2.5. Color-IR (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

Color-IR cost is included in the ortho pricing above.

4.2.2.6. Ground control targets (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

Ground Control cost is included in the ortho pricing above.

4.2.2.7. Optional digital file formats MrSID photomosaic
(Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

The first Mosaic is free, then for each additional mosaic $500 per.

4.2.2.8. Other Cost (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

Not applicable.

SCENARIO THREE PRICING - FOR BOONE COUNTY, THE UNIVERSITY OF MISSOURI, HOWARD COUNTY AND COOPER COUNTY – LOW RESOLUTION

Item 4.2.3 - Orthophotography (See Attachment 3)

Option One: Orthophoto Regional Flight - Total Mileage

4.2.3.1.	Cost for 4.8 sqmi - 3" Color Orthophotography	$ 6,000
4.2.3.2a.	Cost for 808 sqmi - 6" Color Orthophotography	$ 68,500
	Or	
4.2.3.2b.	Cost for 943 sqmi - 6" Color Orthophotography - Additional area is contiguous to Boone County	$ 80,000
4.2.3.3.	Cost for 2,334 sqmi – 9" Color Orthophotography	$ 63,000
4.2.3.4a	**Total**	**$ 137,500**
4.2.3.4b.	**Total with additional area**	**$ 149,000**

4.2.3.5. Color-IR (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

Color-IR cost is included in the ortho pricing above.

4.2.3.6. Ground control targets (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

Ground Control cost is included in the ortho pricing above.

4.2.3.7. Optional digital file formats MrSID photomosaic (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

The first Mosaic is free, then for each additional mosaic $500 per.

4.2.3.8. Other Cost (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

Not applicable.

SCENARIO FOUR PRICING - FOR BOONE COUNTY, THE UNIVERSITY OF MISSOURI, HOWARD COUNTY AND COOPER COUNTY – 6" RESOLUTION IN ALL COUNTIES

Item 4.2.4 - Orthophotography (See Attachment 4)

Option One: Orthophoto Regional Flight - Total Mileage

4.2.4.1.	Cost for 4.8 sqmi - 3" Color Orthophotography	$	6,000
4.2.4.2a.	Cost for 3142 sqmi - 6" Color Orthophotography	$	219,000
	Or		
4.2.4.2b.	Cost for 3277 sqmi - 6" Color Orthophotography - Additional area is contiguous to Boone County	$	229,000
4.2.4.3a	**Total**	**$**	**225,000**
4.2.4.3b.	**Total with additional area**	**$**	**235,000**

4.2.4.4. Color-IR (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

Color-IR cost is included in the ortho pricing above.

4.2.4.5. Ground control targets (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

Ground Control cost is included in the ortho pricing above.

4.2.4.6. Optional digital file formats MrSID photomosaic (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

The first Mosaic is free, then for each additional mosaic $500 per.

4.2.4.7. Other Cost (Identify Cost Below Per PAQ Participant Or Check Here if Cost Identified Below is the Same for All Participants: X)

Not applicable.

4.2.5 Orthophotography Pricing – Continued

OPTION 2 – Per Square Mile Matrix - Alternate to Total Mileage Pricing – Price per each square mile for the indicated mileage at the indicated resolution.

Item Number	Flight Range Total Square Miles	Resolution 3"	Resolution 6"	Resolution 9"	Resolution 12"
4.2.5.1	30 to 100	400	150	100	50
4.2.5.2	101- to 800	300	100	68	35
4.2.5.3	801 to 2000	255	85	62	29
4.2.5.4	2001 to 4000	240	80	59	27
4.2.5.5	4001+	225	75	51	25

4.2.5.6 Other Cost associates with per mile pricing that will be charged:

None

PART TWO - LIDAR PRODUCT

Item 4.2.6 - LiDAR

4.2.6.1. **OPTION 1 – Classifying Bare-Earth LiDAR: County-wide Flight and Processing (See Attachment 5)**

4.2.6.1a.	Cost for 690 sqmi – 0.7m County LiDAR (bare earth and hydro flatten to USGS spec)	$	120,000
4.2.6.1b.	Other Additional Cost_____	$	0
4.2.6.1c.	**Total .7m County LiDAR**	**$**	**120,000**

4.2.6.2.	**OPTION 2 – Classifying Bare-Earth LiDAR: University of Missouri (See Attachment 6)**		
4.2.6.2a.	Cost for 4.8 sqmi – 0.7m LiDAR over campus (Point Cloud (all points returned), bare earth and hydro flatten to USGS spec)	$	12,000
4.2.6.2b.	Other Additional Cost_____	$	0
4.2.6.2c.	**Total .7m MU LiDAR**	**$**	**12,000**
4.2.6.3.	**OPTION 3 – Classifying Bare-Earth LiDAR: University of Missouri (See Attachment 7)**		
4.2.6.3a.	Cost for 4.8 sqmi – 4PPM QL2 LiDAR over campus (Point Cloud (all points returned), bare earth and hydro flatten to USGS spec)	$	13,500
4.2.6.3b.	Other Additional Cost_____	$	0
4.2.6.3c.	**Total 4PPM – QL2 MU LiDAR**	**$**	**13,500**
4.2.6.4.	**OPTION 4 – Classifying Bare-Earth LiDAR: University of Missouri (See Attachment 8)**		
4.2.6.4a.	Cost for 4.8 sqmi – 10PPM QL1 LiDAR over campus (Point Cloud (all points returned), bare earth and hydro flatten to USGS spec)	$	15,000
4.2.6.4b.	Other Additional Cost_____	$	0
4.2.6.4c.	**Total .10PPM MU LIDAR**	**$**	**15,000**

PART THREE – TOPOGRAPHICS AND PLANIMETRICS

4.2.7.	**TOPOGRAPHIC AND PLANIMETRICS (See Attachment 9)**		
4.2.7.1.	Cost for 4.8 sqmi Campus New 2' Contours (Attachment 8)	$	2,500
4.2.7.2.	Cost for 4.8 sqmi Roofline Elevations for MU Campus	$	4,000
4.2.7.3.	**Other cost** associated with topographics and planimetrics that will be charged:		

Item 4.2.7.1. is based on LiDAR being part of the final scope of work.

ALL OTHER COSTS:

4.8 ADDITIONAL CHARGES / ALTERNATE DELIVERABLES (IF ANY)

Regardless of product, identify any other required additional charges below. Attach supporting documentation to help explain the costs. As necessary, if charges a specific charge applies only per certain county/entity or if it is an across-the-board standard rate for the regional flight area. The PAQ Respondent has the option to introduce alternate deliverables here and to price them accordingly:

_____		$ 0
_____		$ 0
_____		$ 0
4.8.1	**Total Additional Charges**	$ 0

Other PAQ Response Details:

5.1 DELIVERY DATES

5.1.1 Estimated total number of planes used for flight(s):

Ortho: 3 LiDAR 2

5.1.2 Estimated calendar date(s) of flight(s): _____

Ortho: 2/1/19 – 3/31/19 LiDAR: 2/1/19 – 3/31/19

5.1.3 Estimated days to complete Orthophotography Product /Delivery to Participating Entity: 122 Calendar Days

5.1.4 Estimated days to complete LiDAR Product /Delivery to Participating Entity: 60 Calendar Days

5.1.5 Estimated days to complete Topographies and Planimetrics /Building Elevations Product (MU)/Delivery to Participating Entity: 16 Calendar Days

The following is a representative overview of the project schedule based on the following scenarios. The actual schedule will be determined based on your selected options.

- **Ortho Schedule is based off of Scenario 4 (1.8.2.1) – 6" orthos for all participating counties**
- **LiDAR Schedule is based off of Scenario 1 (1.8.2.2) – QL2 LiDAR over entire Boone Co.**

Boone Co. 2019 Project Schedule		
Production Task	**Start Date**	**End Date**
Orthophotography		
Flight Acquisition	February 1, 2019	March 31, 2019
Early Access Prelim Orthos**	**April 30, 2019**	
Survey Control	February 1, 2019	February 15, 2019
Aerotriangulation	March 15, 2019	April 15, 2019
Ortho Production	April 15, 2019	August 15, 2019
Ortho Pilot Deliverables**	**May 15, 2019**	
Client Review	August 15, 2019	September 15, 2019
Final Deliverables	September 15, 2019	October 15, 2019
LIDAR - Boone QL2		
Flight Acquisition	January 15, 2019	March 31, 2019
LiDAR Production	April 1, 2019	May 30, 2019
Pilot Deliverables**	**May 1, 2019**	
Client Review	May 31, 2019	June 29, 2019
Final Deliverables	July 1, 2019	July 30, 2019
Mapping - MU Campus		
Planimetric Mapping Production	April 16, 2019	May 1, 2019
Client Review	May 2, 2019	May 17, 2019
Final Deliverables	May 18, 2019	May 31, 2019

5.2 PROJECT CONTACT

If different than the contact provided on the first page of the PAQ Response page, provide a project contact person who will be responsible for coordinating the efforts and personnel of all parties involved in the response, to include, but not be limited to, oral presentations, demonstrations, site visits and responses to request for clarification, if any. Provide the following:

Name: Tim Donze

Address: 520 Spirit of St. Louis Blvd., Chesterfield, MO 63005

E-mail: TimD@surdex.com

Phone Number: (314) 422-7616 direct or (636) 368-4424 desk or (636) 368-4400 main office

Fax: (636) 368-4401

Hours of Availability: 8 am to 7 pm.

5.3 EXPERIENCE AND RELIABILITY

The evaluation of the vendor's proposed experience and reliability will be subjective based on the ability of the vendor to perform the requirements stated herein. Therefore, the vendor should present detailed information regarding their experience and reliability. The following information should be provided by the vendor in order to assist Boone County in the evaluation of the vendor's experience and reliability. The County reserves the right to use this information, including information gained from any other source, in the evaluation process.

Failure to submit requested information may negatively impact the evaluation of the proposal. The County is under no obligation to obtain information from the vendor not submitted with the proposal that may impact the subjective evaluation of the vendor's proposal.

5.3.1 Company History

The vendor should describe in the available space the company's background in provision of photogrammetric services, e.g., when the company was founded, how long the company has been serving the national and Missouri markets, etc.:

Surdex is one of the premier aerial mapping companies in the United States, under continuous operation by the same ownership since 1954. Our headquarters and production facility are based in the greater metropolitan St. Louis, Missouri, area. Over the last decade we have grown from a regional company to a nationwide presence, including projects in Canada and Mexico. Approximately 100 employees work at our headquarters building and hangar complex at the Spirit of St. Louis Airport in Chesterfield, Missouri. Our clientele includes federal, state, and local government as well as private engineering, defense mapping, and Homeland Security.

Surdex Company Details	
Detail	Information
Company Name	Surdex Corporation
Business Address and Production location	520 Spirit of St. Louis Blvd. Chesterfield, MO 63005-1002 United States
Website	www.surdex.com
Year Established	Est. 1954, Missouri
Company Organization	Surdex is a privately held S-Corporation, owned by the same family members since its formation in 1954.
Phone / Facsimile	(636) 368-4400 / (636) 368-4401
Industries Served	Governments (federal, state, county, municipal), private engineering, transportation, and energy

Surdex brings a depth of equipment and experienced staff to the table.

Surdex's Features and Benefits	
Feature	Benefit
In continuous operation under the same ownership for over 60 years.	Demonstrated staying power, assuring clients of the company's financial stability and proven commitment to success. We have a proven focus on assessing and investing in technology.
A base of leadership and experience exemplified by an extremely high retention rate. Our senior staff averages over 25 years of experience at Surdex and within the profession.	Our staff's extensive experience enables us to quickly and easily resolve issues – as well as the foresight to anticipate and prevent many of them.
Our staff has numerous certifications in surveying and photogrammetry.	Certified professional knowledge and achievement that assures our clients of professionalism.
A strong dedication to project management and client interaction.	We involve our clients as true partners and emphasize communication and information to ensure successful projects.
Aggressive research and development effort to improve performance, accuracy, and quality.	Demonstrated embracing of new technology and solutions to provide the highest quality services to our client base.
Fleet of 10 aircraft supported by FAA-certified inspection, maintenance, and repair.	Vast acquisition capacity addressing all types of aerial acquisition. Our in-house maintenance, inspection, and repair staff ensure the maximum availability of these key assets.

Surdex has a strong background in both prime contracting and subcontracting to other companies in the geospatial data and services realm.

Surdex's Geospatial Data Services	
Service	Benefit
Aerial data acquisition with film and digital imaging sensors as well as LiDAR.	Foundation for digital orthoimagery, planimetric mapping, and topographic mapping.
Surdex's customized digital orthoimagery production line is exemplified by performance and quality.	Highest possible quality products and schedule assurance.
LiDAR data acquisition and processing for bare earth and hydro-enforced elevation models, classifications, and contours.	Full service topographic mapping and value-added LiDAR products to address any requirements.
Stereocompilation equipment and software for topographic modeling and planimetric mapping.	Accurate and high-quality mapping.

Our success can be attributed to our:

- **Robust Quality Control Measures**: Building upon achieving ISO Certification for specific geospatial products for the National Geospatial-Intelligence Agency, Surdex has instituted ISO processes internally to optimize our quality control and efficiencies. This provides an exceptionally high level of first-time client acceptance (98.8%) and adherence to schedules (on-time delivery rate of 96.7%).
- **Experienced and skilled staff**: our senior staff averages 25 years of experience, and our technicians average 9 years. We have over 15 Registered Land Surveyors and/or ASPRS Certified Photogrammetrists, and a number of these have advanced degrees.
- **Aerial sensors:** Surdex has eight large-format digital imagery sensors (five Leica ADS100s, three Leica DMC-1s), six Leica RCD30 medium format digital sensors configurable as separate or oblique (five head or three head), two film cameras, and three Teledyne Optech Galaxy LiDAR sensors.
- **Aerial acquisition:** Surdex boasts a fleet of ten Cessna aircraft supported by our own FAA-certified for inspection, maintenance, and repair to ensure maximum availability. Our premier imagery acquisition aircraft are our four twin-turbine Cessna 441 (Conquest), which can operate up to 35,000' and cruise at over 300 knots. They can ferry from our home base to any of the lower 48 states within 6 hours, allowing us to take advantage of good weather.
- **Digital Orthoimagery:** Surdex's processing environment consists of a significant amount of customized software coupled with open source and 3rd party software. Processing is tied into an Enterprise database with comprehensive status tracking and a high degree of task automation. Processing is performed in a distributed processing environment under a common user interface allowing easy cross-training. The software supports all standard file formats such as TIFF, GeoTIFF, MrSID, JPEG, and JPEG2000.
- **Extensive experience**: Surdex has been awarded, through competitive processes, projects of all sizes throughout the nation, including the 275,000 square mile statewide digital orthoimagery project for the State of Texas, over 7 million square miles of orthoimagery for the USDA National Agriculture Imagery Program (NAIP) since 2002, existing contracts with the Army Corps of Engineers, a current USGS GPSC contract, and numerous repeat state and local government and private clients.
- **Web-Based Client Product Inspection Tool**: Our SurCheck℠ online inspection tool streamlines the inspection, remedial action, and acceptance process and has been in use for over five years. It has been proven to simplify and reduce overall project timelines.
- **Ground Control Surveys**: Surdex performs ground control surveys all over the country with RTK GPS systems and geodetic grade GPS equipment.
- **IT infrastructure**: We have over 2.1 PB of digital storage with over 100 processors, supported by a dedicated generator to assure ongoing production in the event of power disruption. All interim and final data is backed up to LT06 tape on rigorous cycles, ensuring speedy recovery and de-archiving.
- **R&D**: Surdex continuously investigates and integrates new hardware and software technology as well as processes. The focus of the R&D staff is to optimize throughput, quality, and accuracy.
- **Planimetric and Topographic Mapping**: Stereo compilation of planimetric and topographic mapping is performed on analytical plotters and softcopy photogrammetric workstations.
- **LiDAR Processing**: We process all LiDAR data using commercial software products produced and custom software tools developed by Surdex.

5.3.2 Vendor References

The offeror should provide at minimum two references below regarding provision of photogrammetric services similar to what is being requested by this PAQ request:

Reference 1:

Company/Entity Name: **Mid-America Regional Council (MARC)**

Contact Name: Jakob Goldman

Contact's Title: GIS Specialist

City: Kansas City, MO 64105

Telephone Number and Area Code (816) 701-8307

Email Address: jgoldman@marc.org

Description of Equipment/Services Furnished The description is listed below in the Project Narrative.

Availability of Reference: Yes

Project Narrative					
Surdex has worked on this project three times since 2010, covering approximately 7,400 square miles of 6" GSD imagery. To reduce building lean of tall buildings in approximately 15 square miles of urban Kansas City, Surdex densified the flight lines. The client-provided DEM was also updated and provided as a deliverable.					
Year	Sensor	GSD	≈ Sq. Mi.	Acquisition Conditions	Notes
2018	ADS100	6"	2,678	February 17 to April 10, 2018	6,150' AGL
2016	ADS100	6"	2,526	February 12-March 27, 2016 3,000' buffer past county boundaries	6,150' AGL
2010	DMC	6"	2,172	Mid-February to late March	4,800' AGL
Project Deliverables				• 6" GSD 4-band digital orthoimagery of Kansas City metro area in GeoTIFF and MrSID format • Updated DEM • Metadata files by tile and county in FGDC .xml format • Mosaic seamlines in ESRI format	
Dates				January 1, 2016 through September 1, 2016	
Subcontractors				None	
Challenges				• Project area includes both Missouri and Kansas • Burning fields in Leavenworth County	
Highlights				Acquisition at 6,150' AGL, with increased flight lines over urban areas, increasing sidelap to 55%, thereby reducing building lean	

Reference 2:

Company/Entity Name: **St. Louis County Imagery Consortium**

Contact Name: Madhukar Mohan, Metropolitan St. Louis Sewer District (MSD)

Contact's Title: GIS Manager

City: St. Louis, MO 63139

Telephone Number and Area Code (314) 768-2735

Email Address: MMohan@stlmsd.com

Description of Equipment/Services Furnished The description is listed below in the Project Narrative.

Availability of Reference: Yes

Project Narrative
Surdex has undertaken this project twice in the past three years for a total of approximately 1,850 square miles. In 2018, Surdex acquired 1,181 square miles of 6" GSD imagery using the ADS100 sensor (we also acquired imagery in St. Charles County, which provided additional project area). In 2016, Surdex acquired 665 square miles of orthoimagery in St. Louis City and County. We collected the imagery using the ADS100 sensor at a resolution of 6" GSD and utilized existing control from St. Louis County and the surface from a Surdex LiDAR project. Surdex has provided yearly orthoimagery for municipalities in the St. Louis region since 2010. City planners use the imagery for decision-making about everything from fixing roads to new building developments. This project is a regional collaboration between 27 St. Louis partners.

Year	Sensor	GSD	≈ Sq. Mi.	Acquisition Conditions
2018	ADS100	6"	1,181	Midday, late in the season
2016	ADS100	6"	665	Midday, late in the season
Project Deliverables				• RGB Natural Color digital orthophotos with 0.5' in GeoTIFF w/tfw and MrSID format, delivered to all partners. • Mosaic seamlines exported to ESRI shapefile. • Tile layout in ESRI shapefile format.
Dates				Late February – Early April each year
Subcontractors				N/A
Highlights				To properly collect data for St. Louis's diverse terrain, Surdex planned additional flight lines over areas with a high density of tall buildings and flew as close to midday and late in the season as possible to minimize the length of shadows.

Reference 3:

Company/Entity Name: **Douglas County, KS**

Contact Name: Bryce Hirschman / Dan Rose

Contact's Title: GIS Coordinator

City: Lawrence, KS 66044

Telephone Number and Area Code (785) 832-5190

Email Address: bhirschman@douglascountyks.org

Description of Equipment/Services Furnished The description is listed below in the Project Narrative.

Availability of Reference: Yes

Project Narrative				
This project was a buyup for the 2017 State of Kansas project. Surdex flew and processed the imagery. The project encompassed Douglas, Shawnee and Jefferson counties.				
Year	**Sensor**	**GSD**	**≈ Sq. Mi.**	**Acquisition Conditions**
2017	ADS100	6"	1,588	Late Spring, leaf off
Project Deliverables				• 6" GSD 3-and digital orthoimagery • Tiff imagery • MrSID mosaics for each county • MrSID mosaics for Topeka and Lawrence
Dates				Flown mid-February to late March 2/2018 - 10/2018
Highlights				• Buyup component for the 2017 State of Kansas project. • Monitored atmospheric conditions for crops being burned in western Kansas, this can cause a thin layer of haze.

Proposed Subcontractors

Surdex will utilize one of our survey subcontractors from our State Contract for field Survey.

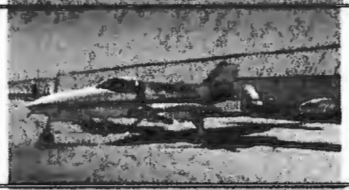
Subcontractors	
Proposed Subcontractor (Name and Address)	**Service Proposed to be Provided by the Proposed Subcontractor**
David Mason & Associates 800 South Vandeventer St. Louis, MO 63110	Field survey
EFK Moen 13523 Barrett Parkway, Suite 250 St. Louis, MO 63021	Field survey

5.4 Hardware and Software including Equipment and Materials

Identify in the available space the all hardware, software, equipment materials and supplies that will be used to conduct requested photogrammetric mapping services (orthophotography, LiDAR, topographies and planimetrics):

Surdex Corporation is a full-service photogrammetric firm. As such, we own and operate all the equipment necessary to process remotely sensed geospatial data. The following is a list of equipment owned and operated by Surdex Corporation.

Surdex's Acquisition Aircraft

Number, Make and Model of Aircraft	Category	Specifications	Image
(4) Cessna 441 Conquest II-10 (with RVSM*)	Twin-Turbine Pressurized	Flight Range: 2,193 nm Altitude: 1,200 - 35,000 AGL Certified Altitude: 35,000 MSL Cruise Speed: ~310 knots	
(1) Cessna 414A Chancellor III	Twin-Piston Pressurized	Flight Range: 900 nm Altitude: 1,200 - 25,000 AGL Certified Altitude: 30,200 MSL Cruise Speed: ~235 knots	
(1) Cessna 335 II	Twin-Piston	Flight Range: 928 nm Altitude: 1,200 - 18,000 AGL Certified Altitude: 26,800 MSL Cruise Speed: ~215 knots	
(4) Cessna TU-206F Turbo Stationair	Single-Engine	Flight Range: 720 nm Altitude: 1,000 - 10,000 AGL Certified Altitude: 26,300 MSL Cruise Speed: ~148 knots	

** RVSM: Reduced Vertical Separation Module. This FAA-certified equipment allows operation above 28,000' (MSL).*

Surdex's Image Sensors

Sensor Make/Model	Serial #	Purchase Date	Calibration Date	IMU Make
Leica ADS100	10510	12/27/2012	06/21/2013	SPAN uIRS
	10515	12/27/2012	07/02/2013	
	10522	12/12/2013	12/16/2013	
	10531	05/14/2014	6/12/2014	
	10552	03/31/2016	04/30/2015	
Leica DMC-1	146	06/24/2005	03/05/2010	IGI AEROControl-IIe
	148	06/22/2006	05/27/2009	
	149	03/22/2007	12/09/2009	

Surdex's LiDAR Sensors				
Sensor Make/Model	Serial #	Purchase Date	Calibration Date	IMU Make
Teledyne Optech Galaxy	5060382	09/27/2016	8/2016	Applanix AP60
Teledyne Optech Galaxy	12SEN314	10/25/2016	11/23/2016	Applanix AP60
Teledyne Optech Galaxy	5060407	02/06/2018	02/23/2018	Applanix AP60

Orthoimagery and Survey Equipment & Software		
Compilation and Orthoimagery		Survey
Stereo Compilation and Mapping 12–Workstations 3–Summit Evolution Direct collection into Arc GIS and Microstation	**Map Edit/Finishing** 4–Workstation Computers 6–GIS Arc/INFO Workstations **Digital Orthoimagery and Imaging** 3 Tape Library Systems 2+ petabyte computer storage capacity 1000+ Core Processing Cluster 12–Workstations XPro	13–Trimble 5700 receivers 6–Trimble TSC1 data collectors running Survey Controller data collection software 1--Leica 5 TCR03 second total station 4–Trimble R8 GNSS receivers 4—Trimble R10 GNSS recievers 1–Trimble R8 GNSS VRS rover with TSC2 data collector running Access field data collection software 1–Trimble R8 GNSS VRS rover with TSC3 data collector running Access field data collection software 4–TOPCON HIPER IV GNSS receivers 10–CHC OPUS RS GNSS receivers with Trimble internal boards 2 – Trimble Business Center (TBC) post processing software 2 – Novatel Waypoint GrafNav/GrafNet GNSS post processing software CORPSCON Blue Marble Geographics GeographiCalculator 1—CHC N71 GNSS CORS base station 1 – Trimmark RTK Base radio
GIS /CADD Software	**Photogrammetric Software**	**Surdex Enterprise Database**
13–ESRI ArcGIS for Desktop 3–AutoCAD 14–Bentley MicroStation 1–GEOPAK Survey 1–GEOPAK Site 2–GEOPAK Descartes InRoads	ImageStation Aerial Triangulation (ISAT) 14–Softplotter Leica XPro	Surdex Inspection Tool Surdex Ortho Surdex Grouping Tool Client Product Acceptance Tool

Production Storage		
System	Storage	Notes
Violin Memory StorNext shared SAN	110TB	Data currently in production. Flash memory better than 400,000 IOPS and 6,000 MB/sec throughput
Infortend StorNext SAN	1 PB	Data currently in production. Drives in a RAID6 configuration.
Windows NTFS Direct Attached Storage (DAS)	1 PB	Raw images – also backed up on LTO6 tapes. The files are distributed across 72 servers and managed by the database
Totals	2.1 PB	Does not include local workstation storage

Backup Power Generator
In the spring of 2016, Surdex installed a diesel-powered backup generator that can fully sustain all production operations in the event of the loss of power; the fuel can be replenished indefinitely. This ensures that adequate time is provided to restore power without interrupting normal operations, ensuring production schedules are maintained.

5.5 Expertise of Vendor's Personnel

The qualifications of the personnel proposed by the vendor to perform the requirements of this RFP, whether from the vendor's organization or from a proposed subcontractor, will be subjectively evaluated. Therefore, the vendor should submit detailed information related to the experience and qualifications, including education and training, of proposed personnel who will be considered key personnel conducting photogrammetric mapping services.

Surdex believes that there is no substitute for experience. Workers' experience on previous projects, resolving difficulties and streamlining processes, enables them to apply their knowledge on your project, saving time, avoiding potential problems, and improving quality.

Surdex staff consists of 100 highly-qualified, highly-trained personnel. We also have an excellent retention rate; of our 25 people in leadership positions, they average over 25 years in the mapping profession and over 15 years employment by Surdex. This longevity equates to higher levels of experience, resulting in an extremely high level of productivity and fewer mistakes – and consequently higher adherence to schedules and quality. Our staff includes:

- 8 ASPRS Certified Photogrammetrists.
- 3 registered professionals land surveyors.
- 1 Project Management Professional (PMP) certification.

1. **Personnel Summary**

Key Personnel Expertise Summary		
Name	**Years Exp.**	**Role**
	Project Management	
Wade Williams, CP	23	Director of Project Management – *ASPRS Certified Photogrammetrist*
Cornell Rowan, CP	34	Project Manager – *ASPRS Certified Photogrammetrist*
	Survey and Control	
Steve Kasten, CP, PLS	37	Survey and Photogrammetric Engineering – *ASPRS Certified Photogrammetrist, Professional Land Surveyor*
	Aerial Triangulation	
Dave Beattie, CP	20	Aerial Triangulation Specialist
Larry Stolte	33	Aerial Triangulation Specialist
	Flight Operations	
Paul Briggs	30	Chief Pilot
Jason Pohlman	11	Flight Acquisition Manager
	Digital Orthoimagery Production	
Colby Forke, CP	18	Director of Image Processing – *ASPRS Certified Photogrammetrist*
John Frese	24	Image Processing Leader
Aaron Garibaldi	12	Orthoimagery Production Lead
	Planimetric and Topographic Mapping and Quality Assurance / Quality Control	
Brad Barker	22	Director of 3D Mapping
	LiDAR Processing	
Michael Goymerac	11	LiDAR Product Leader

2. Resumes of Surdex Key Staff

WADE WILLIAMS, CP
Director of Project Management

EXPERIENCE

- Surdex Corporation
  - Company: 23 years
  - Professional: 23 years

EDUCATION

- B.S. Geography and Cartography, Missouri State University

CERTIFICATION

- ASPRS Certified Photogrammetrist, #1290 (2006)

SOFTWARE PROFICIENCIES

ESRI ArcGIS, Adobe Photoshop, Lizard Tech Geo Express, Global Mapper, Accuracy Analyst, Microstation, FileZilla FTP, Surdex GroupTool

PROJECT DUTIES

With 15 years of project management experience at Surdex, Wade is one of our most experienced project managers. As the Director, he oversees the project management staff, ensuring all projects remain on schedule and all deliverables meet specifications. He provides the team leadership skills to make timely decisions based on his understanding of project initiating, planning, executing, monitor/controlling & closing phases. His knowledge of these key phases ensures the successful completion of each project.

Wade oversees assigned projects and manages the scopes of work for various clients. He is responsible for managing in-house communications regarding all aspects of project execution including client communication, project planning, surveying, aerial imagery acquisition, image processing, aerial triangulation, LiDAR processing, planimetric/

	topographic feature collection and digital orthoimagery production.

CORNELL ROWAN, CP
Project Manager

EXPERIENCE

- Surdex Corporation
  - Company: 10 years
  - Professional: 34 years

EDUCATION

- B.S. Engineering Technology, Jackson State University, Mississippi

CERTIFICATION/MEMBERSHIP

- ASPRS Certified Photogrammetrist, #1055 (1997)

SOFTWARE PROFICIENCIES

ESRI software (ArcInfo, ArcGIS and ArcView), Intergraph's MicroStation, AutoCAD, Autometric's SoftPlotter, PhotoShop and Microsoft Office

PROJECT DUTIES

Cornell oversees assigned projects and manages the scopes of work for various clients.
He is responsible for managing in-house communications regarding all aspects of project execution including client communication, project planning, surveying, aerial photography acquisition, scanning, aerial triangulation, LiDAR processing, planimetric/ topographic feature collection and digital orthoimagery production.

STEVE KASTEN, CP, RLS
Senior VP, Survey / Photogrammetric Engineering

EXPERIENCE

- Surdex Corporation
  - Company: 17 years
  - Professional: 37 years

EDUCATION

- B.S. Earth Science/Cartography, Southern University Edwardsville Illinois
- M.S. Civil Engineering & Photogrammetry, Purdue University

CERTIFICATION / LICENCES

- ASPRS Certified Photogrammetrist, #1038 (1997)
- Survey Licenses:
  - Florida PSM # LS6682
  - North Carolina PLS #L-4106
  - Oregon PP #80665RPP
  - South Carolina PLS, #24303
  - Virginia SP #000119

SOFTWARE PROFICIENCIES

AutoCAD, MicroStation, Global Mapper, Trimble Business Center, Trimble Geomatics Office, Waypoint GrafNav/GrafNet, Corpscon, ISAT, Bingo, XPro, ESRI ArcGIS, IMAGINE, Agisoft Photo, Scan, Pix4D, ISite, Realworks

PROJECT DUTIES

Steve has over 35 years of experience in the fields of photogrammetric engineering application development, photogrammetric mapping, geodesy, cartography and surveying. While at Surdex, Steve has performed disparate duties that include the management of photogrammetric projects, airborne GPS survey data and triangulation. In addition to his extensive project management experience, Steve has experience providing direct photogrammetric engineering support services. He is skilled in developing algorithms for sensor modeling, post processing of GPS data, error propagation, photogrammetric data reduction, and implementing algorithms into engineering programs. Steve is a licensed professional in Survey, here is a listing of his licenses:

- Florida Professional Surveyor and Mapper License # LS6682
- North Carolina Professional Land Surveyor, #L-4106
- Oregon Professional Photogrammetrist, #80665RPP
- South Carolina Professional Photogrammetric Land Surveyor, #24303
- Virginia Surveyor Photogrammetrist, #000119

DAVE BEATTIE, CP

Aerial Triangulation Specialist

EXPERIENCE

- Surdex Corporation
  - Company: 19 years
  - Professional: 20 years

EDUCATION

- B.S. Cartographic Sciences, Missouri State University

CERTIFICATION

- ASPRS Certified Photogrammetrist, #1417 (2009)

SOFTWARE PROFICIENCIES

Surdex Grouping Tool software suite, Leica XPro, ArcMap, Global Mapper, Inertial Explorer and Surdex Hydra

PROJECT DUTIES

Dave's experience ranges from sensor operation, finishing and surveying—to cost estimation. This unique combination gives him the depth of understanding required to accurately complete Surdex's aerial triangulation.

As Aerial Triangulation Specialist, Dave understands the interrelationships between flight parameters, survey layout and field crew coordination. Dave evaluates each FAAT solution, producing the final reports for QC verification and approval. His unique experience supplements his ability to precisely determine the cause of FAAT anomalies and eliminate them from future occurrences where possible.

LARRY STOLTE
Aerial Triangulation Specialist

EXPERIENCE

- Surdex Corporation
  - Company: 33 years
  - Professional: 33 years

EDUCATION

- U.S. Army Electronic School

SOFTWARE PROFICIENCIES

Waypoint – GrafNet, Waypoint – GrafNav, Waypoint – Inertial Explorer, Image Station Automatic Triangulation, Leica XPRO, Surdex Group Tool

PROJECT DUTIES

Larry has over 15+ years of direct experience performing Fully Analytical Aerial Triangulation (FAAT) and photogrammetric services. Larry has a unique blend of experience that allows him to accurately and adequately evaluate and process each FAAT challenge.

As a Fully Analytical Aerial Triangulation Specialist, Larry retains complete knowledge of the interrelationships between flight parameters, survey layout and field crew coordination, as well as a thorough knowledge of the challenges associated with each specialty. Larry personally evaluates each FAAT solution, producing the final reports for QC verification and approval. His unique experience in stereocompilation, surveying, and imagery inspection supplement his ability to precisely determine the cause of FAAT anomalies and eliminate them from future occurrences where possible

PAUL BRIGGS
Chief Pilot

EXPERIENCE

- Surdex Corporation
  - Company: 6 years
  - Professional: 30 years

EDUCATION

- B.S. University Studies, Aviation, Broadcasting and Music, Minot State University North Dakota

CERTIFICATION

- FAA Certified
- ATP Airline Transport Pilot – AMEL #3055926
- Commercial Pilot, Instrument Pilot – ASEL
- FAA Class 1 Medical
- FCC Radio Telephone Operators Permit
- F27 Type Rating

PROJECT DUTIES

Paul joined Surdex in 2013, bringing over 30 years of exceptional pilot skills and expertise in aerial acquisition. At Surdex, prior to becoming Chief Pilot, Paul trained all of Surdex's new and advancing pilots. As Chief Pilot, Paul is responsible managing Pilot's schedules and availability and knowledge of flight specifications for each mission. He is engaged in the pre-flight planning preparations, including monitoring weather conditions, review of aerial flight plans for LiDAR and photography capture, adherence to overall project specifications, proper equipment and material handling procedures, pre- and post-flight status reporting, and all FAA notices and air space designations along with any NOTAMs (notices to airmen).

Paul is also responsible for updates and adherence to Surdex's ISO procedures.

JASON POHLMAN
Flight Acquisition Manager

EXPERIENCE

- Surdex Corporation
  - Company: 11 years
  - Professional: 11 years

EDUCATION

- Applicable Technical Training for Aerial Survey Sensor Operation; Certificate

PROJECT DUTIES

As Flight Acquisition Manager, Jason is responsible for preparation and/or review of aerial flight plans for the capture of imagery or LiDAR data, adherence to overall project specifications, weather condition monitoring, proper equipment and material handling procedures, pre and post flight status reporting.
Jason manages the operation of the sensors, which includes the installation of these sensors into the aircraft and managing maintenance and repair schedules. He oversees the personnel for training on the sensor hardware and software. He maintains a clear understanding of flight capture conditions, internal/external priorities and aerial sensor limitations, installations, calibrations as well as GPS/IMU data collections.

COLBY FORKE, CP
Director of Image Processing (Orthoimagery)

EXPERIENCE

- Surdex Corporation
  - Company: 17 years
  - Professional: 18 years

EDUCATION

- B.S. Geography, University of Nebraska

CERTIFICATION / MEMBERSHIP

- ASPRS Certified Photogrammetrist, #1598 (2016)
- Adoption of ISO 9001 Quality Assurance Standards

SOFTWARE PROFICIENCIES

ArcMap, Applanix PosPac, Adobe Photoshop, Orthovista, GeoExpress, MrSID, Socet Set, Softplotter, Microstation, Global Mapper, Leica XPro, Surdex Production Tools (GroupTool)

PROJECT DUTIES

Colby supervises and coordinates all phases of production that includes image processing, ortho-mosaic, and imagery quality control management. Colby works with the imagery and orthoimagery managers daily to coordinate production tasks, set priorities and assist with resource management. Colby directly reports to Michael Mueller, VP of Operations, on resource allocations and progress of each project. He works closely with each project manager to assure our clients' needs are met for every project.

JOHN FRESE
Image Product Leader

EXPERIENCE

- Surdex Corporation
  - Company: 16 years
  - Professional: 24 years

EDUCATION

- B.A. Art, Northwestern University, Illinois

SOFTWARE PROFICIENCIES

Surdex Grouping Tool software suite, Leica XPro, Leica FramePro, Intergraph ZIPPS, Symantec BackupExec, Adobe Photoshop, GlobalMapper, IntergraphISAT, Inertial Explorer, Aero Office, Suinox Hydra (distributed processing)

PROJECT DUTIES

As the Image Product Leader, John manages a team that is responsible for all image processing and inspection of digital imagery for each mission flown by Surdex. John has overseen the production of digital imagery for some of the company's largest and most challenging projects.

AARON GARIBALDI
Orthoimagery Production Lead

EXPERIENCE

- Surdex Corporation
  - Company: 12 years
  - Professional: 14 years

EDUCATION

- Studied Geographic Information Science and Cartography at the University of West Florida

SOFTWARE PROFICIENCIES

ArcMap, Applanix PosPac, Adobe Photoshop, Orthovista, GeoExpress, MrSID, Socet Set, Softplotter, Microstation, Global Mapper, Leica XPro, Surdex Production Tools (GroupTool)

PROJECT DUTIES

Aaron is involved in the production of high-end digital ortho imagery.
His activities include orthorectification, radiometric balancing, cutline placement, Quality Control and final preparation and packaging of digital orthoimage data products.

BRAD BARKER
Director of 3D Mapping (QA/QC)

EXPERIENCE

- Surdex Corporation
  - Company: 20 years
  - Professional: 22 years

EDUCATION

- B.S. Cartography and Map Technology, Southwest Missouri State University

SOFTWARE PROFICIENCIES

ESRI ArcGIS, AutoCAD, Microstation, TerraSolid Software Suite, DAT/EM, LP360, Global Mapper, FME

PROJECT DUTIES

Brad supervises and coordinates the production phases of compilation, LiDAR, and finishing. Brad works with each of the department managers daily to coordinate production tasks, set priorities, and assist with resource management.
Brad's responsibilities include project design for GIS systems, ensuring LiDAR projects meet USGS LiDAR Base Specifications and Quality Assurance for all derivative product creation. Brad has expertise in GIS/CAD and LiDAR software packages including the full ESRI suite of software products.

MICHAEL GOYMERAC
LiDAR Product Lead

EXPERIENCE

- Surdex Corporation
  - Company: 3 years
  - Professional: 12 years

EDUCATION

- B.S. Geography, Minor in Geology, Northwest Missouri State University

SOFTWARE PROFICIENCIES

MicroStation, TerraSolid Software Suite, GeoCue, LAStools, ArcGIS (Certified), Google Earth, Global Mapper

PROJECT DUTIES

As LiDAR Specialist, Michael is responsible for all phases of LiDAR processing and ancillary production. He has intimate knowledge of the entire LiDAR project life cycle which includes planning, acquisition, ABGPS/IMU processing, initial LiDAR processing, manual and automated classification and editing. Michael is well versed with the TerraSolid Suite of LiDAR processing softwares and GeoCue's data management system. He is also experienced with various software packages from his previous photogrammetric mapping responsibilities.

5.6 OTHER

Identify any other detail about performing requested photogrammetric mapping that may be relevant in the evaluation of PAQ responses that distinguishes or differentiates the vendor from its competition:

1. What Distinguishes Surdex

Every firm submitting on this project likely has all the essential components to undertake this project; what separates them is their ability to manage the product, keep you apprised of its progress, and help you evaluate and validate the product quality and accuracy. They should have the knowledge and experience to avoid most issues inherent in large and complex projects and the ability to shift resources/capacity to keep your project on schedule – without any risk to product quality and accuracy. Hard work on our part should equate to an easy project for you.

- Surdex has instituted rigorous standard process for all phases of production; consistency of approach assures consistency of product and improved adherence to schedules.
- Our ISO Quality Assurance (QA) and Quality Control (QC) mechanisms ensure inspection and validation of all data at each phase of production, prior to advancing it to the next phase of production. Catching any defects at the stage of inception, rather than in later stages of production, results in reduced rework, minimal delays, and better product quality. We provide our clients with an average on-time delivery rate of 97%.
- Our Project Management approach calls for ongoing and regular communication with our clients. Tracking the project internally, Project Managers keep your project on task and on schedule, and they communicate progress to you. Should irregularities occur, their first order of business is to apprise you and inform you of corrective action. We provide access to your project's data via our Enterprise database, which is available 24/7.
- As part of acquisition tracking, we can provide you with our Flight Tracker, an online tool that enables you to track your aircraft in real-time. Many of our clients indicate that being apprised of this critical phase is very important to them – and Surdex is the only firm that offers this service.

- We process data through our web-based inspection tool (SurCheck℠), which provides a methodical, easy-to-use process for data inspection. Irregularities are identified, tagged, sent for correction, and re-inspection to provide you with the highest level of quality. We then provide you with SurCheck so your staff can conduct its own QC of the data. Using this process, we have achieved an exceptionally high level of first-time client acceptance (98.8%).
- Our extensive resources enable us to mobilize assets and personnel, as needed, shifting aircraft as needed to take advantage of windows of opportunity for acquisition and moving staff if for any reason a project becomes delayed – such as due to inclement weather. Many of our competitors do not have a large fleet like us, so they have less ability during the acquisition phase.
- All told, Surdex takes extra effort to ensure your project is accomplished on time, as promised, meeting your specifications, as easily facilitated for you and your staff. We have a client satisfaction rate of 98% being "extremely satisfied." Have peace of mind that your project will turn out exactly as you envisioned.

2. Project Management

Mr. Cornell Rowan will be the project manager and serve as the primary point of contact to your designated representative(s) at all times. Cornell is an ASPRS Certified Photogrammetrist with over 34 years of photogrammetric mapping experience. He will be the direct point of contact, drawing upon others within the Team when required. He reports to the Program Manager for this effort, Mr. Wade Williams, Surdex's Director of Project Management.

Surdex's project management approach is founded on providing relevant information backed by frequent communication. Each of our project managers has experience in nearly all phases of production and most are Certified Photogrammetrists. They are guided by the philosophy that they must support the objectives of their clients and efficiently manage internal resources.

Communication can take the form of face-to-face meetings, e-mails, telephone calls, faxes, webcasts, etc. Our project managers are required to communicate with each of their clients at least once each week and are required to respond to a client's communication within 24 hours of receipt.

If an issue becomes evident to Surdex, our project managers will take the following course of action:

- Inform the client that an issue has arisen and define the situation.
- Develop a set of suggested solutions or actions, consulting internal resources and experts.
- Convey the suggested solutions or actions to the client for discussion and approval.

Each of our project managers is required to:

- Complete a Project Scope document that fully details each project as well as specific internal guidance.
- Conduct a client kick-off meeting to ask questions and arrive at a consensus on all the project's details.
- Host internal meetings:
  - Kickoff meeting with department heads to review all project requirements, evaluate resources, and establish schedules.
  - Weekly internal status meetings with all applicable department heads and senior management.
  - Project close-out meeting that assesses our performance in detail and results in "lessons learned" to improve future performance.
- Maintain information in our Enterprise database:
  - Weekly updates of project cost-to-complete for each task.
  - Weekly updates of project external and internal schedules.

Upon completion of each project, the Project Manager and the business development representative are required to assess the client satisfaction. These results are tabulated and provided to Surdex's Executive Team as well as posted for all employees. Metrics have also been established to grade our progress.

Surdex has developed custom software based on an Enterprise database implementation that provides real-time status to our internal production and management staff. This includes tracking acquisition designs, acquisition progress, and inspection results for both imagery and LiDAR. It also includes extensive tracking of aerotriangulation, DEM development, digital orthoimagery, planimetric and topographic mapping, delivery, and inspection. During the critical acquisition phase, acquisition will be reported daily via graphical and textual reports. Since image inspection occurs in parallel with acquisition, every day includes an update on inspection status and the possibility of isolating re-flights in a timely fashion.

3. Communication for Multi-Participant Projects

Surdex often coordinates projects among several counties, municipalities, and other public entities. For example, in 2018 a project in the State of Mississippi consisted of 10 counties including individual contracts with each partner. One of the largest factors contributing to the success of a project is continuous communication.

Our primary form of communication (receiving and delivering progress reports, responding to questions, etc.) is via the regular email progress reports (noted in the project management section of this document). Each participant receives regular updates which describe the status, any difficulties, proposed resolution, and outcomes of fixes. Participants are continuously updated as to their individual schedules.

Should there be a need for a more immediate, collective form of communication, Surdex can establish a group conference call (in which participants dial up on the telephone) or webinar (in which participants log on to the Internet to share the same screen). Surdex can also attend an in-person meeting with participants at a location convenient to all participants or host the meeting at our facilities.

Proposed Method of Performance

PART ONE: ORTHOPHOTOGRAPHY

Surdex proposes acquiring digital imagery using the Leica ADS100 sensor in aircraft determined by availability and suitability. Surdex will establish sufficient ground control to achieve the prescribed specifications and accuracy standards, with sufficient QC points to validate project accuracy.

Our primary collection parameter is a sun angle above the horizon of 30 degrees or greater. We plan the collection around this number with the general goal of having at least two hours of 30 degrees of more sun angle a day. Using this as a guide, we select the target acquisition dates. Once selected we begin to monitor weather conditions to identify windows of opportunity with suitable atmospheric conditions. When weather is predicted collection conditions, we contact the client to make sure ground conditions for snow, ice and water are appropriate. If approved, we deploy to the base airport in the Mid-Missouri Partners the day before the flight. On the day of flight, we check the weather forecast and fly when the conditions are appropriate.

The following table presents our understanding of the *general* specifications for orthophotography portions of the project. With multiple scenarios / resolutions (3" / 6" / 12" GSD) / project areas, this narrative will describe our acquisition and production process in general. Surdex will discuss these options with Boone County and other participants to elaborate on the scope, answer any questions, and refine a final scope of work. For the most part, each county will be flown at the dominant resolution with higher/lower resolution sub-areas flown separately.

Summary of Digital Orthoimagery Specifications (3" / 6" / 12" GSD)			
Parameter	Specification		Comments
Acquisition Timeframe	Spring 2019		10am – 2pm local time
Buffer	300'		
Ground Conditions	Leaf-off Ground unobscured by snow, haze, fog, dust. Less than 5% cloud cover.		
Sun Angle	Minimum of 30°		
Resolutions by Areas	3" GSD	University of Missouri, Columbia	4.8 sq mi
	6" GSD	Boone County (746 sq mi)	1,340 sq mi
		Cole County	
		Howard County (partial)	
		Callaway County (partial)	
		Cooper County (partial)	
		Moniteau County (partial)	
	12" GSD	Howard County	2,287 sq mi
		Cooper County	
		Moniteau County	
		Callaway County	
Bands	3-Band (Red, Green, Blue)		Optional Color IR on county-by-county basis
Imagery Formats	ESRI Format		
Accuracy Standards	ASPRS Standard Mapping		
Ground Control	Control points and QC points to be determined based on scenarios selected		Controlled using Airborne GPS, MoDOT GPS Reference Station Network and/or MO DNR Geographic Reference System
Datums	Vertical: North American Vertical Datum 1988 Horizontal: North American Datum 1983		(NAVD88) (NAD83)
Reference Frame	Missouri State Plane Central Zone Coordinate System		US Survey Feet

A. Aerial Acquisition Operations

Imagery acquisition is the most critical phase of the project. Surdex brings over a half-century of experience collecting image data and understands the limited opportunities for image acquisition. With Surdex's 10 aircraft located in Chesterfield, Missouri, we can have aircraft "on line" in less than an hour, enabling us to take advantage of good weather to maximize capture.

The start and finish of acquisition will be coordinated with Mid-Missouri Partners to ensure acquisition with optimal visibility and ground conditions.

1. Aircraft

Surdex is widely regarded by clients and colleagues as one of the premier aerial acquisition companies in North America. All of our aircraft are owned and operated by Surdex. We have a fleet of ten acquisition aircraft, which are listed in Section 5.4 earlier in this document.

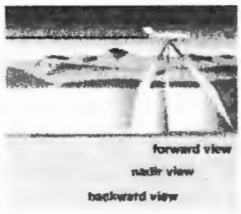
- All aircraft are made by Cessna, standardizing maintenance, repair, inspection, operation, and training.
- Ability to host any of our aerial data acquisition instruments (digital imaging sensors, LiDAR).
- A mix of slower/lower and faster/higher aircraft to address our versatile acquisition equipment and maximize our resources.

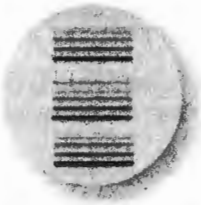
2. Sensor: The Leica ADS100 Digital Pushbroom Camera

Surdex owns five (5) Leica ADS100 Airborne Digital Sensors, making our installation the largest in the United States and one of the largest in the world. Surdex-led teams have logged over 4 million square miles of coverage with the ADS100 as our primary sensor since late 2013.

The pushbroom imaging geometry of the ADS100 includes sets of arrays in the forward, nadir, and back configurations, collecting imagery simultaneously to produce a "pixel carpet" of the ground scene and providing alternative views of the ground scene and stereoscopic coverage. Each set of arrays acquires at full resolution in red, green, blue, and near infrared.

Leica ADS100 imaging operations (courtesy of Leica Geosystems).





Leica ADS100 Imaging Arrays				
Array	Bands	From Nadir	FOV	Pixels
Forward	RGBN	25.6°	65.2°	16,000
Nadir	RGGBN	0°	77.3°	20,000
Backward	RGBN	19.4°	71.4°	18,000

Pushbroom systems present optimal imaging geometry for digital orthoimages and support highly efficient production:

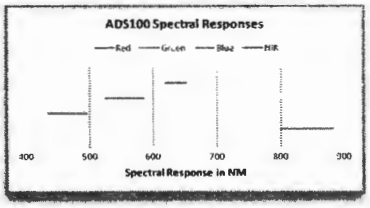
- With the image displacement only varying across the format – and not radial from the center as with frame-format cameras – the amount of elevated feature lean in the final product is dramatically reduced.
- The pixel carpet acquired by the ADS100 substantially reduces the amount of seamlines required to mosaic the orthoimages together, reducing the production effort and minimizing the possibility of seamline artifacts. Correspondingly, the orthoimagery inspection effort is reduced.
- The ADS100 stereoscopic geometry yields the highest attainable horizontal and vertical accuracies and can meet the most stringent ASPRS standards. The ADS100 stereoscopic geometry is superior to the 9"x9" film cameras relied upon for decades.
- With the telecentric lens design of the ADS100, all light rays strike the focal plane normal to the arrays, resulting in the same radiometric response for all pixels. This avoids the well-known "fall-off" issues at the edge of the exposure encountered by the lenses of conventional frame-format cameras. This simplifies balancing during the mosaicking step by minimizing the image-to-image fall-off issue.

- With each band (R,G,B,NIR) in each array collecting at full resolution, features imaged by the ADS100 do not exhibit the blooming and smearing attributed to the pan-sharpening approach taken by virtually every large-format digital frame camera on the market today. This enhances interpretation and results in an aesthetically pleasing rendition of color. This project calls for 3-band imagery, with options for 4-band on a county-by-county basis.
- The spectral responses of the bands do not overlap, making the ADS100 ideal for automated image classification.

Leica ADS100 installation in a Surdex Cessna 441

Features and Benefits of the ADS100	
Feature	**Benefit**
20,000 pixels wide at nadir – one of the largest swaths of any digital sensor on the market today.	Reduced acquisition effort and time. Fewer resources required for large projects.
Smallest pixel size (5um) of any sensor used today.	Allows increase in acquisition altitude, reducing flight time in rugged terrain since fewer line breaks are required, and can often operate above problematic airspaces.
Time-Delayed-Integration (TDI) image motion compensation for the first time in a pushbroom system: (1) Reduces integration/cycle time (2) Increases sensitivity (3) Increases airspeeds	Improved acquisition performance. Higher image quality.
Nadir, forward, back arrays have full color and near infrared.	Improved stereoscopic viewing and exploitation.
Best base-to-height ratio (0.8) of any sensor on the market.	Superior accuracy for digital orthoimagery and topographic mapping.
Benefits of the pushbroom approach: (1) Near-nadir views of ground features (2) Fewer seamlines required in mosaicking process (3) Continuous stereoscopic imaging using the forward and aft arrays	Substantially less building lean. Reduced production effort. Reduced QC effort. Unlike frame-format cameras, full stereoscopic coverage along the flight direction in rugged terrain.

Leica ADS100 Specifications	
Parameter	Value
Sensor Type	Pushbroom
Pan-sharpening	None
Cross-track pixels	Forward: 16,000 Nadir: 20,000 Backward: 18,000
Focal length	62.5 mm
F-number	f4
Pixel size	5.0 um
Parameter	Value
Pixel registration accuracy	1 um
Integration time	≥ 0.5 ms
Height: GSD ratio	12,500:1
Cross-track field of view (FOV)	77.3°
Along-track field of view (FOV)	Fwd: 25.6° Back: 19.4° Stereo: 45°
B/H Ratio	0.80 (Traditional film cameras: 0.6)
Radiometric resolution	14 bits/pixel
Imaging arrays R= red G = green B = blue N = near infrared	13 Arrays: Fwd: RGBN Nadir: RGGBN Back: RGBN
Radiometric response (nm): Red Green Blue Near Infrared (NIR)	619-651 525-585 435-495 808-882



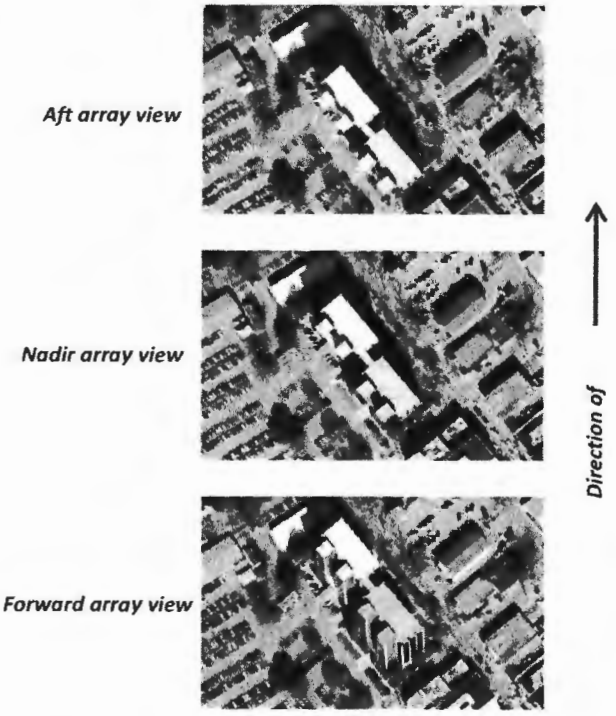
The non-overlapping spectral bands support 4-band projects and are ideal for automated classification.

Using a calibration range near our headquarters or in the field, each ADS100 is "bore-sighted" to determine the alignment and position of the sensor with respect to the GPS antenna and Inertial Measurement Unit (IMU). Surdex also maintains an absolute radiometric calibration of each ADS100 (performed by Leica) to ensure optimal image quality and appearance.

The pushbroom technology offered by the ADS100 streamlines production, especially in situations around elevated structures such as overpasses, bridges, etc. that are not typically represented in bare earth elevation models. Such features generally require a localized surface elevation model to ensure accurate portrayal. Since many features are captured in a near-nadir fashion by the ADS100, this additional production effort is not always required.

The ADS100 forward and aft arrays support stereoscopic exploitation and also provide alternative views of ground features during orthorectification and mosaicking. For example, if specular reflectance hampers imagery from the nadir array, the forward or aft array views of the area can provide an alternative, eliminating this artifact.

The ADS100's arrays provide varying perspectives along the flight line, supporting stereo exploitation and alternative imagery during mosaicking. (Wilson, NC 2017)



B. Project Design

Because there are so many scenarios, it is impossible to provide a definitive project design (flight and control design); upon award, the final project areas will be determined among the participants, and a design will be circulated for approval. All design elements are created to ensure optimal efficiency, taking into account the resolution (GSD), sensor swath width, flight lines, and buffer area. The survey control will be established for all flights – imagery and LiDAR – to maximize coverage and efficiency.

The project design is based on the deliverable tile layout and a 300' buffer around the boundary. Flight planning is the responsibility of Surdex's Flight Acquisition Manager, and each flight plan is reviewed and approved by the Project Manager. The Aerotriangulation and Survey Departments design the ground control network under the direct supervision of a Certified Photogrammetrist and a Registered Land Surveyor.

1. Imagery Flight Design

With multiple diverse options (for both imagery and LiDAR acquisition), this section will discuss our design process in general, opposed to creating specific designs. For each of the four scenarios (covering different area at varied resolutions (from 3" GSD, 6" GSD and 12" GSD for orthoimagery), Surdex will determine the appropriate flying height to ensure the resolution is met. A flight diagram will be laid out with the Leica MissionPro planning software to establish flight lines, and then determine the number and location of control points that are required in order to meet the accuracy specifications. Flight lines will be acquired with a minimum sidelap of 30% to ensure adequate coverage (the ADS100 is a pushbroom sensor and as such has no forward overlap)

This software utilizes an elevation model to rigorously check for adequate forward and sidelap coverage as well as desired product GSD. Flights are planned against the buffered coverage for each seasonal window portion of applicable project areas.

2. Ground Survey Design

After the flight design is complete, Surdex will determine the number and placement of control points that will be required to ensure product accuracy and check points required for validation of the deliverables. Control will be established for both the imagery and LiDAR flights for optimal cost efficiency.

Ground control points are placed to provide a connection between the ground coordinate system and the imagery coordinate system. All imagery will be acquired with a geodetic grade GNSS receiver on the aircraft to reduce the number of needed ground control points. Control points will be generally placed in an evenly distributed pattern throughout the project area. These points will be used in the triangulation process to adjust all the aerial imagery into the project coordinate system.

As a quality check process, Surdex will also target and survey additional ground check points to be used exclusively in the quality check process to evaluate the accuracy of the final digital orthophotography. This QC process will assure that the digital orthophotography meets ASPRS accuracy standards as outlined in the specifications.

Our design approach is:

- Utilize any existing survey points, some of which may be unrecoverable and may need replacement.
- Individual control/check points will be either paneled or photo-identifiable.
- A certain number of check points will be identified to provide independent validation of the project accuracy.
- Overall uniform dispersion of control over the entire project.
- Focus on placing control at junctions of strips, maximizing the number of observations of control points during aerotriangulation to strengthen the solution.

3. Acquisition Effort

During the Spring of 2019, at a 30° sun angle, Surdex will be able to acquire imagery for approximately 4 hours a day during clear weather. Pilots will follow the final approved flight plan, during the hours meeting the minimum sun angle. Owing to the unpredictability of weather, our flight department will mobilize aircraft for a project area when visibility and ground conditions are suitable, and when they are not, the pilots will be redirected to clear areas. This system enables us to acquire multiple projects and shuffle resources to optimize windows of opportunity, as needed.

Imagery is inspected after acquisition, and if any voids or unsuitable imagery is present, a reflight is scheduled as soon as possible following the original flight; this ensures the highest degree of similar conditions between the original imagery and recaptured imagery.

Based on the available hours and the total estimated acquisition hours from the project design, we anticipate up to three imaging aircraft and up to two LiDAR sensors will be required for this effort.

C. Airborne Imagery Acquisition

Acquisition of imagery is one of the most critical phases of any project and requires an extremely high degree of communication between Surdex's Chief Pilot, Flight Acquisition Manager, aircrews, and project manager. Flight plans are updated each evening by merging daily flight reports from the aircrews with the results of imagery inspection to quickly isolate potential re-flights. The Enterprise database issues revised flight plans daily to aircrews via the Internet and/or e-mail.

Surdex's Pilots will inform the local Air Traffic Control (ATC) and/or military air traffic control authority in advance of flight operations. This includes providing aircraft tail numbers and flight designs to ensure the local authority is fully informed. For acquisition involving restricted airspaces and/or Military Operations Areas (MOAs), thorough coordination with the Air Traffic Control centers and often military operations centers is required. In such cases, Surdex proactively provides the necessary information, including flight plans, to the proper authorities to ensure trouble-free access to the areas. Surdex has performed acquisition in and around highly sensitive airspaces, such as White Sands Missile Range (New Mexico), Nellis Air Force Base (Nevada), and the Washington, DC ADIZ (Air Defense Identification Zone). Experience has shown that high degrees of communication and adherence to directives results in long term success. In some cases, a government official has even been present on the aircraft.

Acquisition Approach	
Feature	**Benefit**
Strong coordination with the client: (1) Start and stop acquisition timeframe. (2) Movement to/from the project area. (3) Adherence to client specifications on window, sun angle, etc.	Clients are always aware of our presence on their project.
Coordination with FAA and military operations centers if required. Surdex has successfully operated in some of the most highly sensitive airspaces in the U.S. and Canada.	Assure trouble-free access to restricted or military operations areas.
Monitoring of short and long term weather: (1) Use of weather resources. (2) Enterprise database retains weather reports at each project site during each acquisition window.	Achieves optimal utilization of resources to ensure success for all projects.
Near real-time reporting of status – acquisition and results of inspection.	Clients continuously aware of their project's progress.
Minimize the acquisition window length – oftentimes by putting multiple aircraft on the project. This minimizes the effects of weather and climate on image appearance.	Highest possible image quality across the entire project.
Our large fleet of aircraft and sensors	Ability to handle numerous projects across North America.
Our Enterprise database tracks all acquisition and inspection status: (1) Real-time tracking of our aircraft to monitor acquisition operations. (2) Flight plans updated daily. (3) Re-flights prioritized to ensure minimal time difference. (4) Daily issuance of status.	Maximum application of resources to ensure success.

During imagery acquisition, Surdex flight crews employ the manual exposure value method. Once the aircraft is at the capture altitude, light meter readings are taken over representative terrain and appropriate exposure parameters are locked down. Sensor operators then monitor the meter's measured exposure value beside the current locked value along each flight line. If the locked value differs from the meter's average indicated value by more than 1/3rd f-stop, the operator adjusts the locked value. This exposure metering method is superior to the automatic approach since it does not respond to small bright or dark areas in the scene that would bias the exposure at the expense of the larger area.

Before each acquisition day, a number of activities are undertaken by the aircrew:

- Up-to-date flight plans are downloaded and reviewed.
- Aircraft, ABGPS, IMU, and camera are all inspected for proper operation.
- Final weather checks are made.
- Flight plans are filed with the local airport/FAA.
- If required, base stations are set up.

At the end of each acquisition day:

- Aircraft flight logs are completed.
- Flight reports are completed and emailed or faxed to the production center.
- If necessary, imagery and data transferred from on-board storage to "transfer" hard drives.
- If appropriate, transfer drives are shipped priority overnight to the production center.

It is critical to collect ABGPS/IMU data with the highest possible integrity, taking into account such factors as:

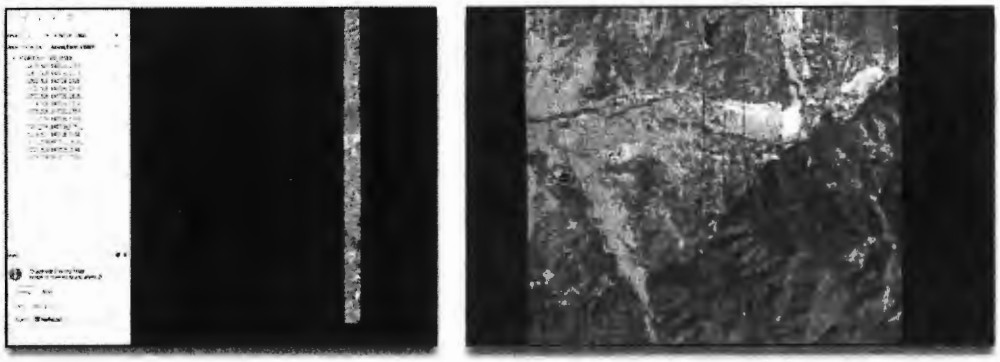
- Operation of base stations to maintain a reasonable distance to the project area.
- Avoiding IMU drift by limiting the length of lines – generally less than 80 miles or 20-30 minutes of flight.
- Using CORS (Continuously Operating Reference Stations) and/or local GPS reference networks to provide multiple observations.

Surdex retains the flight report for each mission and each is reviewed by production personnel. For example, if extreme turbulence or cloud cover is cited by the aircrew for specific areas of the acquisition, prioritized attention is paid to these areas by the inspectors. This may result in a re-flight of a portion or all of a flight line.

D. Imagery Inspection

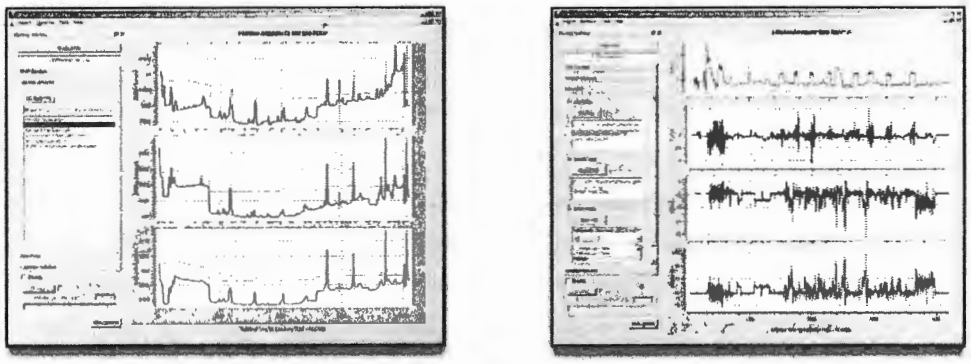
Imagery inspection is critical to the overall success of the project, so all imagery is viewed, graded, and stored in the Enterprise database. Only with this approach can a qualified and timely determination be made regarding the possible need for re-flights and image quality ensured.

ADS100 imagery inspection interface.



Hand-in-hand with image inspection is the processing of ABGPS/IMU data, which supports image reconstruction for pushbroom cameras. Surdex uses the standard Leica workflow to capture and process the ABGPS and IMU data. The ADS100 carries the Novatel SPAN GPS/GNNS inertial navigation system in the aircraft. Surdex uses Trimble R8 model receivers to collect ground base station GPS and GLONASS data during each flight. The position of the ADS100 sensor and the GPS antenna are measured within the coordinate system defined by the central axis of airplane. These measurements along with the GPS and IMU data captured on each flight are processed using Novatel Inertial Explorer software. Inertial Explorer produces a differential solution for the airborne positions and attitude more than a hundred times a second for the duration of the flight. As the Leica ADS100 is a line scanner there are no individual stations, but rather a stream of epochs or fixes are produced at a rate of 128 per second. Only during aerial triangulation are discrete fixes calculated at a spacing dictated by image measurement density.

ABGPS/IMU processing: positional (left) and accelerator (right).



E. AEROTRIANGULATION

Since aerotriangulation (AT) provides the foundation accuracy for the project, it involves checks and balances to ensure accurate results are provided to production process to avoid costly and time-consuming re-work. The inputs to AT include ABGPS/IMU data, sensor boresight data, sensor calibration data, ground control and check point data, as well as the imagery itself.

The AT process involves the following steps:

- Automated measurement of pass and tie points appearing in the overlaps of the imagery.
- Interactive editing of pass and tie points.
- Measurement of control and check points.
- Bundle adjustment yielding refined imagery position and attitude and all point positions.
- If required, re-measurement of points and repetition of the adjustment.

The AT solution is based on a sophisticated bundle adjustment employing a mathematical model of the imaging geometry. It relies on the use of far more observations (observed/recorded values such as ABGPS, IMU, ground control, and image measurements) than are required for a unique solution. Using a least squares optimization approach the observations are refined for a best fit. Careful inspection is made of the various residuals (differences between observed and adjusted values of parameters) reported by the solution. For example, should an ABGPS observed position differ from the adjusted value by a significant amount, this may signal flawed ABGPS data or processing.

Analysis of the quality of the AT solution is performed by a Certified Photogrammetrist who is highly skilled and experienced with the process. Upon the completion of the AT process, the results are stored in the Enterprise Database and published for use in the following production steps.

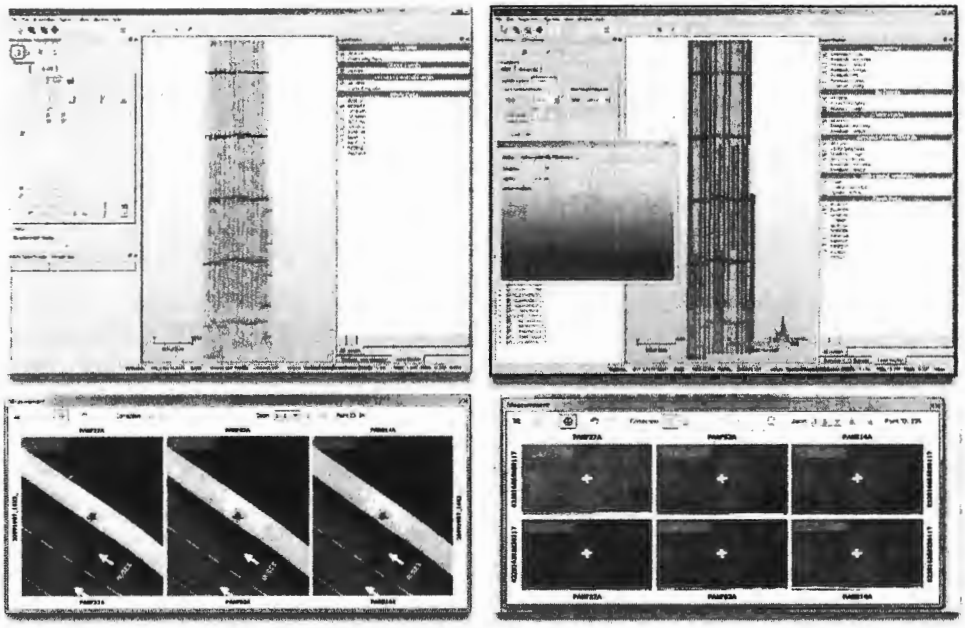
There are several types of points that are measured during the AT process:

Aerotriangulation Points Type		
Type	Description	Measurement
Tie points	Points collected in overlapping images along a flight line/strip of imagery. Used to ensure images in the strip are tied together.	Automatically collected and measured, but may require manual collection and/or editing in difficult areas (dense vegetation, water bodies, etc.).
Pass points	Points collected in overlapping images in adjoining and overlapping flight lines/strips. Ensures adjoining strips are tied together. Pass points are often also tie points so as to strengthen the overall solution.	
Control points	Points of known ground position. Often paneled for recognition and accurate measurement. Manually measured.	Manually measured.
Check points	Points of known ground position. Often paneled for recognition and accurate measurement. Not held to their known position during the AT adjustment process. By allowing their positions to "float", they provide an independent check on the accuracy of the AT.	

The Leica XPro software is used to triangulate ADS100 imagery. It is important to point out that the forward, nadir, and aft arrays of the camera essentially form three separate images of the strip. Thus, the pushbroom scanner is analogous to a frame camera in that all points are imaged in three-way stereoscopic views. Leica's Orima software is used to perform the bundle adjustment.

Aerotriangulation of pushbroom imagery is simplified over the aerotriangulation of frame imagery. There are fewer images from a logistic standpoint, simplifying the amount of automatic matching and manual editing that must be performed. Additionally, the trajectory model ensures cohesive and accurate results within each strip.

Leica XPro ADS100 aerotriangulation interfaces.



An aerotriangulation report written by a Certified Photogrammetrist can be provided upon request. This addresses the following items:

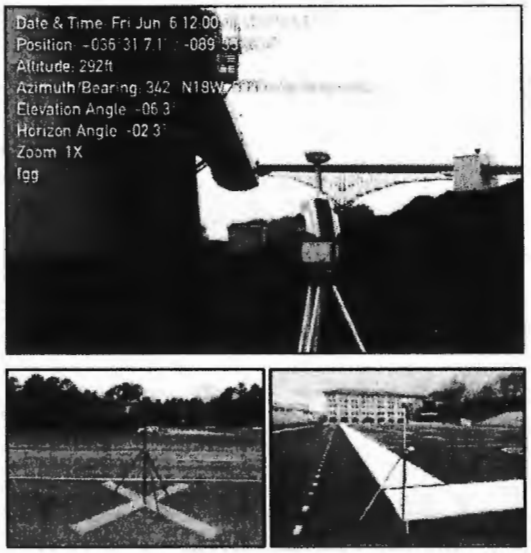
Standard Aerotriangulation Report Contents	
Item	**Description**
Reference frame	Definition of coordinate reference frame used for the aerotriangulation, to include map projection, horizontal datum, vertical datum, linear units (US Survey Feet, Meters, etc.).
Flight line indexes	Shapefile and/or graphical plot illustrating the imagery coverage against the project area. (1) For frame imagery, exposure stations represented as points. (2) For pushbroom imagery, the flight lines represented by polylines between the start and stop of imaging.
Point index	Shapefile and/or graphical plot illustrating the points used in the bundle adjustment, their type, and their identifier.
Weight values	List of weights (standard errors) assigned to all parameters.
Sigma naught (σ_0)	Fundamental single value that expresses the accuracy of the least squares bundle adjustment. Usually reported in microns or pixels and is on the order of 0.1-0.3 pixels.
Standard errors of control points	X,Y,Z standard errors of control points as reported by the bundle adjustment.
Final adjustment of control points	List of control points and a priori and final positions (X,Y,Z).
Points removed from the bundle adjustment	Points (any type) removed from the bundle adjustment and reasons why this action was taken.
Item	**Description**

Residual summaries: **(1) Points (by type)** **(2) Measurements** **(3) Camera positions (frame)** **(4) Trajectory (pushbroom)**	Summary of RMSE (Root Mean Square Error) values and estimated accuracy as reported by the bundle adjustment.
Narrative	Summary of software used for the measurement of points and bundle adjustment, issues encountered, etc.

F. Field Control Survey Operations

The control layout will encompass all final project areas for both the imagery and LiDAR acquisition. To assure consistency in the field data and eliminate observation errors, only fixed height range poles will be utilized during GNSS field data collection. The survey will include only GNSS geodetic receivers set to a minimum of five second epochs for data collection. A minimum GNSS vector observation time of 30 minutes will be utilized. The general data collection minimum observation time will be determined by the vector length using the formula: observation time = 30 minutes + 1 minute per kilometer beyond 30 kilometers. For each GNSS observation site a sketch will be developed, and a digital photo will be acquired in the field. The digital images will be acquired with a software application like Theodolite that automatically records GNSS coordinates and time on all field images.

Ground survey operations.



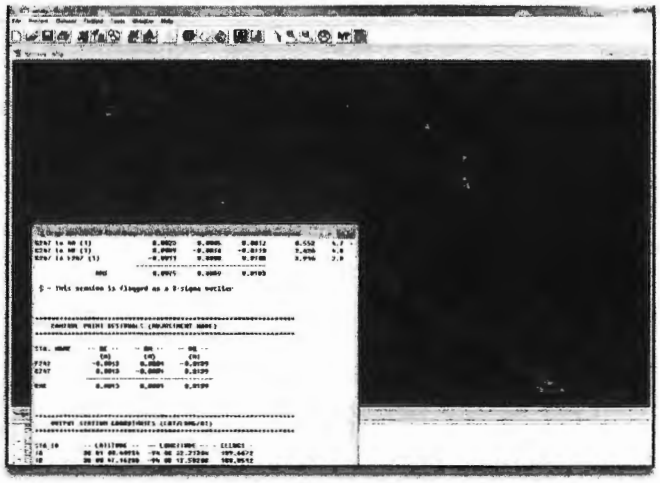
The basic network design will be a GNSS rapid static network, tied into National Geodetic Survey (NGS) horizontal and vertical monuments. The NGS monumentation will consist of a minimum level 1st order horizontal monuments and 2nd order vertical monuments. On a daily basis all field observations and notes will be downloaded to the Surdex ftp site by field crews. The Waypoint GrafNet or similar GNSS Least Squares post-processing software will be utilized for all office processing of GNSS data. An initial free-net adjustment will be done to validate the observations and locate any blunders in the input data. The free-net adjustment will be constrained to one NGS monument, creating a minimally constrained network.

Once the free-net adjustment is completed, all observation data will be processed through the Online Positioning User Service (OPUS). The OPUS solutions for all observations will then be input into the post-processing software as check-points in the solution. A second free-net adjustment will be performed to evaluate the OPUS check-points against the NGS monument free-net. Any discrepancies will be investigated and resolved.

The final adjustment of the network will be fully constrained to a minimum of four NGS horizontal monuments and three NGS vertical monuments. In addition, a minimum of three surrounding NGS Continuously Operating Reference Stations (CORS) sites will be downloaded into the project. The final constrained adjustment will be held to the NGS monuments and all CORS and OPUS solution positions will be evaluated as check-points. Any irregular discrepancies in the final network will be evaluated and resolved. This method of least squares adjustment of the survey network assures a known relationship between the NGS monumentation, CORS, and OPUS solutions within the survey observations.

In summary:

Survey network adjustment using GrafNet software.



- Ground photos will be provided for each point along with pictures of the location to guide measurement of the points during aerotriangulation and orthoimagery accuracy validation.
- A control diagram will be furnished for all survey points utilized on this effort. This will include point positions and observed baselines designating beginning and ending points.
- A least squares adjustment will be performed for all control points. Output to be furnished in Excel format will include results of the constrained and unconstrained adjustment. This will include fixed coordinates and adjusted coordinates in latitude, longitude and ellipsoid height, error ellipse values in meters, relative baseline error ellipses in meters, precision of the observed baselines in parts per million (ppm), and redundancy expressed as degrees of freedom.
- All field notes and observation logs will be neatly kept and indexed. This includes notes pertaining to the establishment and/or extension of monuments. For recovered monuments, information on the condition of each point will be provided in the notes. The observation logs for each point will include all information pertinent to the recovery and observations required for office post-processing.

G. Digital Elevation Model (DEM) Update/Edit

There are two options for how the Digital Elevation Model can be updated based on the final scope of work chosen by the County. It is our presumption that if Boone County chooses to acquire new LiDAR, then that data would serve to generate a new DEM. Using this method, generation of the DEM could not begin until the LiDAR data processing had been completed (pushing the overall schedule back). Alternatively, Surdex could photogrammetrically update the DEM.

This approach is based on using all existing elevation data, augmented where missing or requiring update, by digital correlation and/or interactive editing. Dense image mapping will be developed, consistent with existing spacing and density, to create an accurate surface model required for orthorectification. To provide the most accurate terrain model, the elevation model is stored in Triangulated Irregular Network (TIN) format to support a Digital Terrain Model (DTM) that accommodates a mixture of both gridded and irregularly spaced points, as well as mass points.

If areas require an update, we often use the Leica Semi-Global Matching (SGM) software to create an initial elevation model. SGM yields very high integrity surface models by matching nearly every pixel in all imagery overlaps to create a "photogrammetric point cloud" analogous to first return LiDAR data.

H. Pilot Project

A Pilot Project will be undertaken prior to full-up orthoimagery production in order to:

- Establish the desired appearance of the orthoimagery.
- Check the file form and format against project specifications.

Surdex will coordinate the selection of one or more representative areas of varying ground cover (e.g., urban, suburban, rural, wooded, etc.). Orthoimagery samples will be provided in these areas to establish standards for clarity, tone, balance, and contrast desired for the project. This may require iterative processing of the samples to achieve the desired appearance. Surdex then processes all deliverable imagery to the appearance established during the pilot project.

Surdex typically uses "image metrics" developed on the USDA NAIP to guide initial processing. Our custom software automatically computes many of the image metrics during processing and stores the results in our Enterprise database – beginning with initial processing of the raw imagery all the way through mosaicking and balancing. In our opinion, the key metrics are:

- Histogram clipping – taking care to preserve a tonal range that does not interfere with shadow detail or "blow out" bright areas.
- Brightness – centering the mean pixel count to ensure overall balance. Note that this metric sometimes requires localized modification in unusually bright or dark areas.
- Contrast – properly maintaining contrast to avoid faded or washed out areas.
- Color balancing – performed to avoid shifts in color. A key measure here is that of "neutrality," which means that gray features (concrete roads, for example) remain so during processing. If gray features are preserved, overall true color is maintained throughout.

With years of experience and customized processes and software, Surdex has gained expertise in handling the critical global balance process over very large areas – even the ability to incrementally produce and deliver data to meet client priorities while still maintaining a consistent overall result. Our experience is that only minor radiometric adjustments around seamlines are needed to ensure flawless colorimetry across the entire project area.

I. Digital Orthoimagery Processing

1. Image Processing Approach

Our approach to image processing involves the following key points:

- Sensor-specific processing is used at the front-end of the production chain using sensor manufacturer software. This includes initial color balance, brightness, contrast, etc. Afterwards, all image processing is handled with Surdex's custom-developed software and processes.
- All imagery is retained in 4-band and 12 bits/pixel format ("4x12") until the final tiles are produced. This allows us to make localized adjustments to color, tone, contrast, etc. without compromising the overall quality of the deliverable product.
- The 4x12 format supports re-mapping to 8 bits/pixel, and to color and/or color infrared (CIR).
- All image resampling is performed using bi-cubic or Lagrange interpolation kernels to eliminate aliasing and similar artifacts.

Orthoimagery is produced to a contiguous "Master Tile" layout that encompasses the entire deliverable area with adequate buffering in 4x12 format in the reference frame of the project deliverables. Once the Master Tiles are completed, they can be used to generate all delivery tile layouts, including re-projection and changing of linear units (i.e.: US Survey Foot, International Foot, Meter, etc.) and re-mapping to the desired bit depth and number of bands using an automated process.

Surdex's customized processing environment is a mix of third party, open source, and custom-developed algorithms and processes, operating within a distributed processing environment. We utilize a common user interface, referred to as "Grouping Tool" (GT), and our entire production and project management staff is trained

in its usage – simplifying cross-training to maximize the staff potential. An underlying Enterprise database tracks all source, interim, and final products. Image processing and orthorectification technicians all utilize calibrated display monitors to ensure consistent results.

Features and Benefits of Surdex's Orthoimagery Production Process	
Feature	**Benefit**
Image color, tone, balance, etc. prototyped before production begins in a Pilot Project.	Client participates in desired appearance of final product far in advance of delivery. The pilot project also checks form and format of deliverable imagery, metadata, etc.
All image processing and production performed in "4x12" space (4 bands, 12 bits/pixel) until the cutting of deliverable image tiles: (1) Generate color, 4-band, and/or color infrared (2) 8 or 12 bits per pixel deliverables	Preserving full content provides maximum latitude in mosaicking process. Ensures highest possible quality products.
Internal production tiles are in a contiguous (seamless) format, with deliverable tiles generated at the final stage. This supports: (1) Overlapping deliverable tiles (2) Multiple deliverable tile layouts (3) Multiple map projections (4) Multiple product resolutions	Accommodates clients with requirements for multiple layouts of deliverable products at marginal additional cost. Accommodates last-minute changes. Edits to data only done once to support multiple products.
Highly automated absolute radiometry and atmospheric processing, reduces: (1) Level of subjectivity by technicians (2) Production labor effort (3) Changes to be made in final stages of production	Higher volume and throughput.
Customized seamline generation process: (1) Highly effective (2) Inclusion/exclusion areas (such as building footprints)	Seamless final product. Reduced customer review.
Proven ability to incrementally produce large orthoimagery projects while preserving a seamless appearance at completion.	Allows incremental QC and delivery to address client priorities, leveling of QC resources, and schedule compression.
Enterprise database underlying all imagery and data.	Complete lineage of all processing. Automated generation of FGDC-compliant metadata.
Web-based QC tool available free-of-charge for clients: (1) Reduces cost and time associated with multiple deliveries of hard drives (2) Fast turnaround of fixes and validation of fixes (3) Progress tracking	Accelerates QC and acceptance process. Audit trail of all changes. Reduces time for customer QC.

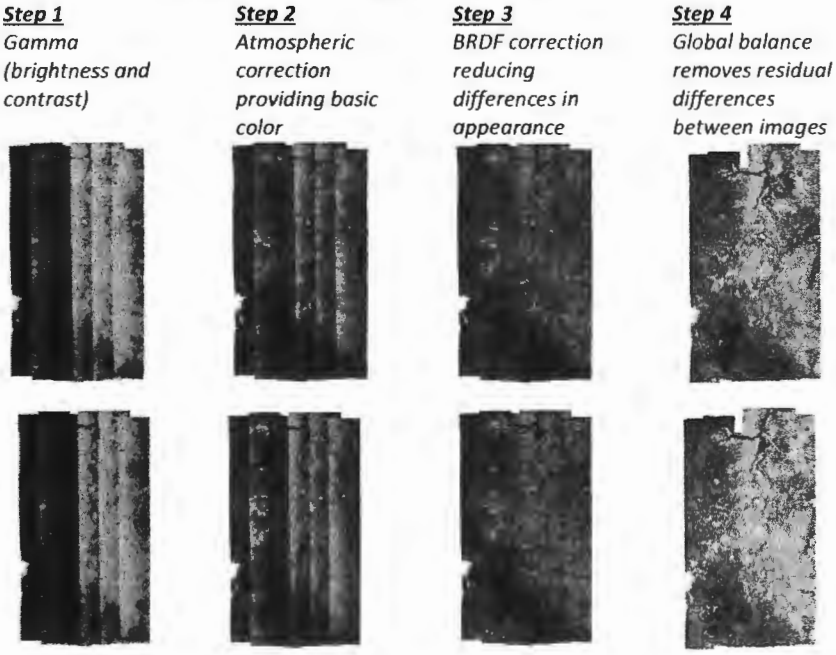
Using Surdex's Grouping Tool, image processing technicians organize large blocks of orthoimagery into groups with common characteristics, not necessarily coinciding with individual flight missions. The tool can display images in ground space, allowing operators to see the relative image quality between neighboring images and can be viewed in either color or CIR to ensure 4-band continuity. The grouping of images is important because:

- The atmospheric conditions during capture may result in imagery covering regions of differing degradation caused by haze. This is particularly true in coastal areas.
- Sun movement during the day affects the direction of sun illumination. Understanding this allows efficient solar corrections of groups with common illumination effects.

There are distinct steps in the overall image processing:

- Grouping of image strip blocks and initial color corrections with a simple gamma correction (brightness and contrast).
- Atmospheric corrections based on radiometric calibration of the sensor.
- Bidirectional Reflection Distribution Function (BRDF) corrections.
- Final Global Balance during the mosaicking phase.

Visual overview of image processing steps.



2. Orthorectification

Orthorectification is performed using the Leica XPro software, which uses a ray trace from a ground coordinate to the pixel. All resampling is performed using bi-cubic resampling to assure pixel location accuracy and avoids aliasing effects common to nearest-neighbor and even bilinear resampling techniques.

3. Mosaicking

Mosaicking encompasses the fundamental steps of (1) editing of artifacts and creating seamlines to "stitch" the orthoimages together and (2) balancing of the imagery to provide a consistent appearance of the imagery (color, tone, brightness, contrast, etc.) targeting the desired appearance established in the Pilot Project. All mosaicking is prototyped within the Grouping Tool environment, providing technicians a view of the final product before actual processing. Seamlines generated in the mosaicking process can be provided as a shapefile and are also a layer in Surdex's web-based inspection tool (SurCheck^{SM}).

The steps in mosaicking are:

- Editing of occlusion or smearing caused by rugged terrain.
- Specular correction, using shape files from imagery inspection.
- Seamline generation.
- Global balancing.

- Creation of the Master Tiles and deliverable tiles.

Specular Reflection

Specular reflections caused by glare from sun reflections off water bodies and/or large structures may be present in some orthoimagery and are delineated during image inspection for use in the mosaicking step. In addition, the Enterprise Database computes the sun elevation angle and azimuth for all acquired imagery.

Surdex's approach is to minimize the spectral reflectance by seamline placement using a standard feathering, thereby ensuring that features along the land/water interface are not affected. This may result in a visible mosaic seamline within a body of water depending on the level of spectral reflectance and or tonal change between the orthoimages.

The ADS100 potentially lends itself to better treatment of objectionable artifacts stemming from effects such as specular reflection, wind chop, and the like involving bodies of water.

Since the ADS100 has continuous acquisition of forward and aft imagery through arrays mounted approximately 25.6° (forward) and 17.7° (aft) relative to the nadir array, it can provide alternative views. Since the key issue with specular reflection and the like is the relative angle between viewing and the sun location, the two arrays provide alternatives to the nadir array. For example, if a mission is flown into the direction of the sun, it is logical to assume that the forward and nadir arrays may be adversely affected by resulting specular reflections. However, the aft array is often unaffected since because is looking in the opposite direction and the orthoimagery technician can use orthoimagery from this array, eliminating or minimizing the adverse effect.

During image inspection, the nadir array is evaluated for specular reflection and each affected image/strip annotated in our Enterprise database. This same database also tracks the sun angle and azimuth at the exact time of imaging, setting the stage for the prediction of specular reflection effects. If a nadir image is flagged for specular reflection, the ortho technician is alerted to the situation and will address it during production.

Seamline Generation

There are three steps in the seamline process:

- Automatic generation of initial seamlines.
- Editing of seamlines by skilled technicians.
- Application of the seamlines.

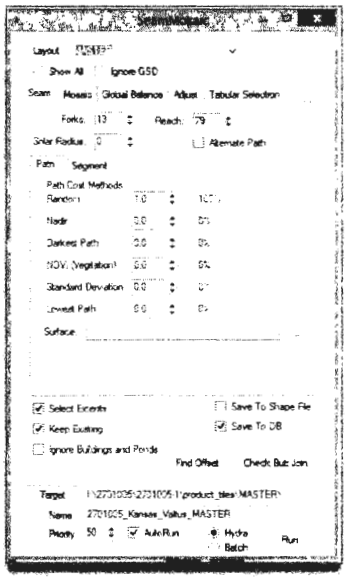
  The automatic seamline generation is executed in our distributed processing environment. Our custom-developed approach analyzes the many possible seamline paths to create the optimal seamline between all overlapping orthoimages.

Technicians review the automated seamlines and correct any requiring revision. The technicians log the accepted seamlines in the database, resulting in each seamline polygon having a record the technician and date/time.

Seamline placement by the technicians focuses on ensuring no distortion or positional displacement to the greatest extent possible. This includes, but is not limited to:

- Elevated transportation features, such as bridges and overpasses, will be locally modelled with a digital surface terrain model that will eliminate layover and smearing.

Custom-developed automatic seamline tool interface.



- Seamlines do not cut through buildings, roads, overpasses, towers, etc. that would result in splitting or otherwise distorting the feature.
- Using the additional imagery over the tall buildings (greater than 6 stories), technicians will ensure the view exhibiting the least lean will be incorporated into the final product.
- The number of seamlines crossing roads is minimized to the maximum extent. If a seamline must cross a road, positions are selected to minimize cutting through any features.
- In general, seamlines are selected to follow linear and natural features, reducing as much as possible temporal and color differences.

Surdex will supply an ESRI shapefile that fully delineates the seamlines, automatically generated by custom software. Each orthoimage merged into the mosaic is defined by a polygon representing its bounds with each of its overlapping neighbors. The polygon attribution contained in the shapefile includes, at a minimum:

- Date of acquisition.
- Polygon start/end date/time.
- Spectral resolution (color, CIR, 4-band).
- Sensor make/model (e.g.: Leica ADS100) and serial number.
- Aircraft type and tail number (e.g.: C441, N2NQ).
- Average flying height.

Global and Block Balancing

Surdex's custom-developed balancing software eliminates any evident residual issues. This is handled by two functions:

- Block Balance fits correction models to each strip of images with a single simultaneous bundle adjustment.
- Global Balance corrects for local differences in illumination between strips. The results can be previewed without the need to generate intermediate files.

Tile Writing

During this step, all balance adjustments and seamlines are applied to the individual orthoimages to create the Master Tiles. Afterwards, the deliverable tiles can be generated and our custom software can create virtually any tile layout using automated batch processing. This includes support for:

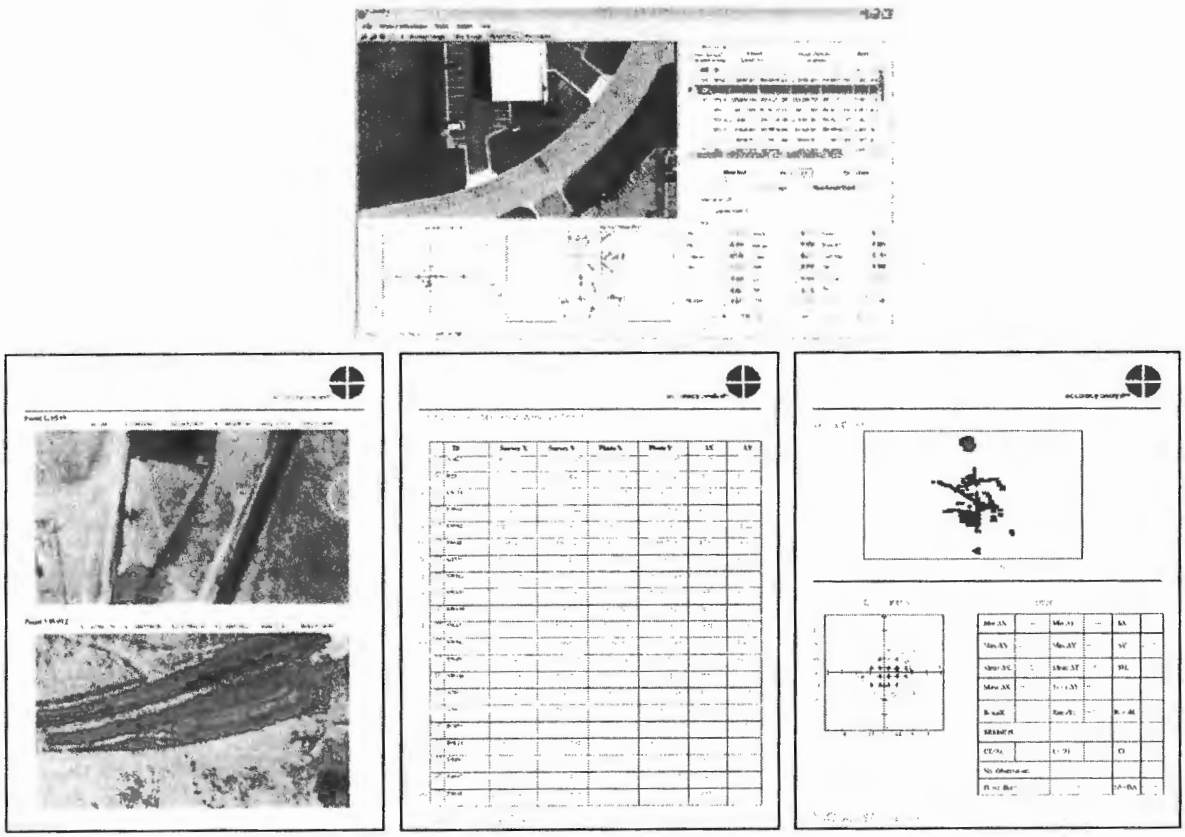
- Overlapping and contiguous tile layouts.
- Multiple tile layouts.
- Creating tiles in other map projections and/or linear units (e.g.: meter vs. US Survey Foot).
- Since the Master Tiles are in 4x12 format, tiles can be delivered as such or remapped to 8 bits/pixel, and in 4-band, color, or color infrared (CIR) format.
- Supported output file formats include MrSID, GeoTIFF, JPEG, JPEG200, ECW, TIFF/TFW, etc.

The Master Tile concept makes error correction during inspection very simple and comprehensive. Once an error is corrected in the Master Tiles, all applicable client tile layouts are automatically regenerated, potentially resolving numerous deliverable tiles.

J. Accuracy Validation

Accuracy validation is used throughout the orthoimagery production process, including the use of aerotriangulation points for interim checks. The Accuracy Analyst software from CompassData is used for formal validation. This software accepts ground point coordinates and guides the user through measuring points on each tile. It has extensive analysis and reporting tools that adhere to NSSDA specifications and guidelines and reports multiple measures of accuracy statistics.

Accuracy Analyst software.



K. Orthoimagery Quality Control Systems

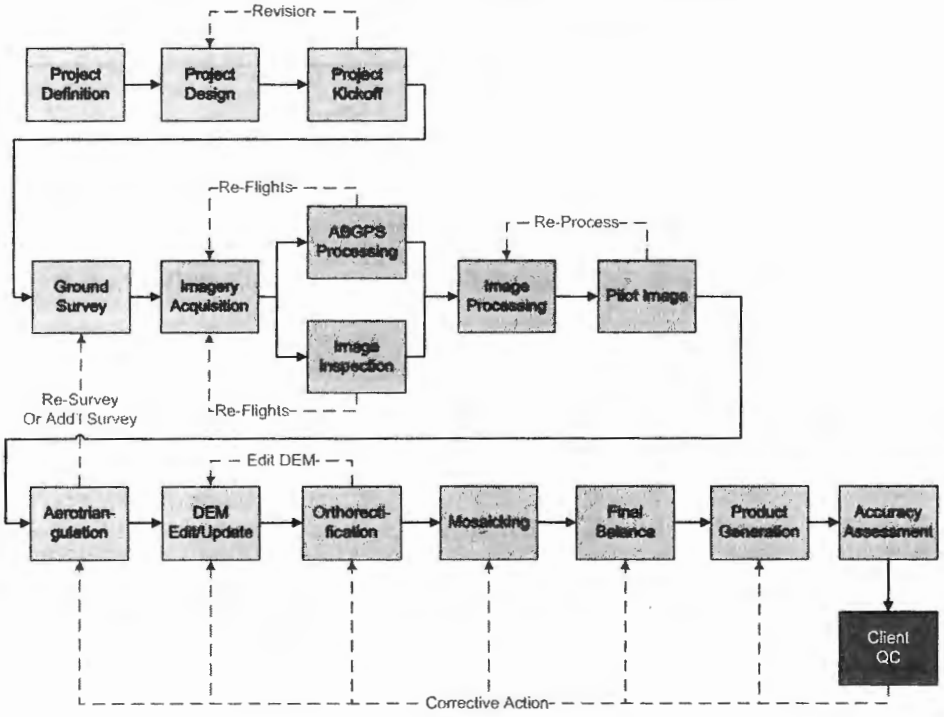
Surdex is committed to providing its services "first time right, on time." Surdex has developed extensive Quality Assurance (QA) and Quality Control (QC) mechanisms for orthoimage projects. Accuracy and quality are thoroughly reviewed before delivery to our clients and Quality Control Systems processed are constantly under review and refinement.

Building upon achieving ISO Certification for specific geospatial products for the National Geospatial-Intelligence Agency, Surdex has instituted ISO processes internally to optimize our quality control and efficiencies.

Summary of Quality Control Systems Phases and Approaches	
Phase	**Approach**
Project design	Internal design reviewed by Project Manager, Certified Photogrammetrist, and Registered Land Surveyor Reviewed by client
Ground survey operations	Field survey operations and processing under the supervision and review of a Registered Land Surveyor
Imagery acquisition	Updating of aircraft inspection, maintenance, and repair prior to and during project Updating of sensor calibrations if required Boresighting of sensors prior to use and/or after installation/re-installation Reporting of detailed progress by each aircrew at end of acquisition day Nightly updating of flight plans incorporating progress and results of inspection
Imagery inspection	Each image graded and reported in Enterprise database Inspection against the following factors, at a minimum: ■ Season window(s) and client start/stop work orders ■ Sun angle and/or timeframe specifications ■ Project specifications for ground conditions (flooding, smoke, haze, etc.) ■ ABGPS/IMU accuracy and quality ■ Camera misfires ■ Image motion/smear ■ Agreement with flight plans ■ Clouds/cloud shadow ■ Specular reflection noted for use by ortho technicians ■ Automated analysis of smear and/or occlusion in rugged terrain for use by ortho technicians
Aerotriangulation	ABGPS/IMU processing reviewed by a Certified Photogrammetrist / Registered Land Surveyor Tailored aerotriangulation reports for client review Dependent upon accuracy requirements, graded against such as: ■ Ground control, ABGPS/IMU, and image residuals ■ Agreement with check points ■ Distribution an placement of pass/tie points in final solution
Elevation modeling	Visual review Comparison of aerotriangulation points to the elevation surface to determine areas of change or problems
Ortho/mosaic	Ortho technicians inspect one another's work and perform edits Depending upon resolution of imagery, planimetric data such as roads, bridges, rail lines, buildings, etc. may be used to focus attention on seamline review/edit
Product QC	Use of pilot project(s) with client to assess: ■ Color, tone, balance specifications/expectations of client ■ Form and format of deliverables ■ Metadata compliance Accuracy analysis using AccuracyAnalyst

The following figure highlights the key steps in the orthoimagery process with red flow lines illustrating loop-backs in the process due to rejection/failure at a step.

Surdex's quality control system process overview.



L. SURDEX'S IMAGERY PREVIEW SERVICE

With years of web services hosting experience behind us on the USDA National Agriculture Imagery Program (NAIP) and with our web-based inspection tool, Surdex is in the unique position to offer clients a web-based imagery preview service. This service provides a visualization of acquisition progress and allows clients to assess whether ground and atmospheric conditions for acquisition were appropriate. This visual depiction is superior to textual reports and graphics of progress for many users and is accessible not only on desktop workstations, but also on most smart phones and tablets.

The service can be implemented as a username/password solution to control access or implemented as fully open access. If desired, the interim imagery can be also incrementally updated with the final imagery as production progresses, maturing into the final imagery service at the completion of the project.

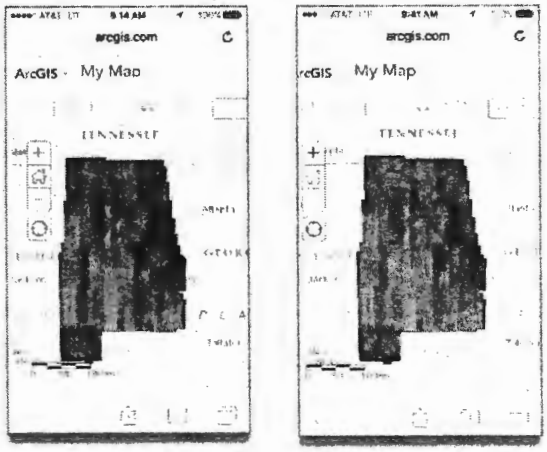
Preview orthoimagery is automatically processed to default imagery metrics, suitable for assessing ground conditions, cloud/cloud shadow cover, flooding, snow/ice, fog, smoke, etc. If re-flights are conducted, their result will overwrite any previous imagery, resulting in a view of the most current situation. Surdex has demonstrated posting preview imagery within 5-10 business days of the date of acquisition.

Preview Processing Compared to Final Product Processing			
Item		Interim	Final Product
Aerotriangulation		None performed. Based solely on ABGPS/IMU processing.	Aerotriangulation supported by ABGPS/IMU, ground control.
Orthorectification		To either existing (unedited) elevation surface or USGS NED.	To final (edited) elevation surface.
Accuracy		Generally 2-4X less accurate than final product.	To product specifications.
Image Processing		BRDF and atmospheric corrections applied. Default processing to basic image metrics/appearance.	Additional processing to desired final product appearance.
Mosaicking	Seamlines	Automated only.	Automated with manual editing to final product specifications.
	Balancing	Block balance only.	Block and global balance to final product specifications.

The preview imagery web service is an OGC-compliant WMS implementation:

- 4-band imagery viewable as natural color or color infrared (CIR).
- A vector overlay portrays the image bounds complete with acquisition time/date, aircraft tail number, camera make/model/serial number, etc.
- It is a REST (REpresentational State Transfer) service that can be viewed by a user in several ways, including but not limited to:
  - As an ArcGIS Java viewer for simple viewing.
  - Within ESRI ArcMAP.
  - Within ESRI ArcGIS.com.
  - Google Earth.

NAIP Imagery Preview Service on iPhone (Alabama).



M. Surdex's Web-Based Inspection Tool (SurCheckSM)

To assist our clients with the inspection of their orthoimagery, Surdex provides – *at no additional cost* – our web-based image inspection tool, SurCheck[SM]. This tool is the result of over five years of continuous improvement and has been met with outstanding reviews and benefited from user requests for enhancement. It is implemented in HTML5, JavaScript, php, and the ArcGIS API for JavaScript, providing flexibility for enhancements in the future.

SurCheck streamlines the inspection, remedial action, and delivery timelines. As call-outs are reported by reviewers, Surdex resolves each and notifies reviewers so they may confirm the correction. Since Surdex works off call-outs in parallel with the inspection process, it is common for reviewers to receive corrections within 1-2 weeks. When all call-outs are resolved for the project the data can be shipped on hard drives for final delivery. In many cases, clients choose to have orthoimagery added to SurCheck incrementally, further expediting inspection and allowing leveling of inspection resources.

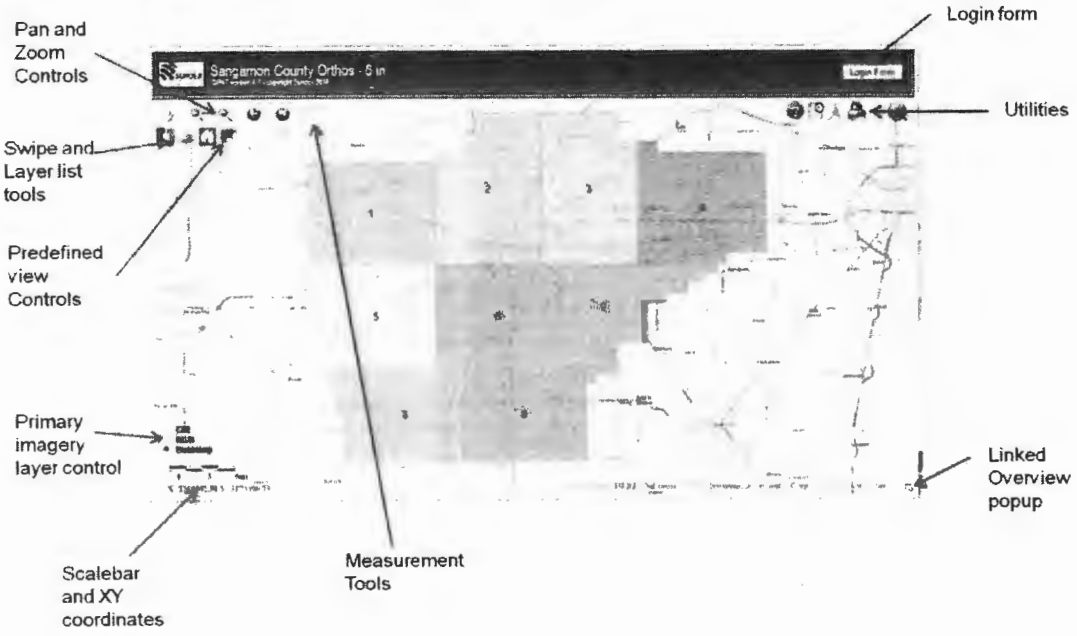
SurCheck™	
Feature	**Benefit**
Administrative	
Username and password login access.	Protected access for client and reviewers.
Client manager can assign reviewers to separate work zones within a project.	Multiple reviewers for each project to increase inspection rate and support multiple partners. Clients can assign multiple reviewers to specific work zones. Managers can view call-outs from reviewers to ensure a consistent approach.
Four (4) tiers of edit calls: 1. **Standard inspector** 2. **Client manager** 3. **Surdex reviewer** 4. **Final client reviewer**	Management of call-out resolution with appropriate levels of responsibility and authority within the client and within Surdex. Covers entire life cycle of inspection and resolution process, ensuring end product is fully inspected and accepted. Client manager can override client reviewers. Surdex reviewer dealing with disposition of a call-out (natural feature, out of scope, etc.).
Help menu for most options.	On-line assistance with operation reduces need for a manual or access to training guide, allowing session to continue uninterrupted.
General Interface	
Operates in Internet Explorer, Firefox, Chrome, Edge, and Safari. Works on smart tablets within individual interface limitations.	No browser plug-in required (prior versions required Silverlight). More flexibility for future enhancements requested by users or implemented by Surdex.
Single-page interface with no pop-up windows. Full-screen primary map window. Logical groupings of toolbars.	Simpler and cleaner interface. Maximizes screen real estate for viewing of larger areas. On-demand overview window.
Surdex-provided overlay of seamlines	Assists in searches for potential artifacts. Issues along seams or poor placement of seamlines are the most common problem found during inspection.
Ability for users to add their own map services.	Examples include historical imagery, vector overlays, control point overlays, parcels, ArcGIS Online layers, etc.
Swipe function with user-selectable layer.	Combined with user-added image services, provides a quick compare to historical imagery. Can swipe color and CIR renditions of 4-band products to review consistency and quality.
Magnifier window with adjustable zoom. Click and drag of magnifier box within window. Adjustable magnifier up to 9X, limited to 1:1 project resolution.	Quick toggling between magnifier and standard view allows reviewers to retain scale with close-up inspection of potential artifacts.
Generate graphical and quantitative histogram of current window, including: 1. **Red, green, blue, NIR, and luminosity (red+green+blue).** 2. **Reporting of basic image metrics measures (contrast, clipping, brightness, etc.).**	Aids in determining adherence to project-specific image metrics.
Progressive inspection of each tile in "snail trail" sequence. Simple acceptance of tiles any key press or mouse click. Accepted tiles are high-lighted.	Methodical approach streamlines inspection and portrays status.

Feature	Benefit
Save call-outs to a shape file or CSV files.	Export call-outs to non-SurCheck users for review. View within other applications (ESRI ArcMap, AutoCAD, etc.) CSV easily imported into Excel.
Measurement tool (points, distance, and area). User-selectable units (i.e.: feet, meters, miles, kilometers, etc.)	Supports investigation of call-outs against specifications (such as seamline shear, size of artifact, etc.).
Print current screen to printer or PDF.	Simplifies creation of samples, bug reporting, etc.

Upon request, Surdex can provide a video and PowerPoint presentation to familiarize and train users on the tool's use, as well as access to a sample project.

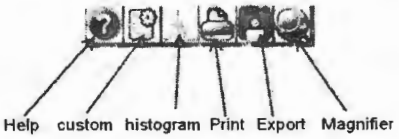
The following pages portray selected aspects of SurCheck.

SurCheck layout and tools.

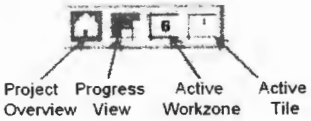


Pan and Zoom Controls

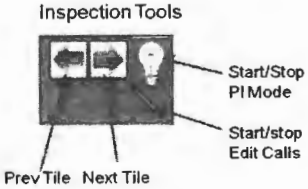
Utilities



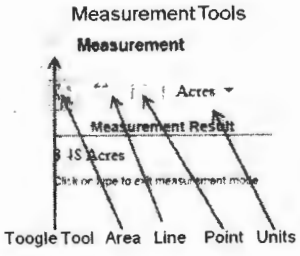
Predefined view Controls



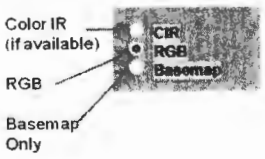
Inspection Tools



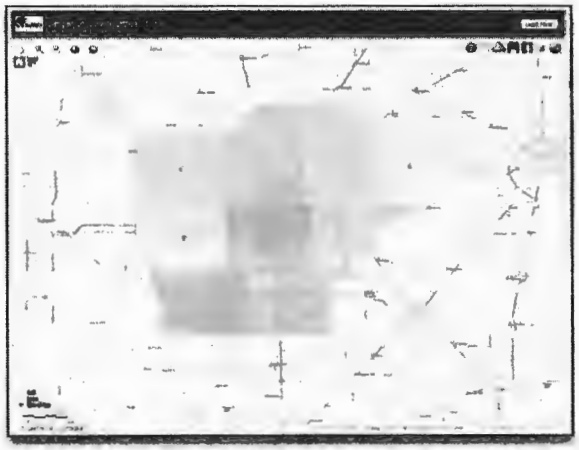
Measurement Tools



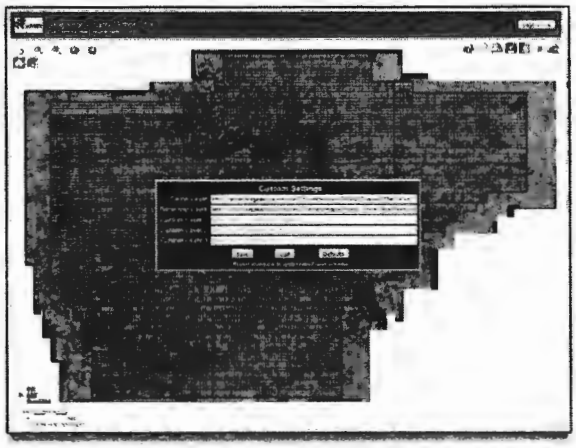
Primary imagery layer control



Initial Screen Showing AOIs.



Custom Settings Form.



Edit Calls Template.

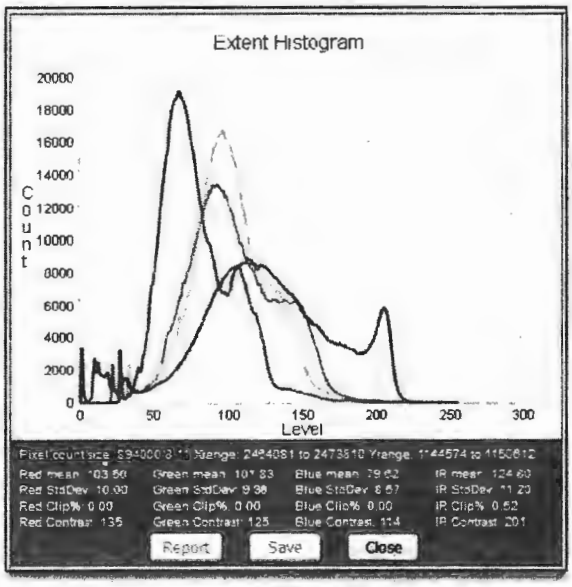
Edit Comments.

Swipe Between Color and CIR.

Swipe Between Color and ArcGIS.com Imagery.

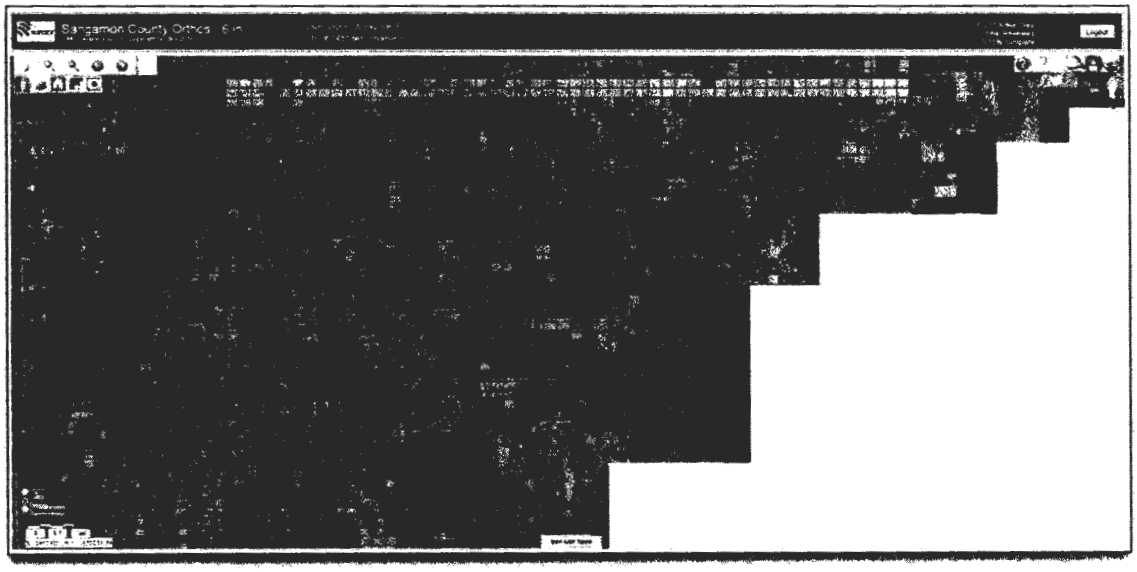
Manager call-out review

Histogram of View Extent.



Magnifier Tool.

Work Zone Progress.



PART TWO: LIDAR ACQUISITION & PROCESSING

In the following pages, we have provided a description of the basic services provided on numerous LiDAR projects. As noted earlier, with four LiDAR scenarios, it is best to describe our LiDAR acquisition and processing processes in general. Upon award, both the acquisition plan and control layout can be determined to optimize the efficient collection of LiDAR data. Regardless of which scenarios are selected, the project deliverables will include (TBD) the point cloud, classified bare earth LiDAR, and hydro flattening to USGS specifications.

The following table presents our understanding of the four possible LiDAR scenarios for the project.

Summary of LiDAR Specifications		
Density / PPSM	Areas	Approximate Area
0.7 ppsm (QL2)	Boone County, MO	690 sq mi
0.7 ppsm	University of Missouri –MU Campus	4.8 sq mi
4 ppsm (QL2)		
10 ppsm (QL1)		

A. Project Design

When designing the project, Surdex includes:

- The buffered project area.
- Project specifications, such a points per meter, horizontal and vertical accuracies, and point classification schemes.
- Ground survey control and base station design.
- Preliminary LiDAR flight plans.

With several single engine aircraft suitable and available for LiDAR collection, and several twin-engine aircraft in reserve, Surdex has the capacity and flexibility to overcome a variety of unforeseen challenges during the acquisition window that may otherwise threaten temporal project objectives.

The following table is an example of specifications for the 0.7m posting.

LiDAR Design Specifications (Sample for 0.7m posting)	
Parameter	Value
Scan Angle/Field of View (FOV)	≤ 40º (+/-20º from Nadir)
Swath Overlap	30%
Flying height (AGL)	2,000 meters
Max laser pulse rate	273 KHz
Swath width	1,456 meters
Average point density	2.44 pts/meter^2
Average point spacing	0.64 meters
Vertical accuracy	<10 centimeters
Estimated ground speed	150 knots

1. Sensor: Teledyne Optech Galaxy LiDAR Sensor

Surdex owns three Optech Galaxy LiDAR sensors, one of the most advanced and efficient sensors available today. It uses innovative LiDAR technology enhancements and incorporated flight and calibration software for significantly increased sensor performance, collection efficiency, improved data quality, and a simplified collection process.

The Optech Suite of software includes FMS (Flight Management Software) and LMS (LiDAR mapping suite), both of which integrate with the Galaxy sensors. These systems facilitate superior mission planning and precise sensor calibration, allowing for exceptional vertical and horizontal point accuracies and industry-leading accuracy for surface derivatives.

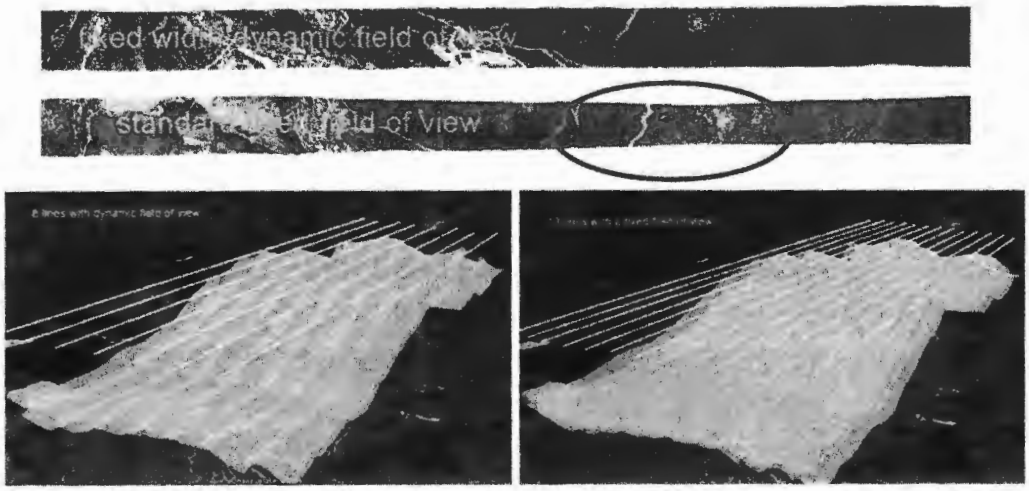
Optech Galaxy Specifications	
Laser Configuration	
Topographic laser	1064-nm near-infrared
Laser classification	Class IV (US FDA 21 CFR 1040.10 and 1040.11; IEC/EN 60825-1)
Beam divergence	0.25 mrad (1/e)
Operating altitudes (1,2,3,4)	150-4700 m AGL, nominal
Effective pulse repetition frequency	Programmable, 35-550 kHz
Laser range precision (5)	< 0.008 m, 1 σ
Scan angle (FOV)	Programmable, 0-60°
Swath width	Programmable, 0-115% of AGL
Scan frequency	Programmable, 0-120 Hz advertised (0- 240 scan lines/sec)
Sensor scan product	2,000 maximum
Absolute horizontal accuracy (2,3)	1/10,000 × altitude, 1σ
Absolute elevation accuracy (2,3)	< 0.03-0.20 m RMSE from 150-4,700 m AGL
Sensor Configuration	
Position and orientation system	POS AV™ AP60 (OEM); 220-channel dual frequency GNSS receiver; GNSS airborne antenna with Iridium filters; high-accuracy AIMU (Type 57); non-ITAR
Flight management system	Optech FMS
SwathTRAK™	Dynamic field of view
PulseTRAK™	Continuous operating envelope
Range capture	Up to 8 range measurements, including last
Intensity capture	Up to 8 intensity returns for each pulse, including last (12-bits/pixel)
Roll compensation	Programmable; ±5° at 50° FOV; increasing as FOV is reduced from 50°
Minimum target separation distance	< 0.7 m (discrete)
Data storage	Internal solid state drive SSD (SATA II)
Power requirements	28 V; 300 W; 12 A
Dimensions and weight	Sensor: 0.34 × 0.34 × 0.25 m, 27 kg — PDU: 0.42 × 0.33 × 0.10 m, 6.5 kg
Operating temperature	0 to +35°C

Optech's cutting edge PulseTrak and SwathTrak technologies not only enable the sensor to collect data with elevated precision and efficiency, but also simplify and improve collection in challenging terrain.

PulseTrak overcomes widely recognized industry challenges by allowing for an altitude-independent continuous sampling envelope that minimizes coverage gaps and density variations often associated with an inability to effectively track coincident laser pulses in the air. The end result of collection is consistent data which improves the efficiency of all subsequent processes in the LiDAR life-cycle and minimizes costly reflights.

Optech's exclusive SwathTrak technology dynamically varies the field of view (FOV) in real time during acquisition to remove the effects of terrain relief on swath width and maintain consistent overlap between swaths. The effects of SwathTrak technology are illustrated in the graphics below, which demonstrate the acquisition efficiency challenges posed by high relief survey areas. The Galaxy is the only system on the market today with a dynamic FOV capability, giving Surdex a distinct advantage in LiDAR collection.

The second major benefit of SwathTrak is efficiency. In areas of extreme relief, the sensor can achieve as much as a 40% reduction in the number of flight lines, resulting in a lower acquisition cost. The consistent overlap and point density achieved by utilizing SwathTrak also greatly simplifies and improves the result of many post-processing steps, including line-to-line relative accuracy adjustments. These advantages are ultimately passed on to the customer in the form of higher quality deliverables and final products, produced at a lower cost.



Sensor Parameters (SwathTrak capabilities)		
SwathTrak	**Without**	**With**
Laser PRF (effective)	500 kHz	500 kHz
FOV	Fixed 30°	Variable 18-42°
Sidelap	50%	20%
Swath Width	530-925 m	750 m
No. of Flight lines	**13**	**8**
Time On-Line	0:41:51	0:26:31
Total Time	**1:41:51**	**1:01:31**

A large advantage of the Galaxy sensor is the smooth surface repeatability. With such a low SSR (~3cm) we are able to align neighboring swaths of data with extreme accuracy. We are also able to more accurately and consistently adjust our datasets to surveyed control. Melding neighboring swaths and control so tightly together allows for a high level of confidence in control reports and reporting RMSE values.

2. LiDAR Ground Survey

The control points established for the imagery will be utilized for the LiDAR acquisition, planned in conjunction with the imagery, to ensure accuracy is met most efficiently.

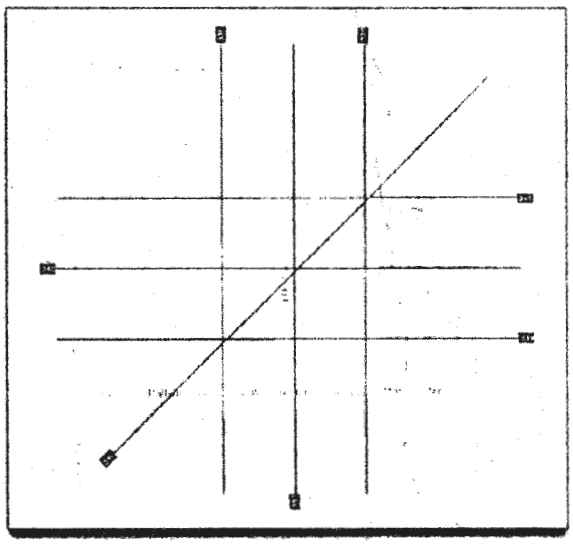
All field notes and observation logs will be neatly kept and indexed. These include notes pertaining to the establishment and/or extension of control. For recovered points, information on the condition of each point will be provided in the notes. The observation logs for each point will include (1) all information pertinent to the recovery, and (2) observations required for reduction.

Check points will be collected per the required distribution for non-vegetated vertical accuracy (NVA) and vegetated vertical accuracy (VVA) validation. Our current plans are based on a single season collection of the LiDAR data, reducing the need for additional check point collection due to temporal change. Check point surveys will tie to NGS monuments used for the base control surveys.

3. Sensor Calibration

Aerial LiDAR acquisition is highly dependent on several sensor sub-systems working in conjunction with each other to produce accurate ranging data and the resulting point cloud. These include the Base GNSS station, ABGPS/GNSS, IMU and the physical laser unit. Surdex's LiDAR system is routinely calibrated over our established boresight at our base of operations in Chesterfield, Missouri.

Calibration approach.



Surdex's procedure to calibrate the Galaxy sensor consists of six lines of acquired data flown in altitude crosshatched pattern, with an additional seventh line flown at an oblique angle to the grid. This vendor-recommended calibration pattern reliably analyzes the behavior of the sensor and adjusts the sensor model calibration parameters to produce consistently accurate data. Recognizing that each project is unique, Surdex executes a sensor calibration on each sensor at the onset of every project using project specific settings. These additional steps ensure that maximum efficiency is achieved during all post processing procedures. This calibration procedure is conducted following the installation of the sensor in an aircraft and anytime there are large temporal differences within the project collect.

A secondary method of boresight validation is conducted on site throughout the project acquisition. This secondary method consists of cross flight lines, perpendicular to the project lines, which are then processed with production lines as a means of sensor validation.

B. Acquisition

As noted earlier, acquisition planning is dependent on the final project scope and project area. Once these are determined, Surdex will develop flight lines that utilize the control points established for the imagery in order to optimize cost efficiency. The acquisition process follows, in general, the procedure for imagery acquisition. Different flight heights will be established for the varied requested points-per-square-meter (ppsm) density and QL1 / QL2 data.

Surdex will base the mobilization schedule on current and forecast weather conditions and verified environmental conditions. Conditions required for LiDAR collection include:

- Cloud, fog and smoke free (between aircraft and ground).
- Snow free (light snow may be acceptable with approval).
- Stream and rivers within normal levels (flood free).
- Leaf off vegetation.

Should crews leave the project site due to extended unfavorable weather/ground conditions, notification will be sent detailing the reason for leaving the project site and Surdex's estimated re-mobilization date.

Surdex will provide progress reports daily with flight trajectories, GPS reports and identify any days where collection was delayed due to weather or other environmental factors.

Two base stations will be identified in advance and will be located as close as possible to the center of that day's collection area. The base station locations will incorporate existing NGS locations whenever possible. If necessary, extra field personnel will be deployed should a base unit be required inside an AOI rather than the nearest airport.

The results from the processed base station data, GNSS data and the GPS surveyed ground control data will be used to create an accuracy report for each site within the project and the project as a whole once it is complete.

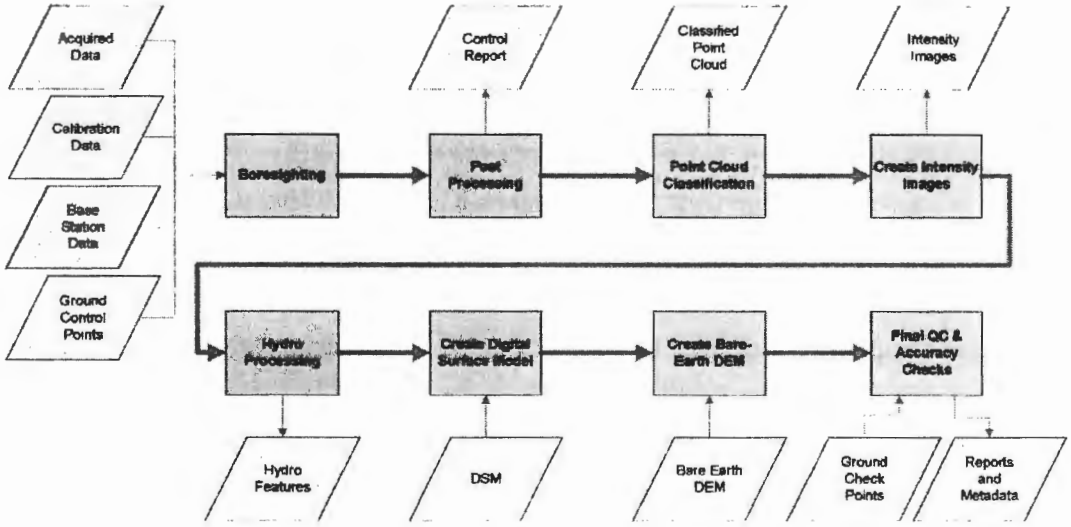
1. Post-Acquisition Data Verification

As daily shipments of the LiDAR data arrive, they are immediately backed up to ensure a complete set of the raw data that was collected will always be available. This serves to secure all data in its native form should it be necessary for review or investigation during subsequent processing. After archival, the initial QC is accomplished on a daily basis. The data is inspected for coverage, continuity and general acceptability. Should an issue be found that requires re-flight, the anomaly is entered into our flight database as a "rejection" and notification sent to the Project Manager, Flight Manager and field crews automatically. The automatic notification eliminates the dependence on human interaction to report an issue. As stated previously, all re-flights are labeled as priority status requiring prompt attention and ensuring as little temporal difference as possible in an effort to avoid issues commonly associated with changes in the ground surface due to development, flooding, and changes in vegetation.

Data will be inspected to ensure the nominal point density has been achieved, intensity values are acceptable, overlap is consistent as planned and unjustified data voids are not present. Inspection will verify that proper planning, acquisition, and sensor function have achieved the desired results.

2. Processing Approach

The following graphic portrays Surdex's general process flow for a typical LiDAR project, addressing all possible deliverables. The following sections address each of the process steps.



3. Boresighting

This step is executed for each project and each sensor involved in collection. We fly a 7 line (3x3x1) pattern with a large amount of overlap allowing LMS software to solve for any discrepancies both intra- and inter-swath. This ensures the data being produced and processed is as accurate as possible both relatively and absolutely.

The Optech LiDAR Mapping Suite (LMS) software is used to produce relatively adjusted and absolutely accurate 3-dimensional LiDAR point clouds by combining the raw range data collected in the field, relevant meteorological data, and onboard GPS and IMU information. However, adjacent lines, lifts, or blocks may occasionally require an additional relative adjustment to align the point clouds associated with each line and/or account for systematic error. Long lifts and lifts that are divided to avoid undesirable conditions (clouds or anomalous ground conditions) tend to be more likely to require post-processing adjustments. Conversely, maximum efficiency in post-processing is often achieved when lines are unsegmented and short.

TerraMatch is a least squares adjustment function contained within the TerraSolid LiDAR production software suite. This software allows the operator to perform retroactive time-based calibration of the LiDAR sensor to correct for mismatched data observed in the produced points. Calibration parameters surface matching adjustments within overlapping areas of LiDAR data to overcome time-dependent sensor anomalies. First, areas covered by overlapping LiDAR flight lines are processed to identify planes in each flight line that are candidates for possible matching. These offset planes are then manually examined and filtered to ensure veracity. Finally, surfaces are measured and processed to adjust the LiDAR sensor parameters, such as changes in position and/or attitude, and the time dependent variability of these parameters. Once resolved, these adjusted parameters are applied to each flight line, producing relatively accurate points.

When data does not meet relative accuracy specifications out of LMS, the affected lines can be evaluated in TerraMatch. Several areas will be identified, and an initial visual review of the point cloud is performed to characterize the nature of the differences.

Once the best TerraMatch solution is found, proprietary Surdex software is used to interactively select and rapidly apply the corrections to mismatched areas of swaths. Once a mission, or multiple missions, has been relatively adjusted, an absolute adjustment against the survey control is computed and applied. The most prevalent corrections are for roll, pitch, or heading. Once corrected through the TerraMatch procedure, the corrections produce well-fitting lines both horizontally and vertically in the overlap areas.

4. Post Processing

When a pre-determined block of data from each lift has been collected and has passed initial QA, it is assembled within LMS and processed. This helps reduce the need for third party adjustment software by solving for solutions and resolving them using the sensor models designed by the hardware manufacturer.

It is within this process that the GNSS data is combined with the collected sensor data and the sensor model to output a production ready point cloud. The data is created in the deliverable projection and the accuracy evaluation begins.

5. Point Cloud Classification

The LiDAR scenarios specified in the RFP are all for bare-earth (BE) classification. Although classification schemes vary for each project specification, the table below *typifies* a bare earth classification scheme. The final scheme will be determined during the project kickoff.

Point classification scheme (LAS 1.4)		
Code	**Definition**	**Comments**
0	Created, never classified	Not delivered
1	**Processed, unclassified**	
2	**Ground (bare earth)**	
3	Low vegetation	
4	Medium vegetation	
5	High vegetation	
6	Building	
7	**Low noise**	
8	Reserved	
9	**Water**	**Hydro only**
10	**Ignored ground (near breakline)**	**Hydro only**
11	Road surface	
12	Reserved	
13	Wire – guard (shield)	
14	Wire – conductor (phase)	
15	Transmission tower	
16	Wire – structure connector	
17	**Bridge deck**	
18	**High noise**	
18-63	Reserved	
64-255	User definable	

The TerraScan software is used to run automated classification routines that have been refined through years of practical experience among many different densities and datasets. Several macros (filter algorithms) may be employed to address variances in terrain, human development, and scene morphology to obtain high-yield results and minimize the effort of manual terrain editing.

Although classification schemes vary for each project specification, the following table typifies a bare earth (BE) classification scheme. The final classifications will be determined during negotiations.

The steps of LiDAR point cloud classification will be performed are described below:

- ***Automated classification:*** Automated filtering macros will address all classifications required.
- ***QA/QC of automated classification:*** A thorough QA/QC is necessary at this point during which technicians review and correct gross misclassifications in each tile. Some manual editing is required to achieve the classification accuracy. There have been some improvements in automated filtering macros in software such as Terrascan, but automation cannot account for every possible scenario and feature combination.
- **Dense Vegetation** A good automated filter will do a relatively sound job of retaining subtle ground features such as berms, banks, and ditches. However, the filters may not perform as well in areas obscured by dense vegetation or other above ground features. When terrain is "shaved" out of the ground class, this requires manual intervention to correct.

- **Buildings vs vegetation** can require extensive manual editing, especially in areas where the two features are overlapping. Even with advanced filtering, automation may become confused by vegetation that is touching or is in close proximity to building rooflines. A building filter may also "see" what appears to be a planar feature in dense forest/vegetation and classify these points as building.
- ***Water features:*** Once classification of the LiDAR points is completed, technicians collect the hydro-flattening breaklines. Water is automatically classified using the completed hydro-flattening line work. This method ensures that the hydro-flattening line work and the water classification match in all areas of the project.
- ***Final QA/QC of classification:*** A final QA/QC is conducted of the classified, all-return point cloud tiles once all classification and hydro finishing are complete. During this review, technicians will visually QC and complete any additional manual edits necessary to correct any remaining classifications issues. This includes a comprehensive manual edit of classifications to ensure accuracy.

C. Hydro Processing

Surdex's process, developed and refined through years of experience, includes both manual and automated procedures. Our R&D staff has developed software to assist and improve efficiency in the hydro-enforcement process.

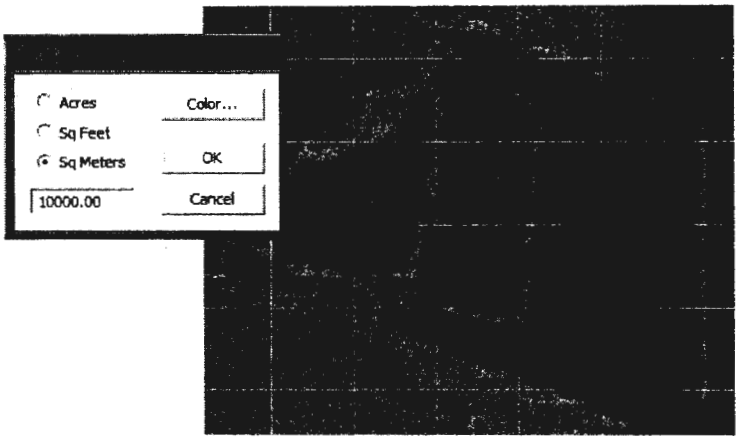
Several sets of data are used to assist technicians develop the hydro-enforcement breaklines. These include LiDAR data, color hill-shade maps derived from the LiDAR data, National Hydrographic Dataset, and intensity images.

Breakline collection will be conducted using custom tools which allow technicians to select specific line types such as river bank and islands as well as polygon types such as lakes and ponds. The interface gives technicians the flexibility to show the object vertices as they are drawing, constrain the line work to a fixed elevation or to use min/max/mean methods of determining elevations. Using a profile view, technicians may also elect to choose an elevation based on their interpretation of the river bank.

Pond and lake features will be collected at one elevation representing the mean elevation of the feature, at the time of flight, where it meets the bank around the edges. To ensure that only one elevation value is present on the pond/lake polygon, the technician is able to lock in the elevation value as they are drawing.

Our custom software contains a tool specifically designed to assist the technician in determining if an island or pond feature meets the minimum collection criteria. By utilizing this tool, technicians are able to apply a grid sized to the minimum unit required allowing quick identification of features that should be collected.

Overlay of 1 Hectare Minimum Map.Unit.



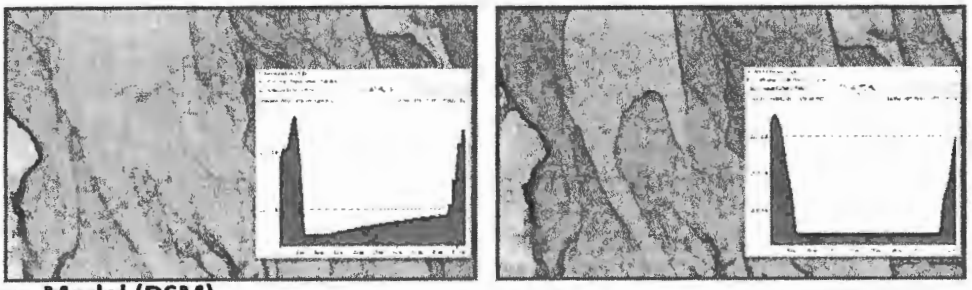
Rivers and streams are initially collected in 2D to ensure that the line work is uniform in the x and y with the edges of river banks. Technicians then set a starting elevation at the head of the water feature and an ending elevation at the end of the water feature. This ensures that a proper starting and ending elevation is determined. The bank lines are then buffered, reclassifying ground points that are directly on or immediately next to the lines. This prevents the line work from following the precise up and down elevation changes from point

to point. While these minute elevation variations in LiDAR could be within the acceptable vertical accuracy threshold of the project, they may still adversely affect the ability of the line work to "flow" downhill properly.

Once the line work has been buffered, technicians revisit the entire length of the water feature, inspecting the elevations to ensure they match the LiDAR ground class. Using the hydro feature collection tool, technicians are able to view the elevations of all vertices to check that they present gradient downhill values (enforced monotonically) and to ensure that the feature is flat from bank to bank.

As a final check of the hydro breaklines, technicians are able to generate a Triangulated Irregular Network (TIN) surface on the fly that incorporates the ground surface and the line work. Thus, this process ensures that the line work will properly hydro-flatten the surface. This final check: (1) eliminates costly errors that could be caused by erroneous line work identified at the end of the process, and (2) allows technicians to make corrections while collecting the line work.

Before (left) and after (right) hydro flattening



1. Create Digital Surface Model (DSM)

The completed and quality-verified classified all-return LiDAR point cloud is used to develop the DSM. The first return of each point, excluding noise, withheld and overlap are used to create a dataset that has the same tile layout as established with the DEM. This dataset is then used by a combination of Surdex and Terrasolid software to create a 32-bit ERDAS .img raster file.

All tiled DSMs will then be reviewed for quality, artifacts, format, and spatial alignment and naming convention according to the project specifications.

Example of Surdex DSM. Surdex's internal tiling scheme cuts tiles for seamless appearance.

2. Create Bare-Earth DEM

The completed and quality-verified classified all-return LiDAR point cloud and hydro-flattening breaklines are used to develop the bare-earth DEM.

The first step in this process will be to create an entry in Surdex's Enterprise Geodatabase that will house the applicable data. A Feature Dataset will be established that follows the Spatial Reference Framework. The LiDAR LAS files are converted to a singular Multipoint Feature Class, where the ground class is extracted from the LAS file and imported into the Feature Dataset. Hydro-flattening breaklines will also be merged and imported into the same Feature Dataset. During the next step, the DEM tile extents will be buffered by 50 meters on all sides of the tile with 90 degree corners. The geographic corners and side midpoints will be used to establish a minimum bounding rectangle that serves as the basis for the buffering of the tile. Once all of the buffered tiles have been created, they will also be stored in the Enterprise Geodatabase containing the Multipoint LiDAR data and hydro-flattening breaklines. The buffered DEM tiles will then be dissolved to create a Project Clip Boundary. This boundary will serve as the maximum processing extent for the DEM creation.

An ESRI Terrain Dataset will then be compiled using the multipoint LiDAR data as embedded masspoints, the hydro-flattening breaklines, and the project clip boundary. This terrain building process will ensure a seamless topographic surface that will eliminate artificial artifacts, seaming, gaps, stepping, and quilting. Once the project wide terrain is built, it will be processed using the pre-established buffered DEM tiles to create exact extent matched DEM tiles that will be stored as hydro-enforced 32-bit floating point raster DEMs.

All tiled DEMs will then be reviewed for quality, artifacts, format, and spatial alignment, shifting, and naming convention according to the project specifications.

At the project kick-off meeting, Surdex and the Client will determine the deliverable product for this phase. The following list itemizes standard parameters; these will be finalized during negotiations.

- DEMs will be hydro-enforced, in 32-bit floating point raster to the nearest 0.01 m.
- A 50 meter buffer will extend on all sides of each tile.
- Tiles will have 90 degree corners.
- No seams, stepping, gaps, or quilting shall be visible unless naturally occurring.
- No artifacts shall be present that should not be in the bare ground class.
- There shall be no over-aggressive or under-aggressive filtering resulting in degraded DEM quality (such as low vegetation present in the ground class or "shaved" terrain features).
- Depression sinks will not be filled in.
- Acceptable data voids inside the project area and voids outside of the project boundary shall be coded as NODATA (-32767).

3. Final QC and Accuracy Checks

Surdex is at the forefront of technology and production. All steps of the data processing phase are subject to our Adaptive QA/QC system which consists of processes and tools developed as a result of years of experience. The Adaptive QA/QC system consists of "living" documents that are updated and improved constantly, based on client and project stakeholder feedback and lessons learned. This approach allows us to quickly address issues such as those caused by rapidly evolving technologies.

Surdex ensures the hardware and collection settings are in full compliance with accuracy standards, before each collect, and any time there is significant off time between collects, we routinely fly a seven line pattern and calibrate our instrument settings.

Our Quality process begins with our initial QA – looking at actual point clouds (created as soon as the next day) to assure the collect was done under favorable conditions and the equipment is fully functional.

The absolute and relative accuracy are rigorously examined prior to any manual classification, ensuring we mitigate any time loss prior to manual editing. Having full confidence that the data meets and exceeds acceptable standards is of the utmost importance before beginning classification.

Surdex continually adheres to and improves upon peer and independent reviews throughout processing.

- An independent, differentially collected GPS base-station coordinate used to review Surdex's processed coordinates gives us full confidence moving forward.
- It is imperative to compare the trajectory to an independently produced trajectory to assure there are no major offsets; this step eliminates time-intensive, costly rework and its impact on schedules.
- Rigorously examining the relative accuracy to ensure specification is met is the only way to be confident that the data is of a high quality.
- The absolute accuracy is of the utmost importance to the overall quality of the dataset by ensuring the LiDAR hardware is both accurate and consistent with its collection.
- Manually reviewing the classified data allows for a QC of the automated classification schema, and Surdex provides an additional assurance by incorporating a peer review to ensure classification consistency across analysts.

Having a series of checks and balances gives Surdex and the client the utmost confidence that the data being produced is of the highest quality.

At the conclusion of a project, Surdex provides a full LiDAR accuracy report including project overview, process and QA/QC description addressing all NDEP/ASPRS procedures and requirements. Accuracy check points are used that are:

- Independent of the points used in production.
- At an accuracy equal to or better than the target product accuracy.

The location of the control points will be determined by evenly distributing them over the project area. We will select control points at key locations in the AOI and along flight lines.

In addition to project control, Surdex will survey checkpoints for internal QC of the project accuracy.

The accuracy report provides documentation of project specifications, control and check point descriptions and photos. In addition to written descriptions, project graphics are used to illustrate AOI's and GPS survey locations. To support accuracy reporting, an Excel spreadsheet is provided listing all survey positions including individual points, land cover types and final accuracy results as charts in the Project Summary Report.

PART THREE: TOPOGRAPHICS / PLANIMETRICS

A. Topographic Mapping

The third part of your request is for topographic / planimetric mapping within the University of Missouri project area of 4.8 square miles. This section discusses the development of 2' contours, using the LiDAR data from this project, plus collection of planimetric roofline elevations.

Contours can be generated several different ways:

- A LiDAR-only approach.
- A photogrammetric-only approach.
- A combined LiDAR and photogrammetric approach.

The decision as to which approach would be used depends partly on accuracy and partly on the density of the LiDAR data and/or resolution of the photogrammetric imagery.

When creating contours from LiDAR, Surdex has defined various levels of contour datasets that reflect common practices, intended usage, and level of effort. The following table defines these levels which range from Level 1 (automatically generated contours) to Level 4 (intended for precise datasets usable for engineering efforts).

Surdex is anticipating the LiDAR will be part of the scope of your project. If this comes to fruition, we recommend Level 3 Contours from LiDAR as the best values. This is also what is priced in the pricing section.

Contour from LiDAR Dataset Levels				
Feature	Level 1	Level 2	Level 3	Level 4
Contour index text	Yes	Yes	Yes	Yes
Attributes for depression contours	Yes	Yes	Yes	Yes
Cartographic edit (text and contours)		Yes	Yes	Yes
Hydrographic breaklines			Yes	Yes
Stereo-compiled breaklines				Yes
Planimetric features (optional)				Yes

The following examples illustrate the quality of each Level over the same area.

Level 1

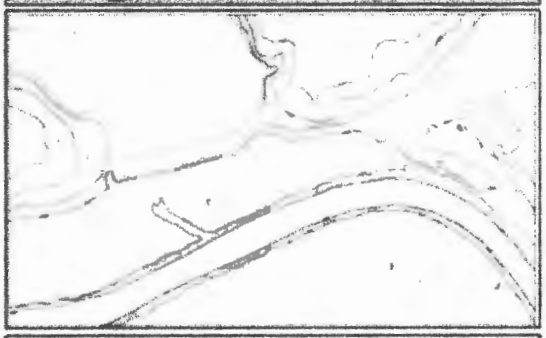
- Automatically generated from LiDAR.
- **No manual editing.**

Level 2

- Manual editing.
- **Anomalies resolved.**
- **Smoothing.**

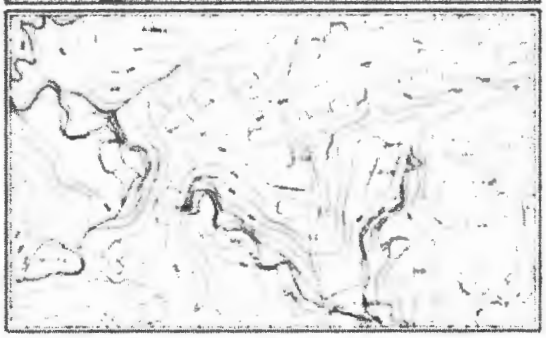
Level 3

- Begins with Level 2 dataset
- **Breaklines from LiDAR surface.**
- **Hydrologic enforcement.**
- **Aggressive cartographic editing.**



Level 4

- LiDAR and/or photogrammetric DTM source.
- **Stereocompilation.**
- **Highest level of breaklines and cartographic editing.**
- **Planimetric data is optional.**



For the purposes of this document, we are presuming that LiDAR will be collected and that it will be the source for the topographic mapping. (The alternative is that contours are generated by photogrammetric compilation.) We are suggesting and have priced Level 3 contours on newly acquired LiDAR. If the LiDAR option is not selected, the scope and cost of generating contours will need to be revisited and negotiated.

B. Planimetric Mapping (Roofline Elevations)

The planimetric mapping work for this project is for roofline elevations only (no feature collection is referenced in the RFP). During final negotiations, Surdex will discuss the options for this aspect based on whether elevation is based on LiDAR data or by imagery with stereo compilation.

If other planimetric feature collection is desired by any of the participants, Surdex has complete in-house capabilities to undertake full planimetric mapping.

Forms and Certifications

WORK AUTHORIZATION CERTIFICATION

PURSUANT TO 285.530 RSMo

(FOR ALL BIDS IN EXCESS OF $5,000.00)

County of St. Louis)

)SS.

State of Missouri)

My name is Katie Funkhouser. I am an authorized agent of Surdex Corporation (Bidder). This business is enrolled and participates in a federal work authorization program for all employees working in connection with services provided to the Agency. This business does not knowingly employ any person that is an unauthorized alien in connection with the services being provided. Documentation of participation in a federal work authorization program is attached hereto.

Furthermore, all subcontractors working on this contract shall affirmatively state in writing in their contracts that they are not in violation of Section 285.530.1 and shall not thereafter be in violation. Alternatively, a subcontractor may submit a sworn affidavit under penalty of perjury that all employees are lawfully present in the United States.

Katie Funkhouser 11/16/2018

Affiant Date

Katie Funkhouser 11/16/2018

Printed Name

Subscribed and sworn to before me this 16 day of November, 2018.

LORIE THOMAS
Notary Public - Notary Seal
State of Missouri, St Louis County
Commission Number 99416841
My Commission Expires Jun 13, 2020

Notary Public

Attach to this form the first and last page of the *E-Verify Memorandum of Understanding* that you completed when enrolling for proof of enrollment.

Last page of the E-Verify Memorandum of Understanding

E-Verify

Company ID Number: 183675

To be accepted as a participant in E-Verify, you should only sign the Employer's Section of the signature page. If you have any questions, contact E-Verify at 888-464-4218

Employer Surdex Corporation

Robert Berger

Electronically Signed 01/23/2 03

Date

Department of Homeland Security – Verification Division

USCIS Verification Division

Title

Electronically Signed

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION LOWER TIER COVERED TRANSACTIONS

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 29 CFR Part 98 Section 98.510, Participants' responsibilities. The regulations were published as Part VII of the May 26, 1988, Federal Register (pages 19160-19211).

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS FOR CERTIFICATION)

(1) The prospective recipient of Federal assistance funds certifies, by submission of this quotation, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective recipient of Federal assistance funds is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this quotation.

Ronald C. Hoffmann, President

Name and Title of Authorized Representative

R. C. Hoffmann — November 16, 2018

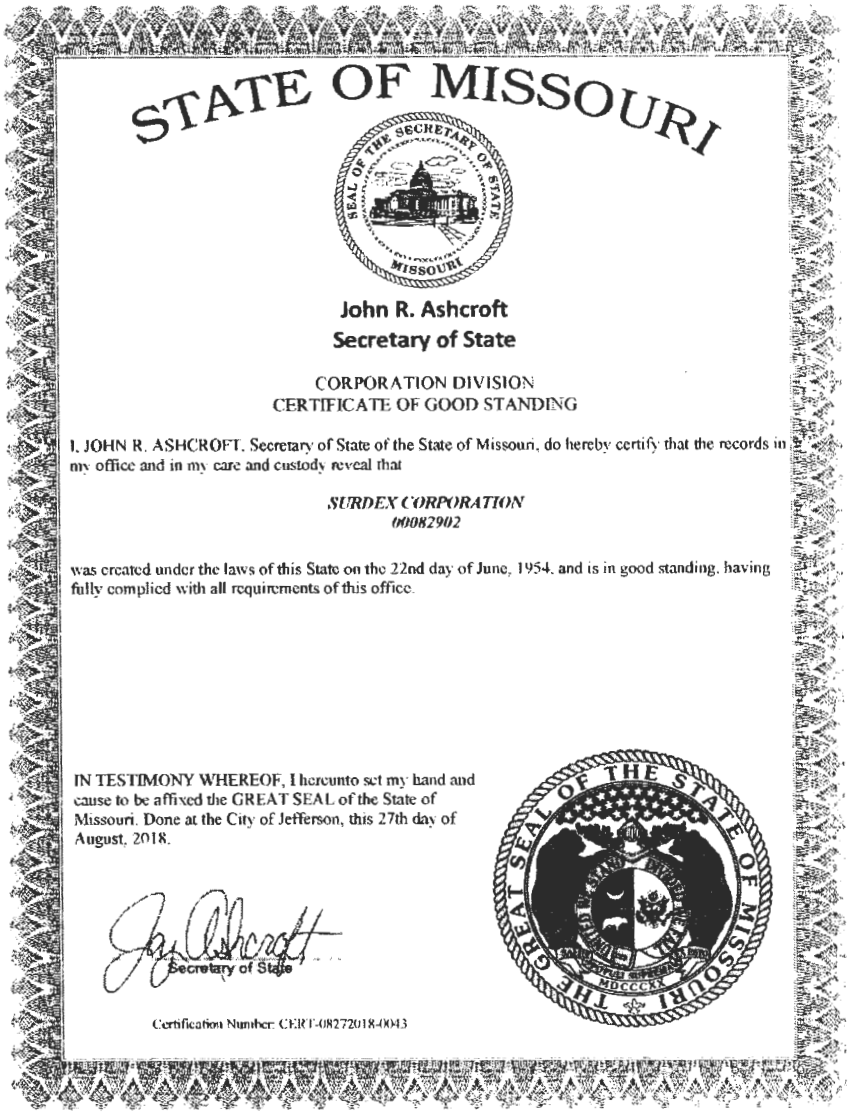
Signature — Date

LICENSES, CERTIFICATIONS, ACCREDITATION, AND/OR PERMITS

Name of Firm	Surdex Corporation
Business Address	520 Spirit of St. Louis Blvd. Chesterfield, MO 63005-1002 United States
Contact	Ron Hoffman, President

Certificate of Good Standing

Missouri Incorporation No.	0082902
Type Ownership	S-Corporation
FEIN	43-0690641
Year Established	Est. 1954, Missouri



STATE OF MISSOURI

John R. Ashcroft
Secretary of State

CORPORATION DIVISION
CERTIFICATE OF GOOD STANDING

I, JOHN R. ASHCROFT, Secretary of State of the State of Missouri, do hereby certify that the records in my office and in my care and custody reveal that

SURDEX CORPORATION
00082902

was created under the laws of this State on the 22nd day of June, 1954, and is in good standing, having fully complied with all requirements of this office.

IN TESTIMONY WHEREOF, I hereunto set my hand and cause to be affixed the GREAT SEAL of the State of Missouri. Done at the City of Jefferson, this 27th day of August, 2018.

Secretary of State

Certification Number: CERT-08272018-0043

NOTICE OF CONTRACT RENEWAL

State Of Missouri
Office Of Administration
Division Of Purchasing
PO Box 809
Jefferson City, MO 65102
www.oa.mo.gov/purch

Air
RFPS 3003490170028S

CONTRACT NUMBER	CONTRACT TITLE
CS170285002	Photogrammetric Mapping Products and Services
AMENDMENT NUMBER Amendment #001	**CONTRACT PERIOD** September 15, 2018 through September 14, 2019
REQUISITION/REQUEST NUMBER N/A	**SAM II VENDOR NUMBER/MissouriBUYS SYSTEM ID** 4306906410 1/ MB00048428
CONTRACTOR NAME AND ADDRESS SURDEX CORPORATION 520 SPIRIT OF ST LOUIS BLVD CHESTERFIELD, MO 63005	**STATE AGENCY'S NAME AND ADDRESS** State of Missouri Various Agency Locations

ACCEPTED BY THE STATE OF MISSOURI AS FOLLOWS:

The State of Missouri hereby exercises its option to renew the contract.

All other terms, conditions and provisions of the contract, including all prices, shall remain the same throughout the above contract period and apply hereto.

SIGNATURE OF CONTRACTOR IS NOT REQUIRED ON THIS DOCUMENT.

BUYER	BUYER CONTACT INFORMATION
Jacqueline Satterlee	Email: jacqueline.satterlee@oa.mo.gov Phone: (573) 751-4085 Fax: (573) 526-9816
SIGNATURE OF BUYER Jacqueline Satterlee	**DATE** 6/22/18

DIRECTOR OF PURCHASING

Karen S. Boeger

PURCHASING N/A.

CONTRACT AMENDMENT ROUTING GUIDE JS CS170285002 A# 001
Revised 08/17/15

RENEWAL: 1 PERIOD OF 2 TOTAL
- ____ Renewal - % Increase ____ Cost Savings
- ____ Renewal - $ Increase ____ Cost Savings
- ✓ Renewal – W/O Increase
- ____ SFS Renewal – Prices In Original Contract
- ____ SFS Renewal – Prices Not in Original Contract

EXTENSION PERIOD: ____
- ____ Extension – 30-Day Termination
- ____ Extension - $ Increase ____ Cost Savings
- ____ Extension – W/O Increase

- ____ Assignment
- ____ Cancellation/Termination
- ____ Other Amendment

Performance Security Deposit: $ ____

Surety Bond: $ ____

Annual Wage Order Number: ____
Annual Wage Order Date: ____
County(ies): ____

Other Instructions: ____

A.	Section 34.040.6, RSMo	Buyer/Section Support	DT	6-21-18
B.	Purchasing Suspension List	Buyer/Section Support	DT	6-21-18
C.	Federal Suspension – SAM.GOV	Buyer/Section Support	DT	6-21-18
D.	Labor Stds – OA/FMDC Contractor Debarment Lists	Buyer/Section Support		
E.	Review of Participation Commitment Attainment – If app, Verify Receipt of 1st Renewal – Blind/Shel Wkshp Affdvt	Buyer	JS	6/22
F.	SFS Review/Justification – Insert Advertising Date, if applicable	Buyer		
		Buyer/Section Support	DT	6-21-18
		Buyer		
		Buyer/Section Support	X	
	Contractor E-Mail Address/Fax Number	timd@surdex.com		
	State Agency Contact E-Mail Address			
	Section 34.040.6, RSMo, Letter	Follow-Up Notes:		

A.	Renewal/Extension Pricing	Buyer/Section Support		
B.	Section 34.040.6, RSMo	Buyer/Section Support		
C.	Performance Security Deposit/Surety Bond	Buyer/Section Support		
D.	Renewal/Extension with Cost Savings Language	Buyer		
E.	Statewide Notice CS 170285-1	Buyer	DT	6-21-18
F.	SFS Authorized Limit $	Buyer		
G.				
	1. E-Verify Exhibit/Affidavit/Documentation	Buyer/Section Support		
	2. Assignment and Consent Form	Buyer/Section Support		
	3. Purchasing Suspension List	Buyer/Section Support		
	4. Federal Suspension – SAM.GOV	Buyer/Section Support		
	5. Labor Stds – OA/FMDC Contractor Debarment Lists	Buyer/Section Support		
		Buyer/Section Support		
		Buyer	JS	6/22
		Buyer/Section Support	DT	6/26/18
	AM 300 PMM 00019409 m1	Buyer/Section Support	DT	6/26/18
	Distribute E-Verify & SDV Documents	Buyer/Section Support		
	E-Mail/Fax NOA to Contractor/Assignee & Agency Contact	Buyer/Section Support	DT	6/26/18
	Copy/Save As Statewide Notice to Internet Folder	Buyer/Section Support later	DT	
		Central Support-Participation	KW	7-9-18
		Central Support-Imaging		7-11-18

NOTICE OF AWARD

State Of Missouri
Office Of Administration
Division Of Purchasing
PO Box 809
Jefferson City, MO 65102-0809
http://oa.mo.gov/purchasing

SOLICITATION NUMBER	CONTRACT TITLE
RFPS30034901700285	Photogrammetric Mapping Products and Services
CONTRACT NUMBER	**CONTRACT PERIOD**
CS170285002	September 15, 2017 through September 14, 2018
REQUISITION/REQUEST NUMBER	**SAM II VENDOR NUMBER/MissouriBUYS SYSTEM ID**
NR 300 31957000001	4306906410 1/ MB00048428
CONTRACTOR NAME AND ADDRESS	**STATE AGENCY'S NAME AND ADDRESS**
SURDEX CORPORATION 520 SPIRIT OF ST LOUIS BLVD CHESTERFIELD, MO 63005	State of Missouri Various Agency Locations

ACCEPTED BY THE STATE OF MISSOURI AS FOLLOWS:

The proposal submitted by Surdex Corporation in response to RFPS30034901700285 is accepted in its entirety, including BAFO #001.

BUYER	BUYER CONTACT INFORMATION
Jacqueline Satterlee	Email: jacqueline.satterlee@oa.mo.gov Phone: (573) 751- 4925 Fax: (573) 526-9816
SIGNATURE OF BUYER	**DATE**
Jacqueline Satterlee	9/7/17

DIRECTOR OF PURCHASING

Karen S. Boeger

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF PURCHASING (PURCHASING)
REQUEST FOR BEST AND FINAL OFFER (BAFO)
FOR REQUEST FOR PROPOSAL (RFP)

BAFO REQUEST NO.: 001
SOLICITATION/OPPORTUNITY (OPP) NO.: RFPS30034901700285
TITLE: Photogrammetric Mapping Products and Services
ISSUE DATE: 05/24/17

REQ NO.: NR 300 31957000001
BUYER: Jacqueline Satterlee
PHONE NO.: (573) 751-4925
E-MAIL: jacqueline.satterlee@oa.mo.gov

BAFO RESPONSE SHOULD BE RETURNED BY: 05/31/17 AT 5:00 PM CENTRAL TIME

MAILING INSTRUCTIONS: **Print or type RFP Number and Return Due Date on the lower left hand corner of the envelope or package. Sealed BAFOs should be in Division of Purchasing office (301 W High Street, Room 630) by the return date and time.**

RETURN BAFO RESPONSE TO:

(U.S. Mail)
PURCHASING or
PO BOX 809
JEFFERSON CITY MO 65102-0809

(Courier Service)
PURCHASING
301 WEST HIGH STREET, RM 630
JEFFERSON CITY MO 65101-1517

CONTRACT PERIOD: Effective Date of Contract through One (1) Year

DELIVER SUPPLIES/SERVICES FOB (Free On Board) DESTINATION TO THE FOLLOWING ADDRESS:

State of Missouri
Various Agency Locations

The vendor hereby declares understanding, agreement and certification of compliance to provide the items and/or services, at the prices quoted, in accordance with all terms and conditions, requirements, and specifications of the original RFP as modified by any previously issued RFP addendums and by this and any previously issued BAFO requests. The vendor agrees that the language of the original RFP as modified by any previously issued RFP addendums and by this and any previously issued BAFO requests shall govern in the event of a conflict with his/her proposal. The vendor further agrees that upon receipt of an authorized purchase order from the Division of Purchasing or when a Notice of Award is signed and issued by an authorized official of the State of Missouri, a binding contract shall exist between the vendor and the State of Missouri.

SIGNATURE REQUIRED

VENDOR NAME	MissouriBUYS SYSTEM ID (SEE VENDOR PROFILE - MAIN INFORMATION SCREEN)
Surdex Corporation	48428
MAILING ADDRESS	
520 Spirit of St. Louis Blvd.	
CITY, STATE, ZIP CODE	
Chesterfield, MO 63005	

CONTACT PERSON	EMAIL ADDRESS
Tim Donze	timd@surdex.com
PHONE NUMBER	FAX NUMBER
636-368-4400	636-368-4401
VENDOR TAX FILING TYPE WITH IRS (CHECK ONE)	
_X_ Corporation ___ Individual ___ State/Local Government ___ Partnership ___ Sole Proprietor ___ IRS Tax-Exempt	
AUTHORIZED SIGNATURE	DATE
R. C. Hoffmann	5/30/2017
PRINTED NAME	TITLE
Ronald C. Hoffmann	President

May 30, 2017

Attention: Jacqueline Satterlee
Division of Purchasing
301 West High Street, Truman Building, Room 630
Jefferson City, MO 65101-1517

RE: **RFP NUMBER:** RFPS30034901700285 BAFO REQUEST NO.: 001
RETURN DUE DATE: 05/31/17 AT 5:00 PM CENTRAL TIME
TITLE: *Photogrammetric Mapping Products and Services*

Dear Ms. Satterlee:

Surdex is pleased to be providing the State of Missouri our BAFO response by filling in the new table in Exhibit D to identify the location of aircraft that our team might use as part of your geospatial contract. The information in Exhibit D identifies our fixed wing aircraft here at Surdex as well as our subcontractors that can provide support with fixed wing and/or helicopter platforms.

As you will see, the Surdex planes operate from our headquarters and maintenance hangar in Chesterfield, Missouri. Surdex has proudly operated in Missouri for its entire existence, sixty plus years.

We have not found cause to change any other portion of our response to the State and hope the review panel has found our response complete and acceptable.

Sincerely,

Tim Donze
Vice President, Business Development
Direct: (314) 422-7616 | Office: (636) 368-4400
TimD@surdex.com

Ronald C. Hoffmann
President, Authorized Agent
Office: (636) 368-4400

BEST AND FINAL OFFER (BAFO) #001 to RFPS30034901700285

TITLE: Photogrammetric Mapping Products and Services

CONTRACT PERIOD: Effective Date of Contract through One (1) Year

The following exhibit in RFPS30034901700285 contains changes: Exhibit D

DESCRIPTION OF AIRCRAFT, OWNED OR LEASED, BASED (ADDED PER BAFO #001)

EXHIBIT D.6 ADDED PER BAFO #001

6. **The vendor should provide the information included in the table below, if necessary the vendor may add additional pages:**

Description of Aircraft	Is the Aircraft Owned, Leased, or Subcontracted? If Leased or Subcontracted, Who is Providing the Equipment?	Where is the Aircraft Based?
Cessna 441 Conquest II-10, Fixed wing Tail # N441EH	Owned / Surdex Corporation	Spirit of St. Louis Airport, Chesterfield, Missouri
Cessna 441 Conquest II-10, Fixed wing Tail # N440EH	Owned / Surdex Corporation	Spirit of St. Louis Airport, Chesterfield, Missouri
Cessna 441 Conquest II-10, Fixed wing Tail # N441FS	Owned / Surdex Corporation	Spirit of St. Louis Airport, Chesterfield, Missouri
Cessna 441 Conquest II-10, Fixed wing Tail # N2NQ	Owned / Surdex Corporation	Spirit of St. Louis Airport, Chesterfield, Missouri
Cessna 414A Chancellor III, Fixed wing Tail # N414EH	Owned / Surdex Corporation	Spirit of St. Louis Airport, Chesterfield, Missouri
Cessna 335 II, Fixed wing Tail # N27EH	Owned / Surdex Corporation	Spirit of St. Louis Airport, Chesterfield, Missouri
Cessna TU-206F Turbo, Fixed wing Tail # N223SC	Owned / Surdex Corporation	Spirit of St. Louis Airport, Chesterfield, Missouri
Cessna TU-206F Turbo, Fixed wing Tail # N7268P	Owned / Surdex Corporation	Spirit of St. Louis Airport, Chesterfield, Missouri
Cessna TU-206F Turbo, Fixed wing Tail # N72582	Owned / Surdex Corporation	Spirit of St. Louis Airport, Chesterfield, Missouri
Cessna TU-206F Turbo, Fixed wing Tail # N72695	Owned / Surdex Corporation	Spirit of St. Louis Airport, Chesterfield, Missouri
Bell 206 Long Range Helicopter	Lease (when needed) / Helicopter Inc.	Cahokia, Illinois, requested with in the area of contracted work
King Air 200, Fixed wing (Geiger-mode LiDAR acquisition)	Leased / Dynamic Aviation Group (DAG), controlled by Harris Corporation	Bridgewater Virginia, Deployed throughout the US as required
King Air 200, Fixed wing (Geiger-mode LIDAR acquisition)	Leased / Dynamic Aviation Group (DAG), controlled by Harris Corporation	Bridgewater Virginia, Deployed throughout the US as required
King Air 200, Fixed wing (Geiger-mode LIDAR acquisition)	Leased / Dynamic Aviation Group (DAG), controlled by Harris Corporation	Bridgewater Virginia, Deployed throughout the US as required

Eric R. Greitens
Governor

Sarah H. Steelman
Commissioner

State of Missouri
OFFICE OF ADMINISTRATION
Division of Purchasing
301 West High Street, Room 630
Post Office Box 809
Jefferson City, Missouri 65102-0809
(573) 751-2387 Fax: (573) 526-9816
TTD: (800) 735-2966 Voice: (800) 735-2466
http://oa.mo.gov/purchasing

Karen S. Boeger
Director

May 24, 2017

Surdex Corporation
520 Spirit of St. Louis Blvd.
Chesterfield, MO 63005
timd@surdex.com

Dear Mr. Donze:

In accordance with paragraph 3.2 of RFPS30034901700285 for Photogrammetric Mapping Products and Services, this letter shall constitute an official request by the State of Missouri to enter into competitive negotiations with your company.

Included with this letter is a complete copy of the RFP, including revisions to the RFP as a result of this request for negotiations. The cover page of the attached RFP is the Best and Final Offer #001 form. This BAFO #001 form must be completed, signed by an authorized representative of your organization, and returned with your BAFO response. Signing the BAFO #001 form cover page confirms your understanding and agreement to comply with the provisions and requirements of the RFP as modified by this request for a BAFO.

In your response to this Best and Final Offer, you may make any modification, addition, or deletion deemed necessary to your proposal. However, please be advised that it is not necessary for you to resubmit your entire proposal. Only the signed BAFO #001 form and any portions of your proposal that are being revised as a result of this request for a Best and Final Offer need be submitted. Your BAFO response is your final opportunity to ensure that (1) all mandatory requirements of the RFP have been met, (2) all RFP requirements are adequately described since all areas of the proposal are subject to evaluation, and (3) this is your best offer, including a reduction or other change to pricing.

You are requested to respond to this request for a BAFO by submitting a written, sealed "Best and Final Offer" **BY 5:00 p.m. Central Time on Wednesday, May 31, 2017** to:

Attention: Jacqueline Satterlee
Division of Purchasing
301 West High Street, Truman Building, Room 630
Jefferson City, MO 65101-1517

The outside of the packet containing the BAFO response needs to state, "BAFO for RFPS30034901700285" on the lower left corner. Please include the **original plus five (5) copies (for a total of six (6) documents)** of your response. In addition, the vendor should provide one (1) copy of the response in a Microsoft compatible format on a CD(s) or flash drive. Faxed or e-mailed responses are not acceptable.

You are reminded that pursuant to section 610.021, RSMo, proposal documents including any best and final offer documents are considered closed records and shall not be divulged in any manner until after a contract is executed or all proposals are rejected. Furthermore, you and your agents (including subcontractors, employees, consultants, or anyone else acting on their behalf) must direct all questions or comments regarding the RFP, the evaluation, etc. to me, as the buyer of record. Neither you nor your agents may contact any other state employee regarding any of these matters during the negotiation and evaluation process. Inappropriate contacts or release of information about your proposal or BAFO are grounds for suspension and/or exclusion from specific procurements.

If you have any questions regarding this BAFO request, please contact me at (573) 751-4925 or e-mail me at jacqueline.satterlee@oa.mo.gov. Your efforts in working with the State of Missouri to ensure a thorough evaluation of your proposal are sincerely appreciated.

Sincerely,

Jacqueline Satterlee

c: Evaluation Team
RFPS30034901700285

Attachment: RFP including BAFO #001 form

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF PURCHASING (PURCHASING)
REQUEST FOR PROPOSAL (RFP)

SOLICITATION/OPPORTUNITY (OPP) NO.: RFPS30034901700285
TITLE: Photogrammetric Mapping Products and Services
ISSUE DATE: 02/22/17

REQ NO.: NR 300 31957000001
BUYER: Jacqueline Satterlee
PHONE NO.: (573) 751–4925
E-MAIL: jacqueline.satterlee@oa.mo.gov

RETURN PROPOSAL NO LATER THAN: 03/15/17 AT 2:00 PM CENTRAL TIME (END DATE)

VENDORS ARE ENCOURAGED TO RESPOND ELECTRONICALLY THROUGH HTTPS://MISSOURIBUYS.MO.GOV BUT MAY RESPOND BY HARD COPY (See Mailing Instructions Below)

MAILING INSTRUCTIONS: Print or type **Solicitation/OPP Number** and **End Date** on the lower left hand corner of the envelope or package. Delivered sealed proposals must be in the Purchasing office 301 W High Street, Room 630) by the return date and time.

RETURN PROPOSAL TO:

(U.S. Mail)
PURCHASING
PO BOX 809
JEFFERSON CITY MO 65102-0809

or

(Courier Service)
PURCHASING
301 WEST HIGH STREET, RM 630
JEFFERSON CITY MO 65101-1517

CONTRACT PERIOD: Effective Date of Contract through One (1) Year

DELIVER SUPPLIES/SERVICES FOB (Free On Board) DESTINATION TO THE FOLLOWING ADDRESS:

State of Missouri
Various Agency Locations

The vendor hereby declares understanding, agreement and certification of compliance to provide the items and/or services, at the prices quoted, in accordance with all requirements and specifications contained herein and the Terms and Conditions Request for Proposal (Revised 10/19/15). The vendor further agrees that the language of this RFP shall govern in the event of a conflict with his/her proposal. The vendor further agrees that upon receipt of an authorized purchase order from the Division of Purchasing or when a Notice of Award is signed and issued by an authorized official of the State of Missouri, a binding contract shall exist between the vendor and the State of Missouri. The vendor shall understand and agree that in order for their proposal to be considered for evaluation, they must be registered in MissouriBUYS. If not registered at time of proposal opening, the vendor must register in MissouriBUYS upon request by the state immediately after proposal opening.

SIGNATURE REQUIRED

VENDOR NAME	MissouriBUYS SYSTEM ID (SEE VENDOR PROFILE - MAIN INFORMATION SCREEN)
Surdex Corporation	48428
MAILING ADDRESS	
520 Spirit of St. Louis Blvd.	
CITY, STATE, ZIP CODE	
Chesterfield, MO 63005	

CONTACT PERSON	EMAIL ADDRESS
Tim Donze	TimD@surdex.com
PHONE NUMBER	FAX NUMBER
636-368-4400	636-368-4401
VENDOR TAX FILING TYPE WITH IRS (CHECK ONE)	
X Corporation ___ Individual ___ State/Local Government ___ Partnership ___ Sole Proprietor ___ IRS Tax-Exempt	
AUTHORIZED SIGNATURE R. C. Hoffmann	DATE 03/15/2017
PRINTED NAME Ronald C. Hoffmann	TITLE President

Table of Contents

Transmittal Letter/ Executive Summary

THE SURDEX TEAM

Surdex is pleased to submit this fully compliant response to RFP **RFPS30034901700285**, "Photogrammetric Mapping Products and Services" issued by the Missouri Office of Administration, Division of Purchasing and Materials Management. Surdex has assembled a team addressing all stated requirements as well as additional capabilities that may be of use in future projects. Our Team presents a capacity that can address the largest envisioned projects in the coming years. Our teammates include a Woman and Minority Business Enterprises (WBE, MBE). By far the majority of work will be performed by Missouri-based businesses, keeping tax revenue and employment within the State of Missouri to the maximum extent.

Our Team brings an array of aerial imagery and LiDAR systems to this effort. This represents a truly all-digital solution for orthophotos, terrain models, contours, planimetric mapping, and the like.

Team Member	Role	Primary Location	Responsibilities
Surdex Corporation	Prime Contractor	Chesterfield, MO	Project design, project management, aerial imagery and LiDAR acquisition, image processing, aerotriangulation, digital orthophotos, DEM/DTM processing, contours, planimetric processing
David Mason & Associates	Subcontractor (MBE)	St. Louis, MO	Field survey
EFK Moen	Subcontractor (WBE)	St. Louis, MO	Field survey
Merrick & Company	Subcontractor	Denver, CO	Fixed-wing and helicopter LiDAR acquisition and processing, mobile LiDAR acquisition and processing
Harris Corporation	Subcontractor	Melbourne, FL, with major Missouri office	Geiger LiDAR acquisition and processing
ESP	Subcontractor	Fort Mill, SC	Mobile LiDAR acquisition and processing

WBE/MBE COMMITMENT

Surdex fully recognizes the need and benefit of the participation of Woman and Minority Business Enterprises and our Team incorporates 2 such businesses to meet the specifications for the State of Missouri. We are proposing levels of participation that we incorporated into our previous Missouri Statewide Project Surdex was responsible for. For this past projects for the State, the WBE/MBE subcontracts amounted to 15.4% of the total contract value.

TECHNOLOGY

Our Team is offering technology that meets and exceeds the RFP specifications. We bring a large number airborne sensors to this effort, hosted in high-performance aircraft. Additionally, we are offering technology that exceeds the stated services so as to better serve potential clients through this contractual relationship.

- Surdex owns and operates five (5) Leica ADS100 pushbroom, multispectral cameras, making our company the largest such installation in the United States and one of the largest in the world.
- Surdex also owns and operates three (3) Leica DMC-1 frame format, multispectral cameras.
- Surdex owns and operates a Leica RCD30 Oblique camera system. With additional components purchased by Surdex, this can be operated as a 5-camera ("penta") configuration suitable for urban mapping, up to two 3-camera ("trio") configurations addressing corridor applications, or a single camera mounted with our Galaxy LiDAR, or operated in a single-camera mode.

The ADS100 technology reduces the acquisition effort with its large swath and ability to fly higher for a given ground resolution. The Oblique system based on the RCD30 medium-format digital camera may also be suitable for smaller orthoimagery projects with 4-band imagery and the added bonus of forward, aft, left, and right oblique views. With our ADS100 and DMC-1 systems, we can provide frame and/or pushbroom technology for each project to meet specific requirements. In most cases, only one type of sensor will be used on a specific project.

In addition to existing and new technology directly addressing the stated RFP requirements, our Team is also offering additional technology that we feel may be applicable to future projects, this includes:

- Surdex's OpTech Galaxy LiDAR acquisition and processing.
- Helicopter-borne LIDAR acquisition and processing.
- Web hosting of geospatial data.
- Mobile LiDAR mapping.
- State-of-the-art Geiger LiDAR acquisition and processing.

PAST EXPERIENCE

In addition to being responsible for the statewide contracts from 2007-2009 and a contract holder for the 2013-2016 state programs, Surdex has been responsible for numerous other projects in and around the State of Missouri. The projects include local, state, and federal government agencies.

If one analyzed the orthoimagery, LiDAR and mapping projects performed in the State of Missouri in the recent past, it is clear that Surdex has uniquely performed to the expectations of our clients. Given Surdex's proven track record, we give our clients the peace of mind that their project will be handled with the greatest of capability, expertise, and care. We fully realize that we are "only as good as our last project".

CAPACITY

To put our digital orthoimagery capacity into perspective, with our advanced imaging technology and the large number of systems at our Team's disposal, we are capable of acquiring and processing the entire 70,000 square miles of the State of Missouri at 1' or 2' resolution every year. From the LiDAR perspective, we estimate that we are able to acquire and process data at 1-meter post spacing for over a third of the State each year.

CONCLUSION

Surdex strongly believes our Team represents the most highly qualified solution that will be offered to the State. Our Team's strengths are:

- The technology and capacity our Team brings provides a cost-effective solution for projects of all sizes.
- Our Team will retain employment and tax revenue within the State to the maximum extent.
- The local presence of our key aerial sensors and fleet of aircraft ensures aerial data capture during adverse weather and climate and minimizes the cost of ferrying systems to and from projects.
- We are embracing the use of MBE and WBE participation in the projects to support the small business program initiatives of the State.

EXHIBIT A: Vendor Information

A. COMPANY HISTORY

Provide a brief company history, including the founding date and number of years in business as currently constituted.

Surdex Corporation is a privately-owned company that has been in continuous operation for over 60 years and is currently one of the 10 largest aerial mapping companies in the United States. We have been based in the greater St. Louis, Missouri, metropolitan area since 1954. Over the last decade we have grown from a regional company to a nationwide presence, including projects in Canada and Mexico. Approximately 90 employees work at our headquarters building and hangar complex at the Spirit of St. Louis Airport in Chesterfield, Missouri. Our clientele include federal, state, and local government as well as private engineering, defense mapping, and Homeland Security.

Our other Team members / subcontractors:

- **David Mason & Associates (DMA)** (MBE, field survey): Founded in 1989, DMA provides civil and structural engineering, architectural document support, land surveying, and construction management/program management services to meet the needs of a diverse base of clients. DMA crews are experienced with property/boundary surveys, aerial mapping and topographic surveys, roadway and right of way surveys, hydraulic and bridge surveys and GPS survey projects.
- **EFK Moen** (WBE, field survey): In February 1998, EFK Moen, LLC was organized under the laws of the State of Missouri to offer civil engineering design consulting. The engineering services we provide are based on integrity and professionalism; and we are dedicated to providing quality service to our clients and substantial career opportunities to our staff. EFK Moen began providing transportation engineering design services as a prime consultant to the Missouri Department of Transportation, the St. Louis Metropolitan Sewer District and numerous Counties and Municipalities and private clients throughout the State of Missouri and now our services have expanded throughout the Midwest. In 1999 EFK Moen began providing Professional Land Surveying services, now under the direction of Chris Ferrante, PLS. A structural engineering group was created in 2000, now managed by Chris Linneman, PE/SE.
- **Harris Corporation** (Geiger LiDAR acquisition and processing): Harris Corporation was created in the late 1890's. The company has approximately $8 billion in annual revenue and over 23,000 employees, including 9,000 engineers and scientists supporting customers in more than 125 countries. For 25 years, Harris has created geospatial information solutions that meet the exacting—and often unique—needs of government and commercial customers. Today, through our IntelliEarth™ Geospatial Solutions, we are making it easier and more cost effective to visualize the physical environment for a wide range of applications. Harris' IntelliEarth™ Geiger-mode LIDAR sensor and tool suite supports cost effective, large area topographic mapping can for multiple geospatial applications, and for generating integrated enterprise geospatial information and situational knowledge products to benefit our customers and stakeholders.
- **ESP Associates, P.A.** (mobile LiDAR acquisition and processing): Founded in 1986, ESP Associates, is a multi-disciplinary, consulting, civil engineering, planning, and geomatics firm. 3D Mobile Mapping is the newest technology used to collect mass quantities of terrestrial LiDAR at both mapping grade and survey grade accuracies. The concept of mounting two 3D lasers, 4 to 6 cameras, a military grade IMU and two GPS receivers to a vehicle and collecting continuous point data clouds at highway speeds provides the most efficient and accurate method of data collection along highways, secondary roads, beaches and other routes permitting vehicle access.

B. TYPE OF SERVICES

Describe the nature of the vendor's business, type of services performed, etc. Identify the vendor's website address, if any.

Surdex's website is: *www.surdex.com*. We perform the following core services:

Surdex Services and Application Performed	
Services	Applications
■ Aerial digital orthoimagery acquisition and processing ■ Planimetric and topographic mapping ■ LiDAR acquisition and processing ■ Oblique imagery ■ Control survey ■ Unmanned Aerial Systems (UAS) acquisition	■ Impervious surface mapping ■ Topographic mapping ■ GIS base and parcel mapping ■ Corridor mapping: utilities, pipeline, transportation ■ Vegetation analysis ■ Land cover/land use ■ Urban planning ■ Forestry ■ Floodplain mapping ■ Agriculture/crop science ■ Environmental assessment ■ Engineering design ■ First responders, EMS, fire and ambulance, schools

C. PREVIOUS EXPERIENCE

Describe any previous project experiences of a similar nature and complexity in scope, responsibility and technologies involved.

Surdex was responsible for the Missouri Statewide 2' resolution projects began in 2007 and finished in 2009 and numerous orthoimagery task orders during the 2013-2016 state contract. Most notably, in 2014-2015, Surdex was responsible for the Texas Statewide Orthoimagery program in which 275,000 square miles of 0.5-meter and 13,000 square miles of mixed 1' and 6" resolution were captured and processed. In addition, we have been involved in numerous IDIQ (Indefinite Delivery/Indefinite Quantity) contractual arrangements, which are similar to those intended by this RFP. Most notably, these include:

- The USDA National Agriculture Imagery Program (NAIP) from 2003 to present. This included three successive IDIQ arrangements varying in length of from 3 to five years. Anywhere from 3-10 contractors were chosen for each IDIQ cycle, competing for annual task orders.
- Surdex is in its second successive IDIQ with the US Corps of Engineers, St. Louis District. Various task orders have been issued against this contract, including technologies such as required and proposed on this RFP.
- Along with our Teammate, Merrick & Company, we hold a Joint Venture contract with the US Geological Survey for the General Photogrammetric Services Contract (GPSC).

For contractual arrangements such as these, Surdex operates as a "broker" of the client. If selected by the State, Surdex will actively investigate possible projects and cost-sharing opportunities that could be brought to this contract as a benefit to the State.

D. PREVIOUS EXPERIENCE WORKING WITH FEDERAL AGENCIES, STATE, COUNTY AND CITY GOVERNMENTS

Provide information regarding previous experience working with federal agencies, state, county, and city governments.

Approximately 90% of our work is for public sector / governmental agencies – federal, state, county, and municipal governments. Many of our projects are for *multiple* public entities (for example, a consortium of several counties,

a county in conjunction with several cities, etc.). Having been a major provider to government entities for over 60 years, Surdex is extremely experienced working with governments and has a clear understanding of their needs.

We undertake projects across the United States and beyond (including Canada, Mexico, and Puerto Rico). Many projects include imagery at multiple resolutions (such as 12", 6", 3" GSD) along with other deliverables (such as LiDAR data, DEM/DTM, topographic mapping, planimetric mapping, and oblique imagery). Surdex performs all services including image and LiDAR acquisition, control survey, aerial triangulation, image and LiDAR processing, and quality assurance/quality control measures at every step of production. The following table describes several of our recent projects (many in Missouri) with a wide range of services and products:

Recent Projects by Type

Type	Client	Description
Federal	USDA National Agriculture Imagery Program (NAIP)	15 consecutive years of imagery at from 2m to 1m GSD covering 32 states. Over 6 million square miles.
	USACE, Meramec Basin LiDAR	LiDAR elevation data (15 cm accuracy on bare ground, and 40 cm in vegetation and hillsides, overall 18 cm), and totaled 5,692 square miles of Eastern Missouri meeting the NDEP Guidelines.
	USACE / MO NRCS / USGS, LiDAR of the Metropolitan St. Louis Sewer District	High-resolution digital elevation data from LiDAR acquisition. The total project included two priority zones of 13 counties and totaled 6,282 square miles.
State	State of Missouri, statewide digital orthoimagery (2007, 2008/9, 2016)	Digital imagery and the production of true color DOQQs at 2' (State Plane) and 0.6 meter (UTM) resolution. In 2007, Surdex was awarded a contract through its existing Department of Transportation agreement.
	State of North Carolina, Digital Orthoimagery Project	Five consecutive years (2012-2016) of 6" GSD imagery of approximately 17,000 square miles.
	Iowa Statewide Digital Orthoimagery Project	Statewide digital orthoimagery at 12"/30cm during the Spring of 2016.
	State of Texas, Statewide Digital Orthoimagery	0.5 meter 4-band digital orthophotography over the entire state of Texas (275,000 square miles). Acquisition was late 2014 through spring of 2015, during leaf-off conditions. Several metropolitan areas elected higher resolution 12" and 6" GSD imagery.
County	Boone County Consortium, Missouri	Multiple resolutions of digital orthophotos covering the counties of Boone, Cole, Howard, Callaway, Cooper, Moniteau and Johnson. 12", 6" and 3" GSD plus LiDAR and 2' contours.
	East-West Gateway Coordinating Council, Missouri	Two projects by the East-West Gateway and the St. Louis Area Regional Response System, in 2012 and 2015, for 6" GSD imagery totaling roughly 9,800 square miles.
	Houston-Galveston Area Council (H-GAC)	Digital orthoimagery in 2012, 2014, and 2016 of approximately 30,000 square miles of imagery from 6", 3" and 12" GSD.
	Mid-America Regional Council (MARC), Kansas	Multi-county project encompassing 2,526 square miles of Kansas City and the surrounding metro area of 6" GSD.
	Newton County, Missouri, Digital Orthophotography	County-wide 6" GSD color digital aerial imagery in the spring of 2016 totaling 627 square miles.
	Nodaway County, Missouri, Digital Orthoimagery	2012 and 2017 digital orthoimagery at 6" and 12" GSD, of 879 square miles each year.
City/Municipal	City of Columbia, Missouri	Part of the seven-county project orchestrated through the Boone County Consortium; 64 square miles of 6" GSD plus LiDAR.
	City of Roswell, Georgia	6" GSD orthoimagery of five Georgia communities in the Roswell, Georgia area totaling 132 square miles.

E. YEARS OF EXPERIENCE WITH GOVERNMENT ENTITIES

Indicate the number of years the vendor's business has been providing services of the nature of those described in the RFP for government entities.

Surdex has been in continuous operation since 1954, marking its 63rd year in 2017. Founded on aerial photography, the company is a premier geospatial data provider primarily focused on orthoimagery, survey, planimetric mapping, and elevation modeling (DEM, DTM, contours). Surdex began the conversion to digital sensors in 2004. LiDAR data capture and processing began in 2005. We began using an Unmanned Aerial System as a mode of capture in 2016, and in 2015-16 were conducting tests on our new Oblique system to incorporate it into our production process.

F. EXPERIENCE DEVELOPING MULTI-RESOLUTIONS ORTHOIMAGERY MAPPING PRODUCTS

Provide the vendor's experience developing multi-resolution orthoimagery mapping products.

Many projects involved multiple resolutions of data. Many large Councils of Governments (COGs) involve both rural and urban expanses and, for funding reasons, often involve lower-resolution data in the outlying areas and higher-resolution data in the urban areas. You will note in the table in Section D above, many of the projects include multiple resolutions and additional planimetric services (such as LiDAR, DEM/DTM update, and topographic/planimetric mapping). In general:

- Rural areas are typically at 1'-2' resolution. Many statewide efforts include 1'-1.5' resolution, leaving local governments to "buy-up" to 6" or better resolutions.
- Urban areas typically require 6" resolution.
- Downtown areas are frequently requiring "near true orthos" at 6" resolution (reduced building lean) and an increasing number are trending toward 3" resolution.

  In the last couple of years, Surdex has been involved in two large projects that illustrate multiple resolutions, both involving federal, state, and local government funding.

- The 2014-2016 Texas Statewide Orthoimagery project entailed 275,000 square miles of 0.5-meter and 13,000 square miles of mixed 1'/6" resolution.
- The long-standing Houston-Galveston Area Council (H-GAC) project includes a large number of local government partners. Starting in 2012, Surdex has acquired and produced 3", 6", and 12" imagery coverage the entire metropolitan area multiple times.

G. EXPERIENCE DEVELOPING MULTI-RESOLUTION ORTHOIMAGERY USING AIRBORNE GPS

Provide the vendor's experience developing multi-resolution orthoimagery using airborne GPS.

Virtually all imagery and LiDAR missions are founded on the collection, processing, and incorporation of Airborne GPS (ABGPS) and IMU (Inertial Measurement Unit) processing in the production effort. Where accuracy requirements permit (ASPRS Standard Mapping and GIS/Class I or lesser accuracy in general terms), this information alone may sufficient to avoid the placing and measuring of ground control points. Surdex's decades of experience has proven that aerotriangulation of the imagery is always required to minimize potential shear between adjacent images or strips of images. Control points will be used on every project to ensure accuracy standards are met or exceeded.

H. SAMPLES

Submit a sample(s) of digital orthoimagery and other photogrammetric products produced for a previous or current client that are representative of the product required herein. However, if the vendor is proposing another entity to provide the services, the vendor should submit samples of some of the proposed entity's previous digital orthoimagery and other photogrammetric products produced.

Surdex is providing samples of digital orthoimagery at various resolutions of projects within the State of Missouri. We are also providing planimetric data from a state project as well. We are also providing a sample of QL2 LiDAR data of the State of Nebraska acquired using our Galaxy LiDAR sensor. Additionally, we are providing Geiger LiDAR data acquired by our subcontractor, Harris. The following is a list of recent sample data representative of our work:

Sample Project Data

Type	Sensor	Description
Digital Orthoimagery	Leica ADS100 sensor	12" GSD TIFF with TIFF world file (Boone County, MO 2016) 6" GSD TIFF with TIFF world file (Boone County, MO 2016) 3" GSD TIFF with TIFF world file (Boone County, MO 2016)
LiDAR	Galaxy LiDAR sensor	QL2, .LAS files, (State of Nebraska, 2016)
Geiger-Mode LiDAR	Harris Geiger-mode sensor	Classified data set 8 ppm (Charlotte, North Carolina) Classified data set 20 ppm (Charlotte, North Carolina)
Planimetric Mapping	ADS100 sensor	Planimetric data set (Columbia, MO 2016)
Topographic Mapping	ADS100 sensor	Topographic data set (Columbia, MO 2016)

Note: all samples are the work of Surdex Corporation with the exception of the Geiger LiDAR data, which was acquired and processed by our Teammate, Harris Corporation.

Viewing and Downloading Samples Data

Our samples has been set up for you to view on an FTP site.

Hyperlink: ftp.surdex.net

User login: Missouri
Password: MO2017

Copy and paste the above hyperlink into a browser URL window or a Windows Explorer address window.

After 3 failed attempts to login, contact us if you have difficulty accessing the data, feel free to email timd@surdex.com for assistance.

EXHIBIT B: Current/Prior Experience

Vendor Name or Subcontractor Name: Surdex Corporation

Reference Information (Current/Prior Services Performed For:)		
References	1	2
Name of Reference Company:	**State of Missouri**	**Mid-America Regional Council (MARC)**
Address of Reference Company ✓ Street Address ✓ City, State, Zip	State of Missouri, Office of Administration Information Technology Services Division Office of Geospatial Information Truman Building, Room 840 Jefferson City, MO 65102	600 Broadway Suite 200 Kansas City, MO 64105
Reference Contact Person Information: ✓ Name ✓ Phone Number ✓ E-mail Address	Arnold Williams, GIS Manager (573) 526-1817 Arnold.wiliams@oa.mo.gov	Jakob Goldman (816) 701-8307 jgoldman@marc.org
Dates of Services:	2016; 2008-2009, 2007	2016 and 2010
If service/contract has terminated, specify reason:	No	No
Dollar Value of Services	$394,335 (2016) $248,619 (2008) $410,909 (2007)	$193,328 (2016), $313,309 (2010)
Description of Services Performed Including the Following:		
✓ *Acquisition of Digital Orthoimagery*	Aerial acquisition of digital imagery and the production of true color DOQQs 2007: GSD: 2' / .6M, square miles: 72,656, 2008: GSD: 2' / .6M, square miles: 75,036, 2016 18", square miles: 30,610. Adverse weather (ice and quick warming) in the spring of 2008 precluded capture of all of the remaining 1/3rd (western portion) of the State. This was completed in the spring of 2009. • Digital Orthoimagery • 30 degree Sun Angle, 5% per DOQQ for clouds/No Snow • DOQQs were provided in both UTM and State Plane reference frames. • Used subcontractors for Survey Data Collection: David Mason & Associates	In 2016 Surdex conducted a multi-county project encompassing 2,526 square miles of Kansas City and the surrounding metro area (consisting of Leavenworth and Wyandotte counties in Kansas; and Platte, Cass, Ray, Jackson and Clay counties in Missouri. To reduce building lean of tall buildings in Approximately 15 square miles of urban Kansas City, Surdex densified the flight lines. The client-provided DEM was also updated and provided as a deliverable. • 6" GSD 4-band digital orthoimagery of Kansas City metro area in GeoTIFF and MrSID format • Updated DEM • Metadata files by tile and county in FGDC .xml format • Mosaic seamlines in ESRI format

Vendor Name or Subcontractor Name: Surdex Corporation

Reference Information (Current/Prior Services Performed For:)		
References	3	4
Name of Reference Company:	**Boone County Consortium (Boone, Cole, Howard, Callaway, Cooper, Moniteau and Johnson Counties, Missouri)**	**City of Columbia, Missouri**
Address of Reference Company ✓ Street Address ✓ City, State, Zip	GIS Dep't, City of Columbia, MO 801 East Walnut, Room 220 Columbia, MO 65201	GIS Dep't, City of Columbia, MO 801 East Walnut, Room 220 Columbia, MO 65201
Reference Contact Person Information: ✓ Name ✓ Phone Number ✓ E-mail Address	Jason Warzinik (573) 886-4325 jwarzinik@boonecountymo.org	Kenny Legleiter, GISP (573) 441-5489 klegleiter@gocolumbiamo.com
Dates of Services:	January 2015 – December 2015	January 2015 – July 2016
If service/contract has terminated, specify reason:	No	No
Dollar Value of Services	$311,000 (Billed under the Boone County Consortium Project)	$311,000 (Billed under the Boone County Consortium Project)
Description of Services Performed including the Following:		
✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LiDAR Elevation Data ✓ Creation of Digital Terrain Model from LiDAR ✓ Creation of Digital Elevation Model from LiDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	Seven-county project orchestrated through the Boone County Consortium, Missouri, with the various counties / municipalities requesting different deliverables. • 3" / 6" / 12" RGB and CIR digital orthoimagery in GeoTiff (Square miles: 3" 5 sq.mi. / 6" 1,373 sq.mi. / 12" 3,148 sq.mi.) • 691 square miles of 0.7M LiDAR • Bare-earth grids, ERDAS Imagine • 2' contours in ESRI Geodatabase • Hydro breaklines in SHP • 27.5 sq. mi. of 1"=200' scale 3D planimetric mapping in ESRI Geodatabase (for the City of Columbia) • FGDC metadata • Flown Spring 2015, delivered Fall 2015	The city's project was a part of the seven-county project orchestrated through the Boone County Consortium, Missouri, with the various counties / municipalities requesting different deliverables. The City project entailed not only digital orthoimagery, but also LiDAR acquisition, topographic mapping and planimetric mapping in select areas. • GDS: 6", square miles: 264 of spring leaf-off 4-band digital orthoimagery with delivery in GeoTIFF and TWF files • Bare-earth LAS • LiDAR data at 0.7m spacing • 28 sq. mi. of 1"=200' scale 3D planimetric mapping in ESRI Geodatabase • Two-foot contours (citywide)

Vendor Name or Subcontractor Name: Surdex Corporation

Reference Information (Current/Prior Services Performed For:)

References	5	6
Name of Reference Company:	**State of North Carolina**	**USDA, NRC Southwest Oklahoma**
Address of Reference Company ✓ Street Address ✓ City, State, Zip	ESP & Associates 3475 Lakemont Blvd. Fort Mill, SC 29708	USDA, Natural Resource Conservation Service URS Corporation
Reference Contact Person Information: ✓ Name ✓ Phone Number ✓ E-mail Address	Harold Rempel, Senior Geospatial Manager (803) 835-0851 Email: hrempel@espassociates.com	Jennifer Williams (303)740-3901 Jennifer.l.williams@urs.com Gary Utley, USDA-NRCS (405)742-1229 Gary.utley@ok.usda.gov
Dates of Services:	2014	2012
If service/contract has terminated, specify reason:	No	
Dollar Value of Services	$888,288	$3M (Merrick and Surdex)
Description of Services Performed including the following:		
✓ *Acquisition of LIDAR Elevation Data* ✓ *Creation of Digital Terrain Model from LIDAR* ✓ *Creation of Digital Elevation Model from LIDAR*	For this task order, Surdex was responsible for all Flight Operations Management, including the acquisition of digital elevation data for 20 Counties in the Eastern Piedmont using airborne LIDAR. Surdex served as the primary Point of Contact (POC) between all ESP Team Members, for the duration of LIDAR Data Acquisition. This task order included block layout designation, daily flight plan management and reporting, team coordination, issue mitigation, coordination with Military Operation Areas (MOAs), and daily progress reporting to ESP. • Sensor: ALS70 • 4,100 square miles • 0.7 meter post processing • Density: 2 points/square meter • Vertical Accuracy: RMSE of 9.25 cm (3.64") or better	Merrick and Surdex were contracted by URS to perform airborne mapping services covering approximately 20,000 sq. miles of various watersheds in Oklahoma in support of the US Department of Agriculture's Natural Resources Conservation Service (USDA-NRCS). The purpose of this project was to generate digital elevation models and contours for use in hydraulic/hydrologic models. Contract Value:

Vendor Name or Subcontractor Name: David Mason & Associates

Reference Information (Current/Prior Services Performed For:)

References	7	8	9
Name of Reference Company:	**Wilson & Company**	**Surdex Corporation**	**Missouri Department of Transportation**
Address of Reference Company ✓ Street Address ✓ City, State, Zip	800 East 101st Terrace, #200 Kansas City, MO 64131	520 Spirit of St. Louis Boulevard Chesterfield, MO 63005	1590 Woodlake Drive Chesterfield, MO 63017
Reference Contact Person Information: ✓ Name ✓ Phone Number ✓ E-mail Address	Erica Stock 816.701.3109 Erica.stock@wilsonco.com	Russell D. Hoffman (636) 368-4400 russh@surdex.com	Shirley Norris, PE (314) 453-5032 Shirley.norris@modot.mo.gov
Dates of Services:	2/2016 – 5/2016	3/2016 – 5/2016	6/2013 – 7/2015
If service/contract has terminated, specify reason:	All work completed	All work completed	All work completed
Dollar Value of Services	$108,200.00	$13,500.00	$284,412.00
Description of Services Performed Including the Following:			
✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data	✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data David Mason & Associates provided horizontal/vertical control for aerial survey of Missouri Department of Conservation site. Scope of services included setting aerial targets panels, acquiring coordinates/elevations via GPS surveying, and removing target panels.	✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data David Mason & Associates provided horizontal/vertical ground control for 2016 East Half of Missouri Orthophoto & Mapping Project. Scope of services included acquiring coordinates/elevations of ground control survey points via GPS surveying.	✓ Acquisition of LIDAR Elevation Data David Mason & Associates provided ground control for both aerial and mobile LIDAR. Surdex Corporation completed the aerial and mobile LIDAR on the project. The project was 10 miles of Highway B in Jefferson County from Highway 21 to Highway 30.

Vendor Name or Subcontractor Name: EFK Moen

Reference Information (Current/Prior Services Performed For:)			
References	10	11	12
Name of Reference Company:	**MoDOT St. Louis District**	**O'Fallon Missouri**	**Surdex Corporation**
Address of Reference Company ✓ Street Address ✓ City, State, Zip	1590 Woodlake Drive. Chesterfield, MO 63017	100 North Main Street O'Fallon, MO 63366	520 Spirit of St. Louis Blvd. Chesterfield, MO 63005
Reference Contact Person Information: ✓ Name ✓ Phone Number ✓ E-mail Address	Greg Horn, PE – District Engineer (314)453-1800 Gregory.Horn@modot.mo.gov	Jeff Schuepfer, PE - Assistant City Engineer Phone: (636)379-5491 jschuepfer@ofallon.mo.us	Russ Hoffman (636)368-4400 russh@surdex.com
Dates of Services:	Design Completed 2013 Construction Completed 2015	Design Completed - Current	2016
If service/contract has terminated, specify reason:	Project has been built.		
Dollar Value of Services	$1,500,000	$1,400,000	$13,500
Description of Services Performed including the Following: ✓ *Acquisition of Digital Orthoimagery*			
✓ *Acquisition of Digital Orthoimagery*	Project Tasks I-70 Ramp Reconfiguration in Downtown St. Louis Property & Topographic Surveys Coordination with MoDOT, IDOT, City of St. Louis, CityArchRiver2015, and other Adjacent Projects Corridor Practical Design/Value Cost Savings	Proect Tasks I-70 Ramp Reconfiguration I-70 Outer Road Dsigns Property & Topographic Surveys Coordination with MoDOT, St. Charles County, and other Adjacent Projects	Surveying – Setting Ground Control Points

Vendor Name or Subcontractor Name: Merrick & Company

Reference Information (Current/Prior Services Performed For:)			
References	13	14	15
Name of Reference Company:	**Midland Surveying –GIS Missouri DOT**	**USDA, NRC Southwest Oklahoma**	**State of North Carolina**
Address of Reference Company ✓ Street Address ✓ City, State, Zip	501 N Market St. Maryville, MO 64468	USDA, Natural Resource Conservation Service URS Corporation	ESP & Associates 3475 Lakemont Blvd. Fort Mill, SC 29708
Reference Contact Person Information: ✓ Name ✓ Phone Number ✓ E-mail Address	Adam Teale (Midland) (660)582-8633 Bradley McCloud (DOT) (573)526-2955 Bradley.mccloud@modot.mo.gov	Jennifer Williams (303)740-3901 Jennifer.l.williams@urs.com Gary Utley, USDA-NRCS (405)742-1229 Gary.utley@ok.usda.gov	*Harold Rempel, Senior Geospatial* Manager (803) 835-0851 Email: hrempel@espassociates.com
Dates of Services:	2012 & 2013	2012	2014
If service/contract has terminated, specify reason:			No
Dollar Value of Services	$604,000 (2013) 396,000. (2012)	$3M (Merrick and Surdex)	
Description of Services Performed Including the Following:			
✓ *Acquisition of Digital Orthoimagery* ✓ *Acquisition of LIDAR Elevation Data* ✓ *Creation of Digital Terrain Model from LIDAR* ✓ *Creation of Digital Elevation Model from LIDAR* ✓ *Creation of Contours Lines* ✓ *Planimetric Mapping*	Merrick & Company partnered with Midland Surveying of Marysville, MO in 2012 and 2013 to provide ground and aerial survey services to included analytics, planimetric compilation, terrain modeling, *orthoimagery, ground surveying,* and Light Detection and Ranging (LIDAR) to be used for preliminary highway design and re-routing. Separate sites throughout the state: LIDAR Density: 0.3' GSD, 1' GSD, and 2' GSD. 2012: 51.8 line miles of Highway 2013: *90.9 line miles* Corridor with of 600' Aerial imagery will be delivered at a 0.5' pixel resolution delivered in .las 1.2 format; planimetric and DTM data were delivered in Microstation and GeoPak formats. 2012: Breaklines are being compiled to help enforce the LIDAR surface.	Merrick and Surdex were contracted by URS to perform airborne mapping services covering approximately 20,000 sq. miles of various watersheds in Oklahoma in *support of the US Department* of Agriculture's Natural Resources Conservation Service (USDA-NRCS). The purpose of this project was to generate digital elevation models and contours for use in hydraulic/hydrologic models. Contract Value:	The objective of this project was to acquire digital elevation data for 20 Counties in the Eastern Piedmont area using airborne Light Detection and Ranging (LIDAR) to include LiDAR *intensity returns* suitable for post- processing of LIDAR data as well as feature extraction. Merrick and Surdex collected the data at 2 points per square meter with a nominal Post spacing of .7 meters.

Vendor Name or Subcontractor Name: Harris Corporation

Reference Information (Current/Prior Services Performed For:)

References	16	17	18
Name of Reference Company:	**State of North Carolina/ ESP Associates**	**Dewberry Consultants, LLC**	**CIRGIS, Inc.**
Address of Reference Company ✓ Street Address ✓ City, State, Zip	ESP & Associates 3475 Lakemont Blvd. Fort Mill, SC 29708	1000 N. Ashley Dr. Suite 801 Tampa, FL 33602	1047 Cove Street Ventura, CA 93001
Reference Contact Person Information: ✓ Name ✓ Phone Number ✓ E-mail Address	Harold Rempel, Senior Geospatial Manager (803) 835-0851 hrempel@espassociates.com	Amar Nayegandhi 813-421-8642 anayegandhi@dewberry.com	Hasan Kasraie (805) 340-4744 terrain@cirgis.org
Dates of Services:	2016 - Ongoing	2016- Ongoing	
If service/contract has terminated, specify reason:			
Dollar Value of Services	>1.5 Million	>1.4 Million	
Description of Services Performed Including the Following:	✓ *Acquisition of LIDAR Elevation Data*	✓ *Acquisition of LIDAR Elevation Data*	✓ *Acquisition of LIDAR Elevation Data* ✓ *Creation of Digital Terrain Model from LIDAR* ✓ *Creation of Digital Elevation Model from LIDAR*
✓ *Acquisition of LIDAR Elevation Data*	9,000 10sq. miles of Geiger-mode LIDAR data acquisition at ≥30 ppsm and deliver calibrated point cloud data with 9.25cm RMSE and a 1 foot contour accuracy. • Acquisition of High Density Geiger-mode LiDAR • Processing to Calibrated Point Cloud	**Upcoming Spring 2017** LiDAR Collection and Processing for 6 Counties (4 Counties in Illinois and 2 Counties in Wisconsin) on the USGS 3DEP Program, 20 ppm, 4,000 sq. miles **Ongoing** 8104 sq. miles acquisition of LIDAR data within South Dakota and delivery of calibrated point clouds at 8 ppsm with 10cm RMSE vertical and 30cm RMSE horizontal accuracy.	512 sq. miles of LiDAR data collection at 20 ppsm and delivery of classified point cloud and Digital Elevation data at 8ppsm with 10cm vertical accuracy.

Vendor Name or Subcontractor Name: ESP & Associates, Inc.

Reference Information (Current/Prior Services Performed For:)			
References	19	20	21
Name of Reference Company:	**State of North Carolina**	**North Carolina** FMP Phases 2, 4 and 5 (2014-2018) QL2 and QL1 LIDAR	**Iowa DOT** On Call Surveying Services
Address of Reference Company ✓ Street Address ✓ City, State, Zip	20322 Mail Service Center Raleigh, NC 27699-0322	4218 Mail Service Center Raleigh, NC 27699	P.O. Box 1159 Ankeny, IA 50023
Reference Contact Person Information: ✓ Name ✓ Phone Number ✓ E-mail Address	Tim Johnson 919.754.6588 tim.johnson@nc.gov	John Dorman 919-825-2296 jdorman@ncem.org	John F. Barber 515-964-2020 jbarber@snyder-associates.com
Dates of Services:	2012-Present	2014 – Present	June 2011 – May 2012
If service/contract has terminated, specify reason:			
Dollar Value of Services	$689,000 (2015)		$111,388
Description of Services Performed including the Following:	✓ Acquisition of Digital Orthoimagery	✓ Acquisition of LiDAR Elevation Data ✓ Creation of Digital Terrain Model from LiDAR ✓ Creation of Digital Elevation Model from LiDAR	✓ Acquisition of LiDAR Elevation Data
✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LiDAR Elevation Data ✓ Creation of Digital Terrain Model from LiDAR ✓ Creation of Digital Elevation Model from LiDAR	Surdex has served as a prime contractor to the State of North Carolina for digital orthophotography for five consecutive years (2012-2016). Project deliverables included 6" color digital orthoimagery in GeoTiff / TFW format, mosaic cutlines in .SHP format and project metadata. ESP was a subcontractor to Surdex on this contract for ground control.	ESP, with support of sub's Surdex, HARIS, worked with NCFMP to collect Quality Level 2 (QL2) LiDAR across the State of North Carolina. Phase II entailed the collection and processing of LiDAR for 20 counties in eastern North Carolina, covering an area of approximately 13,000 square miles. In addition, ESP performed Geiger-mode LiDAR data collection and processing and the generation of Hydro DEM raster products for Phase 4 covering over 9,000 square miles. QA/QC management services as well as processing of LiDAR products.	ESP supported Snyder & Associates on their Iowa DOT On Call Engineering contract providing Tripod Static Scanning, 3D Laser Scanning and Mobile Mapping services on the following projects under this contract: Interstate 35 Interchange with US 30; Warren / Clarke County - I-35; and Story County - US 30.

EXHIBIT C: Expertise of Key Personnel

The resumes are following this table. The table represents the resumes that are included in our response.

Project Staff Experience		
Name	Years Exp.	Role
Surdex Corporation (Prime Contractor)		
Wade Williams, CP	20	Director of Project Management, ASPRS Certified Photogrammetrist
Loran Chick, PLS	25	Project Manager, PLS
Jim Gottgetreu	36	Project Manager
Steve Kasten, CP, RLS	33	Survey and Photogrammetric Engineering, ASPRS Certified Photogrammetrist, RLS
Mike Mueller	30	Senior VP of Operations
Doug Crane	20	Chief Flight Operations Manager
Jason Pohlman	9	Flight Acquisition Manager
Colby Forke, CP	17	Director of Image Processing, ASPRS Certified Photogrammetrist
Brad Barker	16	Director of 3D Mapping
David Mason & Associations (Survey)		
Ronnie Lowe, PLS	33	Director of Survey, MO/IL RLS
EFK Moen (Survey)		
Randy Brickey, PLS	35+	Project Surveyor, MO/IL RLS
Chris Ferrante, PLS	35+	Surveying Manager, MO/IL RLS
Merrick & Company (LiDAR Acquisition and Processing)		
Brian Holzworth, GISP	16	Project Manager – LiDAR, GISCI Certified GIS Professional
Bruce Audey GISP	16	LIDAR Technician Lead, Certified Geographic Information Systems Professional (GISP)
Harris Corporation (Geiger-mode LiDAR)		
Jennifer Nix	21	Project Manager, ASPRS Certified Photogrammetrist
Mark Romano	30	LIDAR Product Manager
Connie L. Stanley	30	Quality Control/Assurance Manager, Certified Mapping, Charting and Geodesy Professional
James M. Earwood	15	Geiger-mode LIDAR Production Manager
Harold W. Rempel, CP, GISP	25	Senior Geospatial Manager, ASPRS Certified Photogrammetrist, Oregon Professional Photogrammetrist, Virginia Surveyor Photogrammetrist, Geographic Information Systems Professional
ESP (Mobile LiDAR)		
Ryan Lavery	7	Geospatial Analyst
Michael Baranowski	7	Geospatial Analyst

Title of Position: Surdex Corporation: Director of Project Management	
Name of Person:	**Wade Williams, CP**
Educational Degree (s): Include college or university, major, and dates	BS Geography and Cartography, Missouri State University (1995)
License(s)/Certification(s), number(s), expiration date(s), if applicable:	ASPRS Certified Photogrammetrist, #1038 (1997)
Specialized Training Completed.	N/A
Number of years' experience in area of service proposed to provide:	20 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Surdex Employee: 20 years Title/Role: Director of Project Management
Describe this person's responsibilities over the past 12 months.	Wade has been a Project Manager with Surdex for the past XX year's, just recently he has been promoted to Director of Project Management. As PM, he oversees assigned projects and manages the scopes of work for various clients. This involves managing in-house communications regarding all aspects of project execution including client communication, project planning, surveying, aerial photography acquisition, scanning, aerial triangulation, LIDAR processing, planimetric/ topographic feature collection and digital orthoimagery production. As Director Wade will oversees the project management staff, ensuring all projects remain on schedule and all deliverables meet specifications.
Previous employer(s), positions, and Dates	N/A
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data ✓ Creation of Digital Terrain Model from LiDAR ✓ Creation of Digital Elevation Model from LIDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Project Manager **Project Involvement:** managing communications regarding all aspects of project execution including client communication, project planning, surveying, aerial photography acquisition, scanning, aerial triangulation, LIDAR processing, planimetric/ topographic feature collection and digital orthoimagery production. Listed below are just a few of the most recent photogrammetric projects Steve has been involved in: Project Experience: • Missouri, Boone County Consortium Digital Orthoimagery and Mapping Project (2016) • Missouri, City of Columbia LIDAR and Planimetric Mapping (2016) • Missouri, Mid America Regional Council (MARC) Digital Orthoimagery Project (2016) • St. Louis Metropolitan Sewer District (MSD) Planimetric Mapping (2014) • Illinois State Geological Survey (ISGS) LIDAR Acquisition and Processing Project (2016 & 2017) • Illinois, Western Illinois University Digital Orthoimagery Project (2015) • Florida, Collier County Digital Orthoimagery Project (2016) • Florida, Palm Beach County Digital Orthoimagery and Mapping (2015) • North Carolina City of Raleigh Orthoimagery and Planimetric Update Project (2014-2017) • North Carolina Statewide Digital Orthoimagery Projects (2013-2017) • North Carolina State Phase II LiDAR Project (2014) • Oklahoma, USDA-NRCS East Central LIDAR Project (2012)

Title of Position: Surdex Corporation: Project Manager	
Name of Person:	**Loran Chick, MO PLS**
Educational Degree (s): include college or university, major, and dates	BS, Business Management, Northwest Missouri State University (1988)
License(s)/Certification(s), number(s), expiration date(s), if applicable:	Professional Land Surveyor: Missouri #2001001907
Specialized Training Completed.	Certificate of Project Management from Saint Louis University, Missouri
Number of years' experience in area of service proposed to provide:	25 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Surdex Employee: 2 years Title/Role: Project Manager
Describe this person's responsibilities over the past 12 months.	As PM, Loran oversees assigned projects and manages the scopes of work for various clients. This involves managing in-house communications regarding all aspects of project execution including client communication, project planning, surveying, aerial photography acquisition, scanning, aerial triangulation, LiDAR processing, planimetric/ topographic feature collection and digital orthoimagery production.
Previous employer(s), positions, and Dates	Missouri Department of Transportation, Highway Liaison Surveyor, 1992-2006 Eagle Point Software, Product Manager, 2006-2011 St. Louis University Missouri, Project Coordinator, 2012-2015
Identify specific information about experience in	*Clearly identify the experience, provide dates, describe the person's role and extent of involvement in the experience.*
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data ✓ Creation of Digital Terrain Model from LIDAR ✓ Creation of Digital Elevation Model from LIDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Project Manager **Project Involvement:** managing communications regarding all aspects of project execution including client communication, project planning, surveying, aerial photography acquisition, scanning, aerial triangulation, LiDAR processing, planimetric/ topographic feature collection and digital orthoimagery production. Listed below are just a few of the most recent photogrammetric projects Steve has been involved in: Project Experience: • Missouri, State of Missouri Statewide Digital Orthoimagery Project (2016) • Missouri, St. Louis Imagery Consortium Orthoimagery Project (2016) • Missouri and Illinois, East-West Gateway Digital Orthoimagery Project (2012 & 2015) • Missouri Department of Transportation for EFK Moen, Contour and Planimetric mapping (2016)

Title of Position: Surdex Corporation: Project Manager	
Name of Person:	**Jim Gottgetreu**
Educational Degree (s): include college or university, major, and dates	BS, Cartography and GIS, University of Wisconsin Madison (1979)
License(s)/Certification(s), number(s), expiration date(s), if applicable:	
Specialized Training Completed.	
Number of years' experience in area of service proposed to provide:	36 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Surdex Employee: 2 years Title/Role: Project Manager
Describe this person's responsibilities over the past 12 months.	As PM, Jim oversees assigned projects and manages the scopes of work for various clients. This involves managing in-house communications regarding all aspects of project execution including client communication, project planning, surveying, aerial photography acquisition, scanning, aerial triangulation, LiDAR processing, planimetric/ topographic feature collection and digital orthoimagery production.
Previous employer(s), positions, and Dates	Walker & Associates, Stereo Compiler (4 years) Sanborn Mapping Company, Project Manager (27 years) Towill, Inc., Processing Manager (3 years)
[illegible]	[illegible]
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LiDAR Elevation Data ✓ Creation of Digital Terrain Model from LiDAR ✓ Creation of Digital Elevation Model from LiDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Project Manager ***Project Involvement:*** *managing communications regarding* all aspects of project execution including client communication, project planning, surveying, aerial photography acquisition, scanning, aerial triangulation, LiDAR processing, planimetric/ topographic feature collection and digital orthoimagery production. Listed below are just a few of the most recent photogrammetric projects Steve has been involved in: ***Project Experience:*** • Illinois, Department of Transportation Statewide Orthoimagery Project (2016-2017) • Illinois State Geological Survey (ISGS) LiDAR Acquisition and Processing Project (2016 & 2017) • Missouri, Mid America Regional Council (MARC) Digital Orthoimagery Project (2016) • Minnesota, Dakota County Digital Orthoimagery (2016) • Porto Rico Digital Orthoimagery Collection Project (2016-2017) • Wisconsin DNR Digital Orthoimagery Project (2015, 2016) • Microsoft Digital Orthoimagery Collection Project (2015) • USDA, NAIP, Digital Orthoimagery Project (2016)

Title of Position: Surdex Corporation: Sr. VP of Survey and Photogrammetric Engineering Design	
Name of Person:	**Steve Kasten, CP RLS**
Educational Degree (s): Include college or university, major, and dates	BS, Earth Science and Cartography, Purdue University (1987) MS, Civil Engineering Photogrammetry Southern University Edwardsville (1983)
License(s)/Certification(s), number(s), expiration date(s), if applicable:	ASPRS Certified Photogrammetrist, #1038 (1997) North Carolina Professional Land Surveyor, #L-4106 Oregon Professional Photogrammetrist, #80665RPP South Carolina Professional Photogrammetric Land Surveyor, #24303 Virginia Surveyor Photogrammetrist, #000119 Florida Professional Surveyor and Mapper License, # LS6683
Specialized Training Completed.	N/A
Number of years' experience in area of service proposed to provide:	33 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Surdex Employee: 18 years Title/Role: Sr. Vice President of Survey and Photogrammetric Engineering Design
Describe this person's responsibilities over the past 12 months.	As the Sr. Vice President of Survey and Photogrammetric Engineering Design, Steve is responsible for the photogrammetric engineering application development, photogrammetric mapping, geodesy, cartography and surveying. He supports the project design of Surdex's photogrammetric projects, and is responsible for the airborne GPS survey data and triangulation for all aerial imagery and LIDAR projects. Steve manages the photogrammetric mapping contract task orders from the USACE, St. Louis District. For the past four years Steve has been involved with the use and production of geospatial data from our UAS systems and has processed the using numerous software products.
Previous employer(s), positions, and Dates	N/A
Identify specific information about Experience:	Clearly identify the client(s), provide dates, describe the person's role and extent of involvement in the experience.
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data ✓ Creation of Digital Terrain Model from LIDAR ✓ Creation of Digital Elevation Model from LIDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Survey and Photogrammetric Engineering Design **Project Involvement:** Steve has been responsible for the photogrammetric control for all types of photogrammetry project for Surdex. He is responsible for developing algorithms for sensor modeling, post processing of GPS data, error propagation, photogrammetric data reduction, and implementing algorithms for both digital imagery and Lidar elevation data. Listed below are just a few of the most recent photogrammetric projects Steve has been involved in: ***Project Experience:*** • Missouri, State of Missouri Statewide Digital Orthoimagery Project (2016) • Missouri, Boone County Consortium Digital Orthoimagery and Mapping Project (2016) • Missouri, St. Louis Imagery Consortium Orthoimagery Project (2016) • Missouri, Mid America Regional Council (MARC) Digital Orthoimagery Project (2016) • Iowa, Statewide Digital Orthoimagery Project (2016) • Illinois, Department of Transportation Statewide Orthoimagery Project (2016-2017) • Illinois State Geological Survey (ISGS) LIDAR Acquisition and Processing Project (2016 & 2017) • Iowa, DNR (DOT) LIDAR Acquisition and Processing Project (2014-2015) • Missouri Department of Transportation for EFK Moen, Contour and Planimetric mapping (2016) • Minnesota, Dakota County Digital Orthoimagery (2016) • Porto Rico Digital Orthoimagery Collection Project (2016-2017) • Wisconsin DNR Digital Orthoimagery Project (2015, 2016) • USDA NAIP, Digital Orthoimagery Project (2016)

Title of Position: Surdex Corporation: Sr. VP of Operations	
Name of Person:	**Mike Mueller**
Educational Degree (s): Include college or university, major, and dates	BS, Mechanical Engineering, University of Missouri Rolla
License(s)/Certification(s), number(s), expiration date(s), if applicable:	
Specialized Training Completed.	N/A
Number of years' experience in area of service proposed to provide:	30 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Surdex Employee: 1 years Title/Role: Vice President of Production and Operations
Describe this person's responsibilities over the past 12 months.	As senior Vice President of Production and Operations for Surdex Corporation, Mike directly supervises and coordinates all phases of production of every project. Mike will be in direct contact with the Directors of the Image Process Services and 3D Mapping departments to ensure projects have the resources and are on schedule. Mike also is responsible for resource allocation and scheduling for survey; aerial photography; fully analytical aerial triangulation (FAAT); stereo mapping; digital imaging; systems management; GIS and GIS data conversion; estimating; and R&D. Mike utilizes Microsoft Project software to track resources and progress of each project, including equipment, personnel and cost. Mike personally reviews quality control reports after each phase of a project, including flight, survey, triangulation, photo lab, digital mapping, digital imaging and GIS development. Mike will be instrumental in Surdex's adaptation of ISO 9000 Quality Assurance Standards in the next year by building the corporate environment for quality, maintaining procedures manual and evaluates suggestions for continuous improvement. He provides a single point of contact for all departments and is an information hub for crews in the field. He works closely with project management to assure that your needs are met for your project.
Previous employer(s), positions, and Dates	N/A
[redacted]	[redacted]
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data ✓ Creation of Digital Terrain Model from LIDAR ✓ Creation of Digital Elevation Model from LIDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Operations Manager **Project Involvement:** directly supervises and coordinates all phases of production of every project. Listed below are just a few of the projects he has directly worked on: • *Missouri, St. Louis Imagery Consortium Orthoimagery Project (2016)* • Iowa, Statewide Digital Orthoimagery Project (2016) • Illinois, Department of Transportation Statewide Orthoimagery Project (2016-2017) • Illinois State Geological Survey (ISGS) LiDAR Acquisition and Processing Project (2016 & 2017) • Missouri Department of Transportation for EFK Moen, Contour and Planimetric mapping (2016) • Porto Rico Digital Orthoimagery Collection Project (2016-2017) • USDA NAIP, Digital Orthoimagery Project (2016)

Title of Position: Surdex Corporation: Chief Flight Operations Manager	
Name of Person:	**Doug Crane**
Educational Degree (s): Include college or university, major, and dates	BS, Aeronautical Engineering from Purdue University MS, Aeronautical Engineering from the Air Force Institute of Technology Graduate of the US Naval Test Pilot School
License(s)/Certification(s), number(s), expiration date(s), if applicable:	
Specialized Training Completed.	Decades of experience in flight test and program management for the US Navy
Number of years' experience in area of service proposed to provide:	20 Years (US Navy Flight Test Officer)
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Surdex Employee: ~1 years Title/Role: Chief Flight Operations Manager
Describe this person's responsibilities over the past 12 months.	Doug is responsible for the personnel (pilot's) that operate our aircraft for aerial acquisition projects. As Chief Pilot, Doug is responsible managing pilot's schedules and availability and knowledge of flight specifications for each mission. He is engaged in the pre-flight planning preparations that include monitoring the weather conditions, review of aerial flight plans for LiDAR and photography capture, adherence to overall project specifications, proper equipment and material handling procedures, pre- and post-flight status reporting, and all FAA notices and air space designations along with any NOTAMs (notices to airmen)
Previous employer(s), positions, and Dates	US Navy, Boeing, St. Louis test flying the new production F/A-18 Super Hornets.
Identify specific information about experience in:	*Clearly identify the experience, provide dates, describe the person's role and extent of involvement in the experience*
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LiDAR Elevation Data ✓ Creation of Digital Terrain Model from LiDAR ✓ Creation of Digital Elevation Model from LiDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Chief Flight Operations Manager **Project Involvement:** manage the acquisition pilots responsibilities for the successful flight mission to meet each projects specifications: Listed below are just a few of the successful projects that have been flown by our pilots: • Missouri, State of Missouri Statewide Digital Orthoimagery Project (2016) • Missouri, Boone County Consortium Digital Orthoimagery and Mapping Project (2016) • Missouri, St. Louis Imagery Consortium Orthoimagery Project (2016) • Missouri, Mid America Regional Council (MARC) Digital Orthoimagery Project (2016) • Iowa, Statewide Digital Orthoimagery Project (2016) • Illinois, Department of Transportation Statewide Orthoimagery Project (2016-2017) • Illinois State Geological Survey (ISGS) LiDAR Acquisition and Processing Project (2016 & 2017) • Iowa, DNR (DOT) LiDAR Acquisition and Processing Project (2014-2015) • Missouri Department of Transportation for EFK Moen, Contour and Planimetric mapping (2016) • Minnesota, Dakota County Digital Orthoimagery (2016) • Porto Rico Digital Orthoimagery Collection Project (2016-2017) • Wisconsin DNR Digital Orthoimagery Project (2015, 2016) • USDA NAIP, Digital Orthoimagery Project (2016)

Title of Position: Surdex Corporation: Flight Acquisition Manager	
Name of Person:	**Jason Pohlman**
Educational Degree (s): include college or university, major, and dates	Some college
License(s)/Certification(s), number(s), expiration date(s), if applicable:	N/A
Specialized Training Completed.	Leica Systems: Technical Training on the operations of the aerial sensor
Number of years' experience in area of service proposed to provide:	9 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Surdex Employee: 9 years Title/Role: Flight Acquisition Manager
Describe this person's responsibilities over the past 12 months.	Jason manages the staffing/personnel for each acquisition mission and the acquisition sensor equipment. This includes the installation of the sensors into an aircraft and maintaining the maintenance and repair schedules. He oversees the personnel for training on the sensor hardware and software. He maintains a clear understanding of flight capture conditions, internal/external priorities and aerial sensor limitations, installations, calibrations as well as GPS/IMU data collections.
Previous employer(s), positions, and Dates	N/A
[illegible]	[illegible]
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data ✓ Creation of Digital Terrain Model from LIDAR ✓ Creation of Digital Elevation Model from LIDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Flight Acquisition Manager **Project Involvement:** prepares and or reviews each projects aerial flight plans for the capture of imagery or LiDAR data. He oversees the adherence to overall project specifications by monitoring weather conditions, confirming the proper equipment and material, and the proper pre and post flight status reporting is completed. Listed below are just a few of the projects he has directly worked on: • Missouri, State of Missouri Statewide Digital Orthoimagery Project (2016) • Missouri, Boone County Consortium Digital Orthoimagery and Mapping Project (2016) • Missouri, St. Louis Imagery Consortium Orthoimagery Project (2016) • Missouri, Mid America Regional Council (MARC) Digital Orthoimagery Project (2016) • Iowa, Statewide Digital Orthoimagery Project (2016) • Illinois, Department of Transportation Statewide Orthoimagery Project (2016-2017) • Illinois State Geological Survey (ISGS) LiDAR Acquisition and Processing Project (2016 & 2017) • Iowa, DNR (DOT) LIDAR Acquisition and Processing Project (2014-2015) • Missouri Department of Transportation for EFK Moen, Contour and Planimetric mapping (2016) • Minnesota, Dakota County Digital Orthoimagery (2016) • Porto Rico Digital Orthoimagery Collection Project (2016-2017) • Wisconsin DNR Digital Orthoimagery Project (2015, 2016) • USDA NAIP, Digital Orthoimagery Project (2016)

Title of Position: Surdex Corporation: Director of Image Processing	
Name of Person:	**Colby Forke**
Educational Degree (s): include college or university, major, and dates	BS Geography, University of Nebraska (1999)
License(s)/Certification(s), number(s), expiration date(s), if applicable:	ASPRS Certified Photogrammetrist #1598 (2016)
Specialized Training Completed.	Adoption of ISO 9001 Quality Assurance Standards
Number of years' experience in area of service proposed to provide:	17 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Surdex Employee: 15 years Title/Role: Director of Image Processing
Describe this person's responsibilities over the past 12 months.	Colby supervises and coordinates all phases of production that includes image processing, ortho-mosaic, and imagery quality control management. Colby works with the imagery and orthoimagery managers daily to coordinate production tasks, set priorities and assist with resource management. Colby directly reports to Michael Mueller, the Sr. VP of Operations, on resource allocations and progress of each project. He works closely with each project manager to assure our clients' needs are met for every project.
Previous employer(s), positions, and Dates	N/A
Identify specific information about experience	Clearly identify the experience, provide dates, describe the person's role and extent of involvement in the experience
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LiDAR Elevation Data ✓ Creation of Digital Terrain Model from LiDAR ✓ Creation of Digital Elevation Model from LiDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Director of Image Processing **Project Involvement:** supervises and coordinates all phases of production that includes image processing, ortho-mosaic, and imagery quality control management. He works closely with each project manager to assure our clients' needs are met for every project. Listed below are just a few of the projects he has directly worked on: • Missouri, State of Missouri Statewide Digital Orthoimagery Project (2016) • Missouri, Boone County Consortium Digital Orthoimagery Project (2016) • Missouri, St. Louis Imagery Consortium Orthoimagery Project (2016) • Missouri, Mid America Regional Council (MARC) Digital Orthoimagery Project (2016) • Iowa, Statewide Digital Orthoimagery Project (2016) • Illinois, Department of Transportation Statewide Orthoimagery Project (2016-2017) • Minnesota, Dakota County Digital Orthoimagery (2016) • Porto Rico Digital Orthoimagery Collection Project (2016-2017) • Wisconsin DNR Digital Orthoimagery Project (2015, 2016) • USDA NAIP, Digital Orthoimagery Project (2016)

Title of Position: Surdex Corporation: Director of 3D Mapping	
Name of Person:	**Brad Barker**
Educational Degree (s): Include college or university, major, and dates	BS Cartography and Map Technology, Southwest Missouri State University (1998)
License(s)/Certification(s), number(s), expiration date(s), if applicable:	N/A
Specialized Training Completed.	Adoption of ISO 9001 Quality Assurance Standards
Number of years' experience in area of service proposed to provide:	21 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Surdex Employee: 85 years Title/Role: Director of 3D Mapping
Describe this person's responsibilities over the past 12 months.	Brad's primary responsibilities include cartographic finishing and design of geographic information system database conversion applications to support CAD/GIS database generation. He is responsible for digital orthophoto and CAD production including data input, editing and plotting. Brad has expertise in CAD/GIS programs including the full ESRI suite of software products. He has intimate knowledge of the entire LIDAR project life cycle which includes planning, acquisition, ABGPS/IMU processing, initial LIDAR processing, manual and automated classification and editing. He is also experienced with various software packages from his previous photogrammetric mapping responsibilities.
Previous employer(s), positions, and Dates	N/A
[illegible]	[illegible]
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data ✓ Creation of Digital Terrain Model from LIDAR ✓ Creation of Digital Elevation Model from LIDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Quality Assurance / Quality Control (QA/QC) **Project Involvement:** supervises and coordinates quality assurance and control product quality control management. He works closely with each project manager to assure our clients' needs are met for every project. Listed below are just a few of the projects he has directly worked on: • Missouri, State of Missouri Statewide Digital Orthoimagery Project (2016) • Missouri, Boone County Consortium Digital Orthoimagery and Mapping Project (2016) • Missouri, St. Louis Imagery Consortium Orthoimagery Project (2016) • Missouri, Mid America Regional Council (MARC) Digital Orthoimagery Project (2016) • Iowa, Statewide Digital Orthoimagery Project (2016) • Illinois, Department of Transportation Statewide Orthoimagery Project (2016-2017) • Illinois State Geological Survey (ISGS) LIDAR Acquisition and Processing Project (2016 & 2017) • Iowa, DNR (DOT) LIDAR Acquisition and Processing Project (2014-2015) • Missouri Department of Transportation for EFK Moen, Contour and Planimetric mapping (2016) • Minnesota, Dakota County Digital Orthoimagery (2016) • Porto Rico Digital Orthoimagery Collection Project (2016-2017) • Wisconsin DNR Digital Orthoimagery Project (2015, 2016) • USDA NAIP, Digital Orthoimagery Project (2016)

Title of Position: David Mason & Associates: Director of Survey	
Name of Person:	**Ronnie Lowe, PLS**
Educational Degree (s): Include college or university, major, and dates	University of Missouri-Rolla – Surveying Jefferson College of Applied Science – Civil Engineering & Applied Science in Civil Engineering & Construction Technology
License(s)/Certification(s), number(s), expiration date(s), if applicable:	Missouri – 002557 December 31, 2017 Illinois – 035.003363 November 30, 2018
Specialized Training Completed.	
Number of years' experience in area of service proposed to provide:	33 years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	**Subcontractor:** David Mason & Associates **Title/Role:** Director of Survey / Field Survey As subcontractor, DMA has worked with Surdex on previous Missouri Statewide projects and provided horizontal/vertical control on other aerial photogrammetry and LiDAR projects.
Describe this person's responsibilities over the past 12 months.	Division Manager/Project Manager for David Mason & Associates
Previous employer(s), positions, and Dates	21 years with David Mason & Associates (1996-current) 12 years with General Consultants (1984-1996)
Indicate specific information about experience in:	
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data ✓ Creation of Digital Terrain Model from LIDAR ✓ Creation of Digital Elevation Model from LiDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Survey **Project Involvement:** Clearly identify the experience, provide dates, describe the person's role and extent of involvement in the experience, provide horizontal/vertical control. Processing GPS data and provide QA/QC

Title of Position: EFK Moen: Project Surveyor	
Name of Person:	**Randy Brickey, PLS**
Educational Degree (s): Include college or university, major, and dates	Missouri Western State University, Bachelor of Science in Technology/Construction Engineering Technology
License(s)/Certification(s), number(s), expiration date(s), if applicable:	Registered Professional Land Surveyor Missouri – 2620 & Illinois – 3441
Specialized Training Completed.	
Number of years' experience in area of service proposed to provide:	35+ years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Subcontractor: EFK Moen Role: Project Survey, Field Survey As subcontractor, have managed and provided horizontal/vertical control on other aerial photogrammetry and LIDAR projects for Surdex Corporation.
Describe this person's responsibilities over the past 12 months.	Randy has successfully provided project surveyor duties on over $1,000,000 of surveying work over the past 12 months
Previous employer(s), positions, and Dates	Various Surveying Firms since 1985 Randy has been a Project Surveyor at EFK Moen since 2015.
[illegible]	[illegible]
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data ✓ Creation of Digital Terrain Model from LIDAR ✓ Creation of Digital Elevation Model from LIDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	**Role:** Survey **Project Involvement:** Randy routinely works with all types of photogrammetry files • Randy routinely works with elevation data from LiDAR Data and or traditional photogrammetry files • Randy routinely works Digital Terrain Models from LiDAR Data • Randy routinely works LIDAR Elevation Models • Randy routinely creates Contour Lines from traditional survey methods. • Randy routinely creates Contour Lines from traditional survey methods.

Title of Position: EFK Moen: Surveying Manager	
Name of Person:	**Chris Ferrante, PLS**
Educational Degree (s): Include college or university, major, and dates	St. Louis Community College, Assoc. in Applied Science/Civil Engineering, 1984
License(s)/Certification(s), number(s), expiration date(s), if applicable:	Registered Professional Land Surveyor Missouri – 002494 & Illinois – 35003564
Specialized Training Completed.	
Number of years' experience in area of service proposed to provide:	35+ years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	Subcontractor: EFK Moen Role: Survey Manager, Field Survey Surdex has worked as a subcontractor to EFK Moen on Missouri DOT projects for aerial imagery and mapping.
Describe this person's responsibilities over the past 12 months.	Chris has successfully led his department of eight staff members on over $1,000,000 of surveying work over the past 12 months. Chris has been the Surveying Manager at EFK Moen since 2001.
Previous employer(s), positions, and Dates	Volz Engineering 1983 - 2001
[illegible]	[illegible]
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data ✓ Creation of Digital Terrain Model from LIDAR ✓ Creation of Digital Elevation Model from LIDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	Chris routinely works with all types of photogrammetry files • DTM task that most traditional survey filed personnel do not work with daily. • Field Survey for acquisition project, this is a task that most traditional survey filed personnel do not work with daily. • Chris routinely works with elevation data from LIDAR Data and or traditional photogrammetry files • Chris routinely works Digital Terrain Models from LIDAR Data • Chris routinely works LiDAR Elevation Models • Chris routinely creates Contour Lines from traditional survey methods. • Chris routinely creates Contour Lines from traditional survey methods.

Title of Position: Merrick & Company: Project Manager – LiDAR	
Name of Person:	**Brian Holzworth, GISP**
Educational Degree (s): Include college or university, major, and dates	BA, Political Science; Minor History; Minor East European Affairs, (1993) Hickam AFB, Radar Imagery Analysis, (1991) Goodfellow AFB, Imagery Interpretation, (1988)
License(s)/Certification(s), number(s), expiration date(s), if applicable:	■ GISCI Certified GIS Professional, #00057054 ■ Project Management Institute (PMI) ■ Working toward Project Management Professional (PMP) certification ■ American Society for Photogrammetry & Remote Sensing (ASPRS) ■ Working toward Certified Mapping Scientist (CMS) certification
Specialized Training Completed.	• Environmental Systems Research Institute (ESRI) ArcInfo 8.0, 1999 • Defense Security Service FSO Program Management, 1999 • PMI/ESI Managing Projects in Organizations, 1999 • NIMA Outsourcing, 1999, 1998, 1997 • Geographic Information Systems for Local Government, 1998 • Managing Through Empowerment, 1997 • Management Problems of the Technical Person in Leadership, 1996 • NIMA Validator, 1995 • VPF Conversion, 1995 • Advanced ArcInfo, 1995 • VMAP ArcInfo, 1994 • Franklin Time Management, 1994
Number of years' experience in area of service proposed to provide:	16 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	**Subcontractor: Merrick & Company** **Role:** LiDAR Fixed-wing and helicopter LiDAR acquisition and processing, mobile LiDAR acquisition and processing Surdex and Merrick are under a JV and have worked together on many Orthoimagery and LiDAR Projects.
Describe this person's responsibilities over the past 12 months.	Mr. Holzworth is a project manager with 29 years of progressive experience in managing remote sensing and GIS projects. His primary responsibilities include project scope management; planning, resource management; project estimating, technical liaison between production resources and the client; contract/risk management; quality control/quality assurance execution; and revenue management.
Previous employer(s), positions, and Dates	12 Years with other firms
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LIDAR Elevation Data ✓ Creation of Digital Terrain Model from LIDAR ✓ Creation of Digital Elevation Model from LIDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	• 2013 Midland Surveying / Missouri Department of Transportation aerial mapping • 2011 LiDAR Survey and High Resolution Digital Images for GIS, Pantex Plant, Amarillo, Texas. • Nebraska Iowa Regional Orthophotography Consortium (NIROC) LiDAR and Planimetric mapping. • LiDAR & Imagery, Salt Creek, Nebraska. • Edwards Air Force Base, California, LiDAR / Hyperspectral Acquisition and Processing.

Title of Position: Merrick & Company: LiDAR Technician Lead	
Name of Person:	**Bruce Audey GISP**
Educational Degree (s): Include college or university, major, and dates	Centre of Geographic Sciences, in Lawrencetown, Nova Scotia, a two-year technical course in Cartography/Digital Mapping, (1998/1999)
License(s)/Certification(s), number(s), expiration date(s), if applicable:	Certified Geographic Information Systems Professional (GISP) #00061177
Specialized Training Completed.	
Number of years' experience in area of service proposed to provide:	16 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	**Subcontractor:** Merrick & Company **Role:** LiDAR Fixed-wing and helicopter LiDAR acquisition and processing, mobile LiDAR acquisition and processing Surdex and Merrick are under a JV and have worked together on many Orthoimagery and LiDAR Projects.
Describe this person's responsibilities over the past 12 months.	Mr. Bruce Adey has more than 16 years of experience working in the Geospatial Industry which range from stereo compilation to LiDAR projects. As the Photogrammetry/LiDAR Technical Lead, Bruce works directly with Project Mangers/Director of Operation in developing schedules and budgets for current projects, assists with scheduling and pricing for potential projects, supports the development & direction of the MARS® software, and also works closely with the technical staff through production to ensure that the data collected and delivered meets or exceeds industry/client standards.
Previous employer(s), positions, and Dates	12 Years with other firms
Identify specific information about experience in	Briefly describe the experience, provide dates, describe the person's role and extent of involvement in the experience
✓ All types of Photogrammetry projects ✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery ✓ Acquisition of Digital Orthoimagery ✓ Acquisition of LiDAR Elevation Data ✓ Creation of Digital Terrain Model from LiDAR ✓ Creation of Digital Elevation Model from LiDAR ✓ Creation of Contours Lines ✓ Planimetric Mapping	• 2014 Airborne LiDAR Collection & Processing, North Carolina. LiDAR Processing Supervisor. • 2014 USGS LiDAR Collection Processing of 12 Counties in Virginia. LiDAR Processing Supervisor • 2013 Midland Surveying / Missouri Department of Transportation aerial mapping • 2011 LiDAR Survey and High Resolution Digital Images for GIS, Pantex Plant, Amarillo, Texas. • Nebraska Iowa Regional Orthophotography Consortium (NIROC) LiDAR and Planimetric mapping. • LiDAR & Imagery, Salt Creek, Nebraska. • Edwards Air Force Base, California, LiDAR / Hyperspectral Acquisition and Processing.

Title of Position: Harris Corporation: Project Manager	
Name of Person:	**Jennifer Nix**
Educational Degree (s): Include college or university, major, and dates	BS- Geography Wright State University, Dayton, Ohio 1996 MBA- Colorado State University, Ft. Collins, CO 2014
License(s)/Certification(s), number(s), expiration date(s), if applicable:	• ASPRS Certified Photogrammetrist • International Software Testing Qualification Board (ISTQB)-CTFL Certification • ISO 9001- 2015 Certified Auditor
Specialized Training Completed.	ASPR Workshop Instructor
Number of years' experience in area of service proposed to provide:	21 Years
Describe person's relationship to vendor.	Harris Employee (1 Year)
Describe this person's responsibilities over the past 12 months.	Manage LiDAR Processing, Production and Delivery
Previous employer(s), positions, and Dates	DigitalGlobe 2005- 2016 Sanborn 2001-2005 Woolpert 1996- 2001
[illegible]	[illegible]
✓ All types of Photogrammetry projects	DigitalGlobe- Production Supervisor
✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery	DigitalGlobe- Production Supervisor
✓ Acquisition of Digital Orthoimagery	Sanborn & Woolpert- Photogrammetrist and Project Manager
✓ Acquisition of LIDAR Elevation Data	Harris Corporation and Sanborn Production Supervisor
✓ Creation of Digital Terrain Model from LiDAR	Harris Corporation- Production Supervisor
✓ Creation of Digital Elevation Model from LIDAR	Harris Corporation- Production Supervisor
✓ Creation of Contours Lines	Sanborn & Woolpert- Photogrammetrist and Project Manager
✓ Planimetric Mapping	Sanborn & Woolpert- Photogrammetrist and Project Manager

Title of Position: Harris Corporation: LiDAR Product Manager	
Name of Person:	**Mark Romano**
Educational Degree (s): Include college or university, major, and dates	BS-Electrical Engineering
License(s)/Certification(s), number(s), expiration date(s), if applicable:	Florida Surveying Mapping Society (ASPRS Accreditation Program)- Co-Author Course Development & Instructions August 2012
Specialized Training Completed.	
Number of years' experience in area of service proposed to provide:	30 Years
Describe person's relationship to vendor.	Harris Employee (2.5 Years)
Describe person's responsibilities over the past 12 months.	Geiger-mode LIDAR Production Manager
Previous employer(s), positions, and Dates	ESP Associates- Director Geospatial Services 2013-2015 Earth Eye LLC - VP & CEO 2011-2013 Merrick & Company – Director of Technology 2002-2011
Identify specific information about experience key [illegible]	*Clearly identify the experience you've noted, describe the person's role and extent of involvement in the experience.*
✓ All types of Photogrammetry projects	ESP Associates and Merrick & Company
✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery	ESP Associates and Merrick & Company
✓ Acquisition of Digital Orthoimagery	ESP Associates and Merrick & Company
✓ Acquisition of LiDAR Elevation Data	Harris Corporation and Previous Positions
✓ Creation of Digital Terrain Model from LiDAR	Harris Corporation and Previous Positions
✓ Creation of Digital Elevation Model from LiDAR	Harris Corporation and Previous Positions
✓ Creation of Contours Lines	ESP Associates and Merrick & Company
✓ Planimetric Mapping	ESP Associates and Merrick & Company

Title of Position: Harris Corporation: Quality Control/Assurance Manager	
Name of Person:	**Connie L. Stanley**
Educational Degree (s): include college or university, major, and dates	BS –Geology, Tennessee Technological University, 1985 Geographic Information Systems Certification – Indiana University, 1992
License(s)/Certification(s), number(s), expiration date(s), if applicable:	Certified Mapping, Charting and Geodesy Professional – National Geospatial Intelligence Agency
Specialized Training Completed.	Employer-sponsored Geospatial Production Training
Number of years' experience in area of service proposed to provide:	30 Years
Describe person's relationship to vendor.	Harris Employee (13 Years)
Describe this person's responsibilities over the past 12 months.	LIDAR QA/QC Manager
Previous employer(s), positions, and Dates	Space Imaging- Manager Production Services 2001-2004 DMA- Project Manager, Terrain Analyst, Cartographer 1985-2001
✓ All types of Photogrammetry projects	In all Previous Positions
✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery	In all Previous Positions
✓ Acquisition of Digital Orthoimagery	In all Previous Positions
✓ Acquisition of LIDAR Elevation Data	In all Previous Positions
✓ Creation of Digital Terrain Model from LIDAR	In all Previous Positions
✓ Creation of Digital Elevation Model from LIDAR	In all Previous Positions
✓ Creation of Contours Lines	In all Previous Positions
✓ Planimetric Mapping	In all Previous Positions

Title of Position: Harris Corporation: Geiger-mode LiDAR Production Manager	
Name of Person:	**James M. Earwood**
Educational Degree (s): include college or university, major, and dates	MS- Geographic Information Systems
License(s)/Certification(s), number(s), expiration date(s), if applicable:	
Specialized Training Completed.	
Number of years' experience in area of service proposed to provide:	15 Years
Describe person's relationship to vendor.	Harris Employee (8 Years)
Describe this person's responsibilities over the past 12 months.	Geiger-mode LiDAR Production Manager
Previous employer(s), positions, and Dates	US Air Force- LiDAR Analyst 2002-2007
Identify specific information about experience in:	*Clearly identify the experience; provide dates, describe the person's role and extent of involvement in the experience*
✓ All types of Photogrammetry projects	
✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery	
✓ Acquisition of Digital Orthoimagery	
✓ Acquisition of LiDAR Elevation Data	Harris and US Air Force Positions
✓ Creation of Digital Terrain Model from LiDAR	Harris and US Air Force Positions
✓ Creation of Digital Elevation Model from LiDAR	Harris and US Air Force Positions
✓ Creation of Contours Lines	
✓ Planimetric Mapping	

Title of Position: ESP & Associates: Senior Geospatial Manager	
Name of Person:	**Harold W. Rempel, CP, GISP**
Educational Degree (s): include college or university, major, and dates	
License(s)/Certification(s), number(s), expiration date(s), if applicable:	ASPRS Certified Photogrammetrist, #R1418 Expires – 2/2019 Oregon Professional Photogrammetrist, #79605RPP Expires – 12/2018 Virginia Surveyor Photogrammetrist, #000040 Expires – 12/2017 Geographic Information Systems Professional # 61210 Expires – 1/2019
Specialized Training Completed.	Defense Mapping Agency – Topographic Training Department of Defense – Image Analysis, Photogrammetry
Number of years' experience in area of service proposed to provide:	25 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	**ESP Employee:** 4 years **Title/Role:** *Senior Geospatial Manager*
Describe this person's responsibilities over the past 12 months.	As the *Senior Geospatial Manager for* ESP Associates, Harold is responsible for management, project design, quality control, and execution of geospatial projects to include LIDAR, Orthoimagery, and photogrammetric mapping. Harold manages all geospatial components of ESP's projects as well as ESP's Photogrammetric Services contract with the North Carolina Department of Transportation and ESP's prime contract with the North Carolina Floodplain Mapping Program.
Previous employer(s), positions, and Dates	McKim & Creed – Operations Manager 2012-2013, SAM Inc. – Quality Control Manager 2011-2013, URS Corporation – Geospatial Project Manager 2008-2011, EarthData International – various positions 1997-2008, United States Marine Corps – Image Analyst 1989-1997
✓ All types of Photogrammetry projects	**Role:** Photogrammetry and LiDAR **Project Involvement:** Mr. Rempel has over 20 years of experience in remote sensing, photogrammetric mapping and project management. This includes large and small scale projects, from multi-year statewide programs to county and municipal mapping projects. Mr. Rempel also brings valuable experience in working closely with project stakeholders in developing technical specifications, managing Quality Control and Quality Assurance, and providing comprehensive management solutions to mapping projects. He co-authored FEMA's "Procedure Memorandum 61-Standards for LiDAR and Other High Quality Digital Topography", managed significant work for the North Carolina Floodplain Mapping Project, led the development and implementation of quality procedures for ISO 9001 certification. *Project Experience:* • North Carolina Floodplain Mapping Program, Phases 4 and 5 (2016 – Present) • North Carolina Dept. of Transportation, Photogrammetry IDIQ, (2017 – 2018) • North Carolina Floodplain Mapping Program, Phase 2 (2014-2015) • Texas Natural Resources Information System HPIDs LIDAR and Orthophotography Program, (2011-2013) • North Carolina Orthoimagery Program, (2010) • Florida Division of Emergency Management LIDAR Program, (2007-2008) • NOAA Coastal Services Center Geospatial Services Contract (2005-2008) • South Carolina Statewide LiDAR Program (2007-2008) • North Carolina Floodplain Mapping Program, Phases 1-3 (2001-2007)

Title of Position: ESP & Associates: Geospatial Analyst	
Name of Person:	**Ryan Lavery**
Educational Degree (s): Include college or university, major, and dates	BA, Geography, Appalachian State (2013)
License(s)/Certification(s), number(s), expiration date(s), if applicable:	N/A
Specialized Training Completed.	N/A
Number of years' experience in area of service proposed to provide:	7 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	**ESP Employee:** 3 years **Title/Role:** Geospatial Analyst (Quality Control Lead)
Describe this person's responsibilities over the past 12 months.	Geospatial Analyst (Quality Control Lead) for the NCFMP Phase 4 & 5 project. Responsible for the front end quality checks of data received and of the quality of deliverables from 10 Geospatial Technicians.
Previous employer(s), positions, and Dates	N/A
Identify specific information about experience for:	Clearly identify the experience, provide dates, describe the person's role and extent of involvement in the experience
✓ All types of Photogrammetry projects	**Role:** Quality Control Manager **Project Involvement:** Mr. Baraowski has over 3 years of experience in geospatial quality control and production task to include the quality control and management of products derived from LiDAR such as DEMs, DTMs, intensity images, hydro-enforced DEM products, and the creation of contours and planimetric data utilizing LiDAR point cloud. ***Project Experience:*** • North Carolina Floodplain Mapping Program, Phases 4 and 5 (2016 – Present) • North Carolina Floodplain Mapping Program, Phase 2 (2014-2015) • Various FEMA and COE LiDAR projects in MS, AR, TX and NC

Title of Position: ESP & Associates: Geospatial Analyst	
Name of Person:	**Michael Baranowski**
Educational Degree (s): Include college or university, major, and dates	BA, Geography/City and Regional Planning, University of North Carolina at Chapel Hill (2007) AAS, Geomatics/Survey Technology, Central Piedmont Community College (2016)
License(s)/Certification(s), number(s), expiration date(s), if applicable:	N/A
Specialized Training Completed.	N/A
Number of years' experience in area of service proposed to provide:	7 Years
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	ESP Employee: 3 years, 8 months Title/Role: Geospatial Analyst (Production Lead)
Describe this person's responsibilities over the past 12 months.	Geospatial Analyst (Production Lead) for the NCFMP Phase 4 & 5 project. Responsible for managing workflow and deliverables from 10 Geospatial Technicians.
Previous employer(s), positions, and Dates	Woolpert, Geospatial Analyst, 2007-2011
[illegible]	[illegible]
✓ All types of Photogrammetry projects	**Role:** Production Manager **Project Involvement:** Mr. Baraowski has over 7 years of experience in geospatial production and production management to include the production and management of products derived from LiDAR such as DEMs, DTMs, intensity images, hydro-enforced DEM products, and the creation of contours and planimetric data utilizing LiDAR point cloud. ***Project Experience:*** • North Carolina Floodplain Mapping Program, Phases 4 and 5 (2016 – Present) • North Carolina Floodplain Mapping Program, Phase 2 (2014-2015) • Various FEMA and COE LiDAR projects in MS, AR, TX and NC • FAA Airport GIS Aeronautical Surveys, Airside Surveys and Photo control (2007-2011)

EXHIBIT D: Method of Performance

1. PRODUCTS/SERVICES PROVIDED

The vendor should indicate in the table below which products/services they are able to provide. Additionally, the vendor should identify any additional photogrammetric mapping products and services that the vendor is able to provide.

PRODUCT/SERVICE DESCRIPTION	CHECK BOX BELOW IF THE VENDOR PROVIDES SPECIFIED PRODUCT/SERVICE	CHECK BOX BELOW IF A SUBCONTRACTOR IS PROPOSED TO PROVIDE THE PRODUCT/SERVICE
Acquisition of Digital Orthoimagery	☑	
Acquisition of LiDAR Elevation Data	☑	
Creation of Digital Terrain Model from LiDAR	☑	
Creation of Digital Elevation Model from LiDAR	☑	
Creation of Contours Lines	☑	
Planimetric Mapping	☑	
Mobile LiDAR mapping		☑
Oblique Imagery Capture and Processing	☑	
Helicopter-Borne LiDAR Capture and Processing		☑
Geiger LiDAR Capture and Processing		☑
Web Hosting of Geospatial Data	☑	
Oblique Imagery Capture and Processing	☑	
Photogrammetric Point Clouds	☑	

The following table maps the required and Surdex-offered product/service categories to the members of our Team and their projected roles. The roles are categorized as follows:

- "Sole" – only provider on the Team.
- "Lead" – primary provider on the Team.
- "Supporting" – supporting provider to a lead company.
- "Backup" – provides capacity in reserve for very large efforts or recognized single-point-of-failure.

Product/Services by the Surdex Team						
		Subcontractors				
Product/Service	Surdex Corporation	Merrick	ESP	Harris	EFK Moen (WBE)	David Mason (MBE)
Acquisition of Digital Orthoimagery	Lead				Support (Survey)	Support (Survey)
Acquisition of LiDAR Elevation Data	Lead	Backup			Support (Survey)	Support (Survey)
Creation of Digital Terrain Model from LiDAR	Lead	Backup			Support (Survey)	Support (Survey)
Creation of Digital Elevation Model from LiDAR	Lead	Backup			Support (Survey)	Support (Survey)
Creation of Contours Lines	Lead	Backup			Support (Survey)	Support (Survey)
Planimetric Mapping	Sole					
Products/Services Added by Surdex						
Mobile LiDAR		Lead	Support		Support (Survey)	Support (Survey)
Oblique Imagery	Sole				Support (Survey)	Support (Survey)
Helicopter-Borne LiDAR		Sole			Support (Survey)	Support (Survey)
Geiger LiDAR Capture and Processing	Support - Processing			Lead		
Web-Based Solutions	Sole					
Oblique Imagery Capture and Processing	Sole					
Photogrammetric Point Clouds	Sole					

2. PROJECT APPROACH

The vendor should provide a description of their proposed project approach for categories of products/services the vendor proposes to provide.

2.1 Categories of Products/Services

a) Acquisition of Digital Orthoimagery

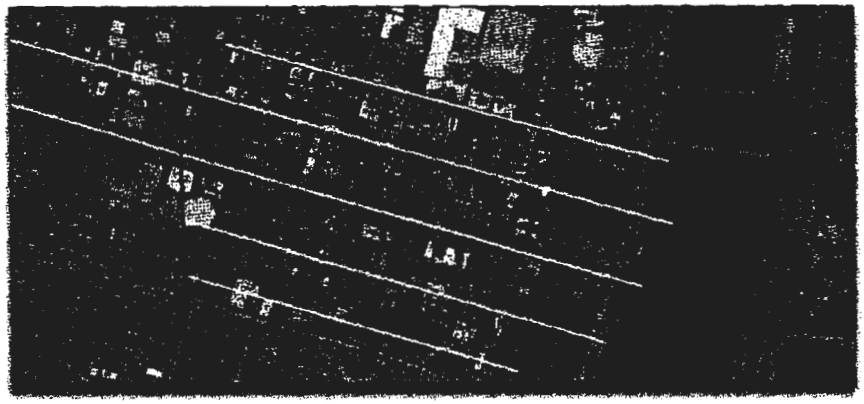
An orthoimagery project design is driven by the deliverable tile layout and a buffer around the boundary and includes a flight design and a control survey design. Flight planning is the responsibility of Surdex's Chief Pilot and is reviewed and approved by the Project Manager. The Aerotriangulation and Survey Departments design the ground control network against the flight plans. A Certified Photogrammetrist from Aerotriangulation and a Registered Land Surveyor are responsible for the design.

Surdex uses the Leica MissionPro flight planning software for acquisition planning. This software utilizes an elevation model to rigorously check for adequate forward and sidelap coverage as well as desired product GSD. A flight designer uses the software to achieve both efficient acquisition and coverage of the entire area. Flights are planned against the buffered coverage for each seasonal window portion of applicable project areas.

The flight planning software addresses rugged or uneven terrain in two ways:

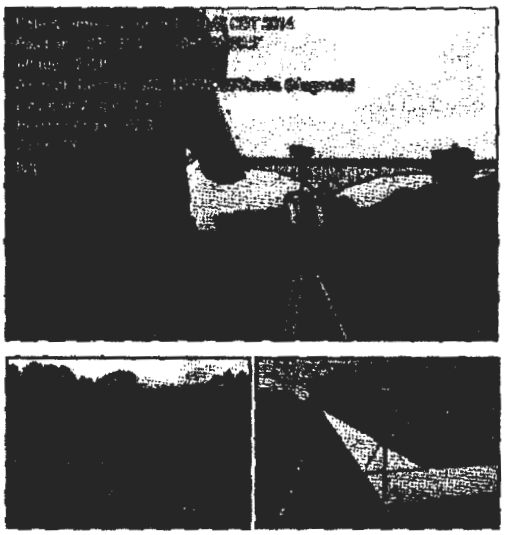
- The targeted GSD is treated as a "maximum" value by the software and is never exceeded when compared to the terrain model. This may require "line breaks" to alter the flying height in very rugged terrain.
- The sidelap setting is treated as a "maximum" value and the spacing between lines is modified to ensure the value is not exceeded.
- For highly built-up urban areas resolutions of 1'/30cm or better, several strategies are undertaken to ensure building and elevated feature lean is minimized:
- Additional flight lines are designed to align with the major streets/avenues if these transportation routes do not align with the baseline flight orientation.
- Sidelap is increased, often by inserting intermediate lines between the existing lines to double the sidelap.
- Forward lap is increased to 80% or more to optimize vertical views along the flight line.
- These steps provide additional imagery for the technicians to use during the mosaicking process, resulting in most cases of varying views to select from. The following graphic shows an example from the St. Louis area in 2015. In this case, the baseline north-south design (red) was augmented by diagonal flight lines (yellow/tan) and tighter spacing to increase the sidelap.

Excerpt of Flight Plan Addressing the Built-Up Areas in Downtown St. Louis.



Ground survey is performed to establish control and checkpoints for the project. To assure consistency in the field data and eliminate observation errors, only fixed height range poles are utilized during GNSS field data collection. The survey will include only GNSS geodetic receivers set to a minimum of five second epochs for data collection. For each GNSS observation site a sketch will be developed and a digital photo will be acquired in the field. The digital images will be acquired with a software application like Theodolite that automatically records GNSS coordinates and time on all field images.

Field data and ground survey control and checkpoints.

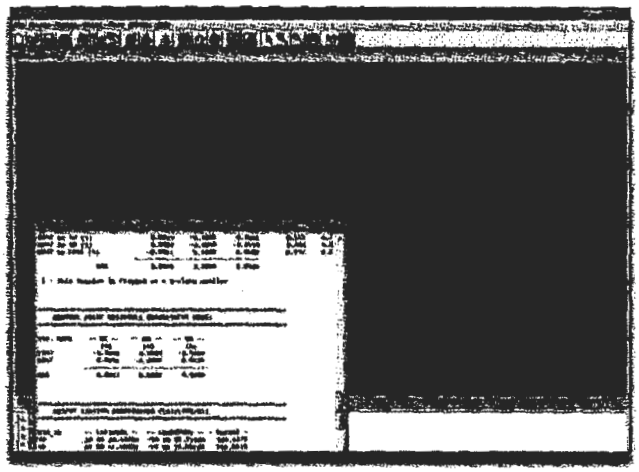


The basic network design will be a GNSS rapid static network, tied into National Geodetic Survey (NGS) horizontal and vertical monuments. The NGS monumentation will consist of a minimum level 1st order horizontal monuments and 2nd order vertical monuments. On a daily basis all field observations and notes will be downloaded to the Surdex ftp site by field crews. The Waypoint GrafNet or similar GNSS Least Squares post-processing software will be utilized for all office processing of GNSS data. An initial free-net adjustment will be done to validate the observations and locate any blunders in the input data. The free-net adjustment will be constrained to one NGS monument, creating a minimally constrained network.

Once the free-net adjustment is completed, all observation data will be processed through the Online Positioning User Service (OPUS). The OPUS solutions for all observations will then be input into the post-processing software as check-points in the solution. A second free-net adjustment will be performed to evaluate the OPUS check-points against the NGS monument free-net. Any discrepancies will be investigated and resolved.

The final adjustment of the network will be fully constrained to a minimum of four NGS horizontal monuments and three NGS vertical monuments. In addition, a minimum of three surrounding NGS Continuously Operating Reference Stations (CORS) sites will be downloaded into the project. The final constrained adjustment will be held to the NGS monuments and all CORS and OPUS solution positions will be evaluated as check-points. Any irregular discrepancies in the final network will be evaluated and resolved. This method of least squares adjustment of the survey network assures a known relationship between the NGS monumentation, CORS, and OPUS solutions within the survey observations.

Survey network adjustment using GrafNet software.



Generally:

- A sketch will be provided for each point along with pictures of the location to guide measurement of the points during aerotriangulation and orthoimagery accuracy assessment.
- A control diagram will be furnished for all survey points utilized on this effort. This will include point positions and observed baselines designating beginning and ending points.
- A least squares adjustment will be performed for all control points. Output to be furnished in Excel format will include results of the constrained and

unconstrained adjustment. This will include fixed coordinates and adjusted coordinates in latitude, longitude and ellipsoid height, error ellipse values in meters, relative baseline error ellipses in meters, precision of the observed baselines in parts per million (ppm), and redundancy expressed as degrees of freedom. All information will be referenced to field notebooks.

- All field notes and observation logs will be neatly kept and indexed. This includes notes pertaining to the establishment and/or extension of monuments. For recovered monuments, information on the condition of each point will be provided in the notes. The observation logs for each point will include all information pertinent to the recovery and observations required for office post-processing.

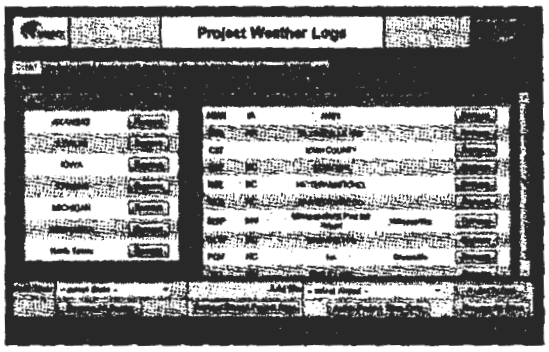
Acquisition of imagery is one of the most critical phases of any project. Successful acquisition relies on an extremely high degree of communication between Surdex's Chief Pilot and all aircrews. Flight plans are updated each evening by merging progress to date with the results of imagery inspection (isolating potential re-flights). These plans reside in the Enterprise database and are distributed daily to aircrews via the Internet and/or e-mail. Surdex's Chief Pilot will inform the local Air Traffic Control (ATC) and/or military air traffic control authority in advance of flight operations. This includes providing aircraft tail numbers and flight designs to ensure the local authority is fully informed.

For acquisition involving restricted airspaces and/or Military Operations Areas (MOAs), thorough coordination with the Air Traffic Control centers and often military operations centers is required. In such cases, Surdex proactively provides the necessary information, including flight plans, to the proper authorities to ensure trouble-free access to the areas. Surdex has performed acquisition in and around highly sensitive airspaces, such as White Sands Missile Range (New Mexico), Nellis Air Force Base (Nevada), and the Washington, DC ADIZ (Air Defense Identification Zone). Experience has shown that high degrees of communication and adherence to directives results in long term success. In some cases, this has even required that a government official be physically present on the aircraft.

Acquisition Approach	
Feature	Benefit
Strong coordination with the client: (1) Start and stop acquisition timeframe. (2) Movement to/from the project area. (3) Adherence to client specifications on window, sun angle, etc.	Clients are always aware of our presence on their project.
Coordination with FAA and military operations centers if required. Surdex has successfully operated in some of the most highly sensitive airspaces in the U.S. and Canada.	Assure trouble-free access to restricted or military operations areas.
Monitoring of short and long term weather: (1) Use of weather resources. (2) Enterprise database retains weather reports at each project site during each acquisition window.	Achieves optimal utilization of resources to ensure success for all projects.
Near real-time reporting of status – acquisition and results of inspection.	Clients continuously aware of their project's progress.
Minimize the acquisition window length – oftentimes by putting multiple aircraft on the project. This minimizes the effects of weather and climate on image appearance.	Highest possible image quality across the entire project.
Our large fleet of aircraft and sensors	Ability to handle numerous projects across North America.
Our Enterprise database tracks all acquisition and inspection status: (1) Real-time tracking of our aircraft to monitor acquisition operations. (2) Flight plans updated daily. (3) Re-flights prioritized to ensure minimal time difference. (4) Daily issuance of status.	Maximum application of resources to ensure success.

Before each acquisition day, a number of activities are undertaken by the aircrew:

Dedicated weather tracking for each project.

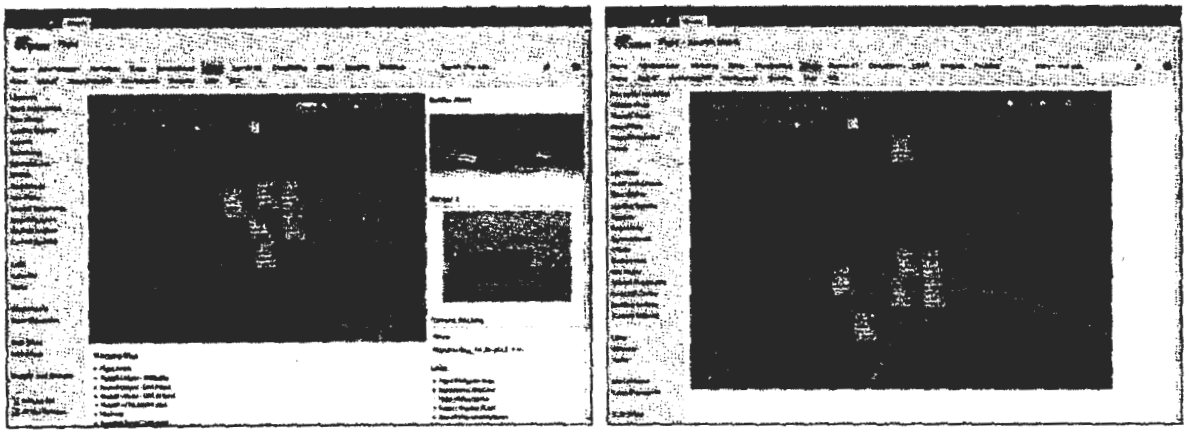


- Up-to-date flight plans are downloaded and reviewed.
- Aircraft, ABGPS, IMU, and camera are all inspected for proper operation.
- Final weather checks are made.
- Flight plans are filed with the local airport/FAA.
- If required, base stations are setup.
- At the end of each acquisition day:
- Aircraft flight logs are completed.
- Flight reports are completed and emailed or faxed to the production center.
- If necessary, imagery and data transferred from on-board storage to "transfer" hard drives.
- If appropriate, transfer drives are shipped priority overnight to the production center.
- Surdex maintains a flight report for each mission that is used by the production center to appraise the results. For example, if extreme turbulence or cloud cover is cited by the aircrew for specific areas of the acquisition, prioritized attention is paid to these areas by the inspectors.

It is critical to collect ABGPS/IMU data with the highest possible integrity, taking into account such factors as:

- Operation of base stations to maintain a reasonable distance to the project area.
- Avoiding IMU drift by limiting the length of lines – generally less than 80 miles or 20-30 minutes of flight.
- Using CORS (Continuously Operating Reference Stations) and/or local GPS reference networks to provide multiple observations.
- Each of Surdex's aircraft is equipped with the Skytracker instrumentation that uses GPS to continuously report the position, airspeed, and altitude of the aircraft. Unlike flight tracking systems such as Flight Aware that only have access to aircraft operating under IFR (Instrument Flight Rules) or filed VFR (Visual Flight Rules) positioning, Skytracker continuously reports status. Surdex has customized internal applications that allow the viewing of the aircraft status in various ways.

Surdex continuously tracks our aircraft on our internal SharePoint site.

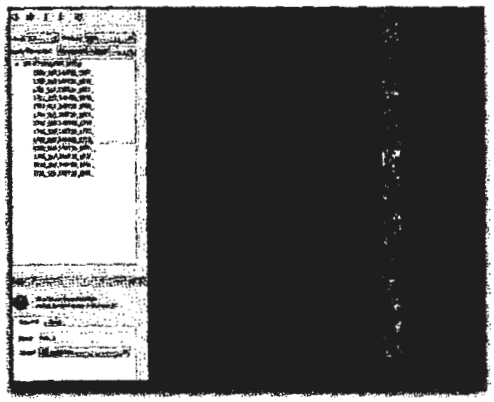


Should re-flights be necessary, Surdex will prioritize them to be acquired as quickly as possible after the initial flights. By doing so, differences in ground conditions are minimized to ensure re-flights can be blended into the original flights during production. If the re-flight is not a full line, it will include full stereoscopic overlap with the remaining portions of the line.

As with all ortho projects, QA/QC of acquired image data is critical to the overall success of this project. With complete and thorough inspection Surdex and the State are assured that the final delivered ortho will be free of artifacts and image irregularities. Because of this critical importance, imagery inspection is based on 100 percent inspection—all image is viewed, graded, and stored in a database available to all personnel in production. Only with 100 percent inspection can a qualified determination be made regarding the possible need for re-flights.

Imagery Inspection Task/Item	Inspection Method	QA / QC
Image QA/QC processing	Analytical and visual	Performed and reviewed by a CP and/or RLS
Acquisition date/time/sun elevation	Analytical	Automatic verification via Enterprise database
Sun angle	Analytical	
Forward lap	Analytical	
Sidelap	Analytical	
Crab	Analytical	
Tilt	Analytical	
Cloud/cloud shadow	Visual	May be cause for rejection and re-flight
Smoke/haze	Visual	
Excessive flooding/standing water	Visual	
Excessive ice/snow	Visual	
Image motion	Visual	
Dust/cloud registration	Analytical and visual	
Specular reflection	Visual	
Camera misfire	Analytical and visual	
Specular reflection	Visual	Delineated for use in orthoimagery production process

Imagery Inspection.



Hand-in-hand with image inspection is the processing of ABGPS/IMU data, which is critical for pushbroom cameras to support image reconstruction. Surdex uses the standard Leica workflow to capture and process the ABGPS and IMU data. The ADS100 carries the Novatel SPAN GPS/GNNS inertial navigation system in the aircraft. Surdex uses Trimble R8 model receivers to collect ground base station GPS and GLONASS data during each flight. The position of the ADS100 sensor and the GPS antenna are measured within the coordinate system defined by the central axis of airplane. These measurements along with the GPS and IMU data captured on each flight are processed using Novatel Inertial Explorer software. Inertial Explorer produces a differential solution for the airborne positions and attitude more than a hundred times a second for the duration of the flight. As the Leica ADS100 is a line scanner there are no individual stations, but rather a stream of epochs or fixes are produced at a rate of 128 per second. Only during aerial triangulation are discrete fixes calculated at a spacing dictated by image measurement density.

Inspection is conducted for digital images against the acquisition requirements of:

- Within the prescribed season window
- Within the prescribed sun angle.
- Within prescribed ground conditions such as free from standing water (other than natural or man-made ponds and lakes), free of snow, ice, etc.
- The imagery is free of clouds and cloud shadows.

Inspection is not limited to conditions, but also addresses the following:

- Camera misfires.
- Adherence to planned station coordinates, using ABGPS/IMU information and/or navigation grade GPS from aircraft logs.
- Specular reflection – noted in the database for use by the ortho technicians.
- Image artifacts.

All results of inspection are retained in Surdex's Enterprise database. Note that re-flights are moved up in priority for image inspection as the data is necessary for subsequent project phase(s) such as aerotriangulation and orthorectification.

Aerotriangulation (AT) is ultimately responsible for the foundation accuracy of the project and for this reason it involves checks and balances to ensure accurate data is made available to the entire production process to avoid costly and time-consuming re-work. Using ABGPS/IMU data coupled with ground control, the position and attitude information of the imagery is refined to make possible the accurate geopositioning of any point on the ground. The inputs to AT are:

- ABGPS/IMU data.
- The imagery.
- Ground control points and any check points.

The AT process involves:

- Automated measurement of pass and tie points appearing in the overlaps of the imagery.
- Interactive editing of pass and tie points.
- Measurement of control and check points.
- Solution of the refined imagery position and attitude as well as all point positions.
- If required, re-measurement of points and repetition of the solution.

The AT solution involves a sophisticated "bundle adjustment" using the method of least squares and a mathematical model of the imaging sensor geometry. This includes utilizing the results of the "boresighting" of the sensor (relative position of the lens to the GPS antennas and relative orientation to the IMU) and synchronization with the ABGPS signal.

The bundle adjustment relies on the use of far more "observations" (initial, observed/recorded values such as ABGPS, IMU, ground control, and image measurements) than are required for a unique solution and because of this employs a least squares optimization approach in the solution. Each observation is "weighted" based on its estimated accuracy to provide a balance in the optimization. Since there are far more observations than required, careful inspection is made of the various "residuals" reported by the solution. For example, an ABGPS position residual is the difference between the final adjusted value and the initial value from ABGPS processing. Should this differ more than the estimated ABGPS accuracy, this may signal flawed ABGPS data or processing. Since ground points involve measurements on numerous images, their ground positions and image measurements also have associated residuals. From a high level viewpoint, the ABGPS/IMU and any ground control point data provide a rigid solution that is used to refine initial imagery position and attitude to achieve the highest accuracy.

There are several types of points that are measured during the AT process:

Aerotriangulation Points Type		
Type	Description	Measurement
Tie points	Points collected in overlapping images along a flight line/strip of imagery. Used to ensure images in the strip are tied together.	Mostly automatically collected and measured, but may require manual collection and/or editing in difficult areas (dense vegetation, water bodies, etc.).
Pass points	Points collected in overlapping images in adjoining and overlapping flight lines/strips. Ensures adjoining strips are tied together. Pass points are often also tie points so as to strengthen the overall solution.	
Control points	Points of known ground position. Often paneled for recognition and accurate measurement. Manually measured.	Manually measured.
Check points	Points of known ground position. Often paneled for recognition and accurate measurement. Not held to their known position during the AT adjustment process. By allowing their positions to "float", they provide an independent check on the accuracy of the AT.	

Analysis of the quality of the AT solution is performed by a Certified Photogrammetrist who is highly skilled and experienced with the process. Upon the completion of the AT process, the results are stored in the Enterprise database and published ("exposed") for use in the following production steps. For orthoimagery projects, this also includes comparing the multitude of AT points to the elevation model. Although a small percent of the automatically generated points are not on the ground (bare earth) surface, the majority provide a very good check on (1) the fit of the AT and (2) the general quality of the elevation model. This comparison can be useful to delineate changes required in the elevation model.

A bound report on the aerotriangulation process can be provided at the completion of each block and will be written by a Certified Photogrammetrist. This will address, at a minimum, the following items:

- Coordinates and residuals for all points.
- Coordinates as specified in the project design parameters.
- Description of control points and check points used in the process.
- RMS values and projected ground elevation accuracy for all points.
- Delineation of discarded points and rationale.
- Summary of statistics generated for the final bundle adjustment.

The accuracy of an orthoimagery is founded on the accuracy of the aerotriangulation process. However, the limiting accuracy becomes the accuracy and quality of the elevation model. To achieve the accuracy standards, our approach is based on using all existing elevation data, augmented where missing (or requiring update), by digital correlation and/or interactive editing. This may include new development, street alignment, drainage modification and large areas of grading. Mass spot points will be developed, consistent with existing spacing and density, to create an accurate surface model required for orthorectification.

Elevated features, such as non-grade crossings of transportation lines and bridges, often require a localized elevation model to ensure no layover and/or smearing is introduced into the final product. In contrast to most initial DTMs/DEMs which are "bare earth," these models are Digital Surface Models (DSMs). A DSM is kept in a TIN (Triangulated Irregular Network) format. TINs are not constrained to a grid of points that would affect the accuracy and quality of the final product. During orthoimage production, all overpasses, bridges, transportation lines, and even "urban canyons" are scrutinized to determine whether a localized DSM is required to maintain product quality.

If significantly large areas require an update, we often use the Leica Semi-Global Matching (SGM) software. This approach yields very high integrity surface models by essentially matching every pixel in the forward, aft, and nadir arrays to create a "photogrammetric point cloud."

Surdex's R&D staff has worked diligently over the last decade to improve accuracy, quality, and throughput of orthoimagery. This effort has resulted in a mix of third party, open source, and custom-developed algorithms, processes, and software operating within a standardized user interface. The common operating interface is referred to as "Group Tool" (GT), and our entire production and project management staff is trained in its operation. Underlying this is an Enterprise database that tracks all source, interim, and final products. Image processing and orthorectification technicians all utilize calibrated display monitors to ensure consistent results.

Surdex's Group Tool displays image metrics for all views.

Luminosity histogram (Red, Green, and Blue bands combined)

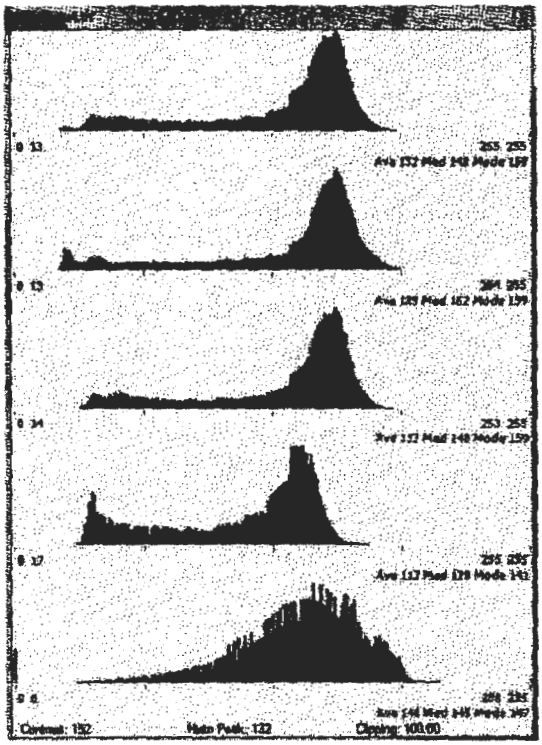
Red band histogram

Green band histogram

Blue band histogram

Near infrared band histogram

Image metric statistics



We limit sensor-specific processing to the front-end of the production chain and all imagery is retained in 4-band and 12 bpp (bits/pixel) format ("4x12") until the final tiles are produced. This allows us to make localized adjustments to color, tone, contrast, etc. without compromising the overall quality of the deliverable product. The 4x12 format also supports re-mapping to 8 bits/pixel, to color only, or color infrared (CIR). All image resampling is performed using bi-cubic or Lagrange interpolation kernels to eliminate aliasing and similar artifacts.

Orthoimagery is produced to a contiguous "Master Tile" layout that encompasses the entire deliverable area with adequate buffering. Master Tiles are nominally 8K x 8K (8,192 x 8,192) pixels in size, in 4x12 format, and in the dominant reference frame of the project. Once the Master Tiles are completed, they can be used to generate all delivery tile layouts, including re-projection and changing of linear units (i.e.: US Survey Foot, International Foot, Meter, etc.) using an automated process. Thus, we can support multiple layouts with ease. Should an error be found during product inspection, the Master Tiles are first corrected and then the deliverable layout re-generated. In this way, errors affecting multiple layouts and/or tiles are easily resolved.

Features and Benefits of Surdex's Orthoimagery Production Process	
Feature	**Benefit**
Image color, tone, balance, etc. prototyped before production begins in a Pilot Project.	Client participates in desired appearance of final product far in advance of delivery. The pilot project also checks form and format of deliverable imagery, metadata, etc.
All image processing and production performed in "4x12" space (4 bands, 12 bits/pixel) until the cutting of deliverable image tiles: (1) Generate color, 4-band, and/or color infrared (2) 8 or 12/16 bits per pixel deliverables	Preserving full content provides maximum latitude in mosaicking process. Ensures highest possible quality products.
Internal production tiles are in a contiguous (seamless) format, with deliverable tiles generated at the final stage. This supports: (1) Overlapping deliverable tiles (2) Multiple deliverable tile layouts (3) Multiple map projections (4) Multiple product resolutions	Accommodates clients with requirements for multiple layouts of deliverable products at marginal additional cost. Accommodates last-minute changes. Edits to data only done once to support multiple products.
Highly automated absolute radiometry and atmospheric processing reduces: (1) Level of subjectivity by technicians (2) Production labor effort (3) Changes to be made in final stages of production	Higher volume and throughput.
Customized seamline generation process: (1) Highly effective (2) Inclusion/exclusion areas (such as building footprints)	Seamless final product. Reduced customer review.
Proven ability to incrementally produce large orthoimagery projects while preserving a seamless appearance at completion.	Allows incremental QC and delivery to address client priorities, leveling of QC resources, and schedule compression.
Enterprise database underlying all imagery and data.	Complete lineage of all processing. Automated generation of FGDC-compliant metadata.
Web-based QC tool available free of charge for clients: (1) Reduces cost and time associated with multiple deliveries of hard drives (2) Fast turnaround of fixes and validation of fixes (3) Progress tracking	Accelerates QC and acceptance process. Audit trail of all changes. Reduces time for customer QC.

Using Surdex's Group Tool, image processing technicians organize large blocks of orthoimagery into groups with common characteristics – not necessarily coinciding with individual flight missions. The tool can display images in ground space, allowing operators to see the relative image quality between neighboring images. Imagery can be viewed in either color or CIR to ensure 4-band continuity. The grouping of images is important because:

- The atmospheric conditions during capture may result in imagery covering regions of differing degradation caused by haze. This is particularly true in coastal areas.
- Sun movement during the day affects the direction of sun illumination. Understanding this allows efficient solar corrections of groups with common illumination effects.

Overview of Surdex's image processing steps.

Step 1: Simple gamma (brightness and contrast) correction as used in such functions as aero-triangulation and elevation model editing.	Step 2: After application of atmospheric corrections. Color now established for the ground scene.	Step 3: After application of BRDF corrections. Note the dramatic reduction in the differences in appearance between orthoimages.	Step 4: After global balance. Residual differences between orthoimages have been eliminated.

Surdex maintains full 4-band (R,G,B,NIR) and full bit depth (12 bits/pixel) until the final cutting of deliverable tiles. Since the red and green bands are common to the color and CIR renditions within a 4-band file, care must be taken to ensure proper appearance of both. In general, much of the balancing is confined to the NIR band. First the color rendition (R,G,B or bands 1,2,3) is locked down and then the NIR band is processed to achieve the CIR rendition (NIR,R,G or bands 4,1,2 – the blue band is excluded). From our extensive experience with 4-band products, we have found that client expectations for a CIR rendition vary, primarily due to prior experience with color infrared film. Surdex's web-based inspection tool (SurCheck) has the ability to render either a natural color or CIR view of 4-band products.

Orthorectification will be performed using the Leica XPro software. The orthorectification process employed by the XPro software includes a ray trace from a ground coordinate to the pixel. All resampling is performed using bi-cubic resampling to assure pixel location accuracy and avoids aliasing effects common to nearest-neighbor and even bilinear resampling techniques.

Mosaicking encompasses two fundamental phases: (1) editing of artifacts and creating seamlines to stitch the raw orthoimages together and (2) balancing of the imagery to provide a consistent appearance of the imagery (color, tone, brightness, contrast, etc.) associated with the desired appearance determined in the Pilot Project. Mosaicking inputs are the raw orthoimages along with shape files that guide editing of specular reflection and obscured/smeared areas. Once all seamlines are finalized and balancing complete, the Master Tiles are generated to support the generation of the deliverable tile layouts.

The mosaicking steps are:

- Editing of occlusion or smearing caused by rugged terrain.
- Specular correction.
- Seamline generation.
- Global balancing.

Surdex has developed a custom software module to detect potential occlusions and smearing that may occur in rugged terrain. This software creates a shapefile that directs technicians to examine pixels that may require correction. If correction is required, corresponding imagery from overlapping orthoimagery is inserted to replace it during the mosaicking process.

Specular reflections caused by glare from sun reflections off water bodies and/or large structures may be present in some imagery. During the 100% image inspection, technicians note images containing specular reflections and will take steps to reduce it, such as seamline placement. Touch-up ensures features are not obscured along the land/water interface.

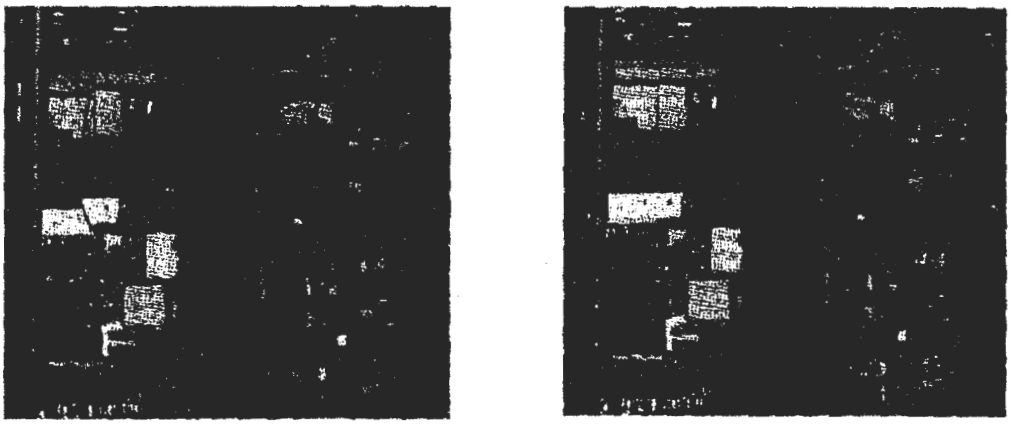
There are three steps in the seamline process:

- Automatic generation seamlines.
- Editing of seamlines from within Group Tool.
- Application of the seamlines to create the Master Tiles.

The automatic seamline generation is queued from within Group Tool for execution in Surdex's distributed processing environment. Seamline data is stored in a database as OGC simple binary objects. We have created a cost-based approach that analyzes the cost of many paths to create the best seamline between orthoimages. Multiple cost factors can be weighted by the technician to provide flexibility to tailor seamline placement strategy to the landform and land cover for a given project. A mix of percentage weights will result in the software calculating a cost for each path by summing the weighted contribution of each cost factor. Technicians review the automated seamlines and correct any requiring revision. The technicians log the accepted seamlines in the database, resulting in each seamline polygon having a record of who accepted it and when.

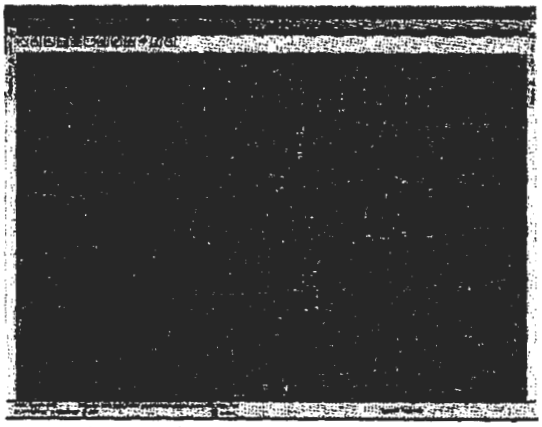
To demonstrate the utility of the seamline data during inspection, the following graphics show automatically generated seamlines and the result of interactive edit. The edit resolves a seamline that sliced through buildings by modifying the seamline placement to follow a more effective path – in this case along a road where its presence is not visible in the final product. If a technician failed to properly address this artifact, inspection with the seamline overlay would clearly point out the error.

Initial automatic (left) and manually-adjusted (right) seamlines.



Surdex will supply an ESRI shapefile that fully delineates the seamlines. Our custom software automatically generates the seamline data during production, made possible by our software integrating automatic seamline generation and interactive edit into a single application and interface. Each orthoimage merged into the mosaic is defined by a polygon representing its bounds with each of its overlapping neighbors. The polygon attribution contained in the shapefile includes:

Example of Final seamlines.



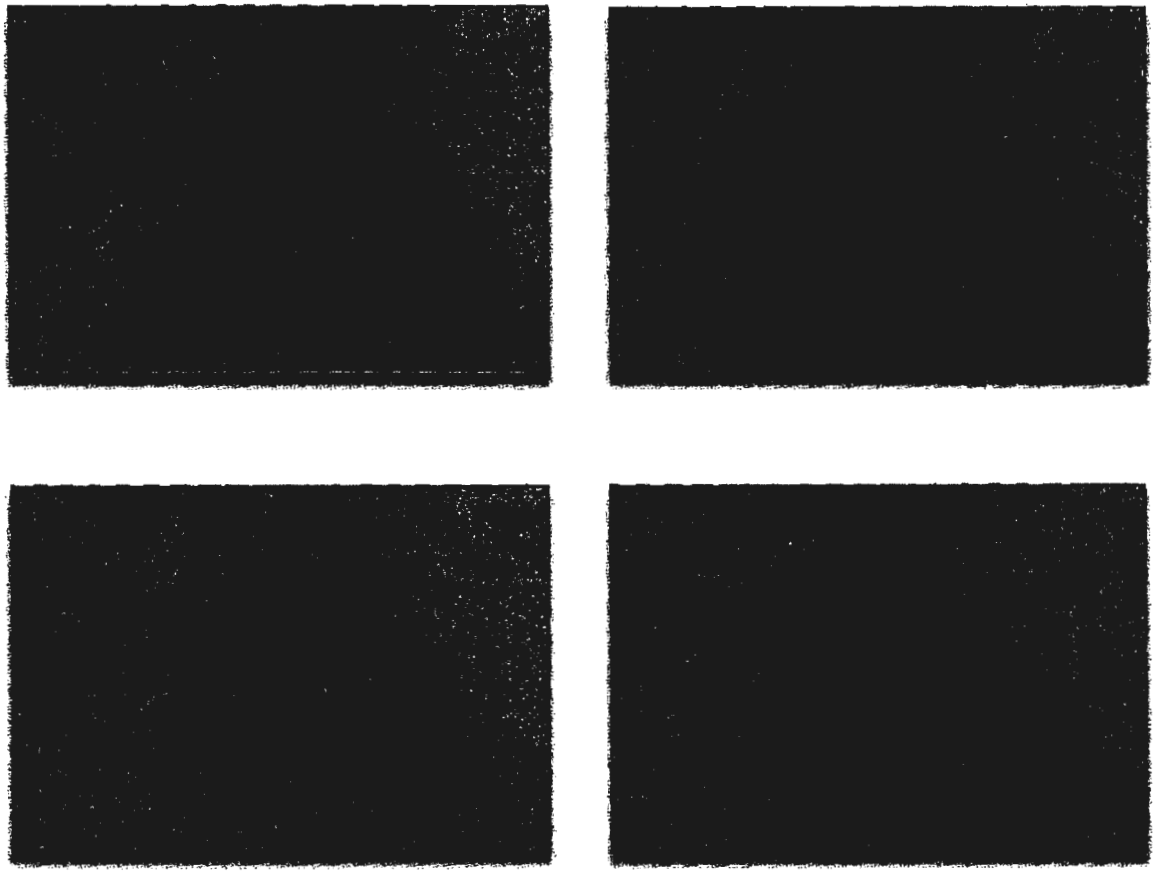
- Date of acquisition.
- Polygon start/end date/time.
- Spectral resolution (color, CIR, 4-band).
- Sensor manufacturer and model (e.g.: Leica ADS100).
- Sensor serial number.
- Aircraft type and tail number (e.g.: C441, N2NQ).
- Average flying height.

Surdex's custom-developed Global and Block Balance software used during mosaicking eliminates any residual atmospheric and radiometric anomalies that hamper the appearance of a seamless dataset. After application of BRDF and atmospheric correction each orthoimage still needs corrections to match its neighbor and achieve the desired appearance. This is handled by two functions:

- Block Balance fits correction models to each strip of images with a single simultaneous bundle adjustment.
- Global Balance is then run to correct local differences in illumination between strips, and the results can be previewed in Group Tool without the need to generate intermediate files.

Global Balance uses a "rigid body model" correction calculated for each orthoimage that best forms a normalized block fitting neighboring orthoimages. Higher-order polynomial versions of the rigid body result in a "flexible body" correction that transitions differences in the overlapping regions. As this is a model-based approach, it is possible to limit the influence of scene specific differences in overlapping orthos. For example, if crops are mature and green in one flight line and only tilled soil in the overlapping neighbor, the model will disregard these measurements as outliers and not force the green crops to match the brown soil.

Before (left) and after (right), both color (top) and CIR (bottom) global balancing. (Seamlines not applied).



During tile-writing, all balancing adjustments and seamlines are applied to the individual orthoimages to create the Master Tiles. Once this is complete, all deliverable tiles can be generated. Using our custom software, virtually any tile layout can be generated on demand using automated batch processing. This includes support for:

- Overlapping and contiguous tile layouts.
- Multiple tile layouts.
- Creating tiles in other map projections and/or linear units (e.g.: meter vs. US Survey Foot).
- Downsampling the resolution, such as creating a 1' resolution tile set from a 6" tile set.
- Since the Master Tiles are in 4x12 format, tiles can be delivered as such or remapped to 8 bits/pixel, and in color or color infrared (CIR).
- Supported output file formats include MrSID, GeoTIFF, JPEG, JPEG200, ECW, TIFF/TFW, etc.

Besides the obvious ability to generate data in virtually any desired tile layout, the Master Tile concept makes error correction during inspection very simple. Once an error is corrected in the Master Tiles, all applicable client tile layouts are automatically re-generated, limiting the correction to a single action potentially resolving numerous deliverable tiles.

b) Acquisition of LiDAR Elevation Data

Surdex LiDAR Acquisition

Surdex has extensive experience acquiring and processing LiDAR data. In the past ten years, Surdex has conducted over 200 projects involving LiDAR. In 2014, we were on track to complete over $6 million in LiDAR work. Recently we completed a LiDAR project covering over 5,692 square miles and a current program encompassing over 20,373 square miles This includes extensive work in Missouri and Oklahoma and prior work in the State of Texas.

Prior to mobilizing acquisition assets, Surdex will coordinate a conference call to confirm, step by step, the project specifications and proposed work plan. Based on the outcome of these initial discussions, Surdex will address the Flight Operations Plan and make all necessary adjustments or modifications to the plan. Once the Flight Operations Plan has been modified/validated, the proposed geodetic control layout will be cross-checked against the validated plan to ensure that all necessary ground control positions are consistent with any confirmed flight changes.

LiDAR Ground Control

A least squares adjustment will be performed for all control points. Output to be furnished in Excel format will include results of the constrained and unconstrained adjustment. This will include fixed coordinates and adjusted coordinates in meters, error ellipse values in meters, relative baseline error ellipses in meters, precision of the observed baselines in ppm (parts per million), and redundancy expressed as degrees of freedom. All information will be referenced to field notebooks.

All field notes and observation logs will be neatly kept and indexed. This includes notes pertaining to the establishment and/or extension of control. For recovered points, information on the condition of each point will be provided in the notes. The observation logs for each point will include all information pertinent to the recovery and observations required for reduction.

Check points will be collected, per the required distribution for bare earth and vegetation validation. Our current plans are based on a single season collection of the LiDAR data reducing the need for additional check point collection due to temporal change. Check point surveys will tie to NGS monuments used for the base control surveys.

Acquisition

Surdex will base the mobilization schedule on current and forecast weather conditions and verified environmental conditions. Conditions required for LiDAR collection require:

- Cloud and fog free (between aircraft and ground).
- Snow free (light snow may be acceptable with approval).
- Steam and rivers within normal levels (flood free).
- Leaf off vegetation.

Should crews leave the project site due to extended unfavorable weather/ground conditions, notification will be sent detailing the reason for leaving the project site and Surdex's estimated re-mobilization date.

Surdex will provide progress reports daily providing flight trajectories, GPS reports and identify any days where collection was delayed due to weather or other environmental factors.

Two base stations will be identified in advance and will be located as close as possible to the center of that day's collection area. The base station locations will incorporate existing NGS locations where acceptable. Surdex has identified that the project area is not covered by available CORS therefore, we will establish GPS base stations manned by Surdex personnel.

The base station location will be identified and presented to the County for approval before any flight operations commence to demonstrate that the sites are acceptable for baseline lengths.

The results from the processed base station data, ABGPS data and the GPS surveyed ground control data will be used to create an accuracy report for each mission and for the overall project once it is complete.

Sensor Calibration

LiDAR is highly dependent on several sensor sub-systems working in conjunction with each other to produce accurate ranging data and the resulting point cloud. This includes the Base GNSS station, ABGPS/GNSS, IMU and the physical laser unit. Surdex's LiDAR system is routinely calibrated over our established boresight at our base of operations in Chesterfield, MO.

Surdex's procedure to calibrate the sensor consists of four lines of acquired data flown in cardinal directions with two lines at one altitude and the other two (opposing directions of the first two) are at a different altitude. This calibration is accomplished when the sensor is installed in the aircraft required for a given project. This procedure is also accomplished if anomalies are found and unresolved during processing.

A secondary method of validation/calibration is conducted on site during the project acquisition. This secondary calibration is accomplished by acquiring cross flight lines perpendicular to the "project" lines before and after each lift. These data are processed and used as validation and calibration of the data collected over the project site.

Post-Acquisition Data Verification

As daily shipments of the LiDAR arrive, the data are immediately backed up prior to any inspection or processing. This serves to secure all data in its native form should it be necessary for review or investigation during subsequent processing. After archival, the initial QC is accomplished on a daily basis. The data is inspected for coverage, continuity and general acceptability. Should an issue be found that requires re-flight, the anomaly is entered into the database as a "rejection" and notification sent to the Project Manager, Flight Manager and field crews automatically. The automatic notification eliminates the dependence on human interaction to report an issue. As stated previously, all re-flights are labeled as priority status requiring prompt attention.

Post processing and verification of acquired data will be accomplished upon receipt of data from the field. Standard QC checks are designed to verify that data meets or exceeds all requirements of the project.

Data will be inspected to ensure nominal point density has been achieved on single swath data, excluding overlap. Although data voids caused by water bodies or areas of low reflectivity will most likely not be present due to the geography of the area to be collected, inspection will verify that proper planning, acquisition, sensor function have achieved the desired results.

In our experience, due to detailed project planning, spatial distribution of collected data from the Leica ALS70HP continually meets specifications relating to clustering, and routinely meet all QC checks against minimum points contained in prescribed grid cells.

Fixed-Wing LiDAR Acquisition (Merrick & Company)

Merrick & Company's Geomatics group provides fixed wing aerial LiDAR wide area mapping capabilities. Merrick operates the most state of the art airborne LiDAR sensor on the market to provide the best accuracy while optimizing collection efficiency. This system is design to produce mapping and even engineering grade LiDAR data to meet all USGS Quality Level LiDAR (even QL0) and derivative delivery products. Special design features allow for significantly improved collection efficiency over terrain compared to all other LiDAR systems on the market. This system also has a co-mounted 80 MP digital camera for high quality orthophoto mosaic deliverables as well.

USGS LBS Adherence

In real world project applications meeting USGS QL2 point density requirements, we have witnessed the Galaxy repeatedly produce the following data quality measurement capabilities:

- Absolute accuracy: typically around **5 cm RMSEz** for NVA check points
- Relative accuracy: typically around **4-8 cm RMSD** per overlap region
- Smooth Surface Repeatability: typically around **2-5 cm absolute** due to its laser ranging precision of 8 mm at 1 σ
- Maximum range error due to highly reflective targets (such as paint stripes): **0 cm**
- Maximum number of range measurements per pulse: **8 returns**
- Minimum pulse separation (distance between subsequent multiple recorded returns): **≤ 0.7 m**

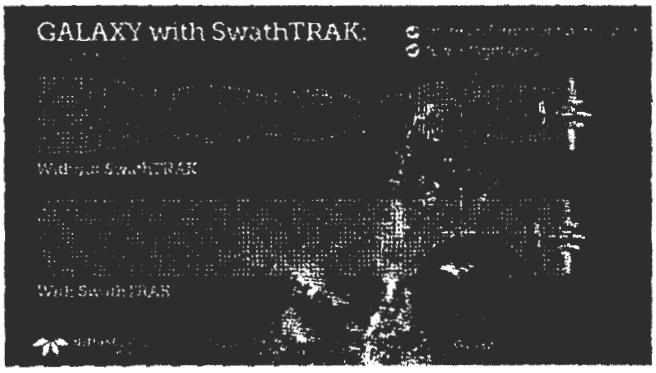
Obviously acquired point density is customizable by flight planning parameters but the above results are achievable for USGS QL1 and QL2 data density requirements (≥ 8 pls/m2 and ≥ 2 pls/m2 respectively). With careful flight planning and appropriate processing techniques, the Galaxy can achieve even USGS QL0 specifications.

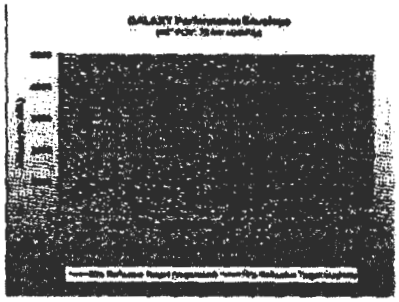
System Specifications

- Operating altitude: 150 – 4,700 m AGL
- Vertical Accuracy: 3-6 cm RMSEz
- Horizontal Accuracy: 1/10,000 x AGL
- Laser Wavelength: 1,064 nm
- Laser Pulse Rate: 35-550 kHz with PulseTRAK™ technology for multipulse blind zone mitigation
- Minimum Pulse Separation: ≤0.7 m
- Point Density Range: ≤ 20 points per square meter in single pass
- Field of View (FOV): 60° degrees (maximum), roll compensation and SwathTRAK™ dynamic field of view adjustment included
- Intensity Range: 12-bit

System Components

- Optech Galaxy
- Applanix AP60 GNSS and IMU
- Trimble TAC 80 MP RGB digital camera





c) Creation of Digital Terrain Model from LiDAR

Terrasolid/TerraScan software is used to run automated classification routines. Several macros (filter algorithms) may be employed to address variances in terrain and scene morphology to obtain high-yield results and minimize the effort of manual terrain editing. The level of classification is dependent upon project-specific requirements. The following table is an example for QL2 and LAS V1.4.

Classification Scheme	
Code	Description
1	Processed, but unclassified
2	Bare earth
7	Low noise
9	Water
10	Ignored ground (near breaklines)
17	Bridge decks
18	High noise

The steps during which LiDAR processing will be performed are described below:

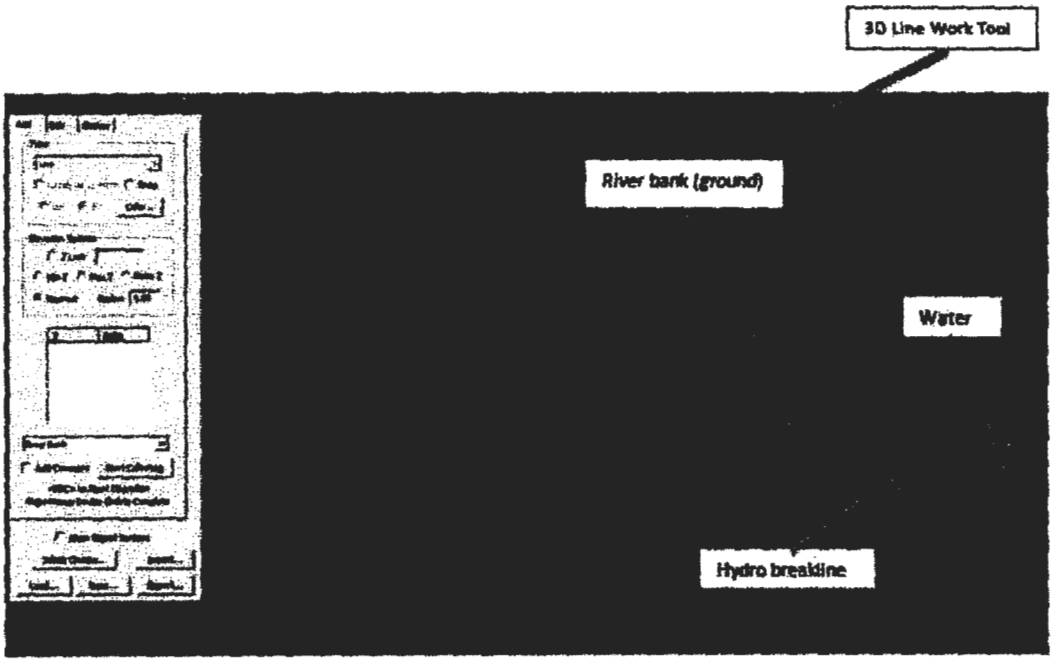
- Automated classification: Automated filtering macros will address all classifications.
- QA/QC of automated classification: A thorough QA/QC is necessary at this point. During this QA/QC, technicians will review each tile thoroughly for any gross errors caused by the software.
- Water features: Once the LiDAR tiles have been mostly classified, technicians will collect the hydro-flattening breaklines. Water is then automatically classified using the completed hydro-flattening line work. This method ensures that the hydro-flattening line work and the water classification match in all areas of the project.
- Final QA/QC of classification: A final QA/QC of the classified, all-return points cloud tiles will be conducted once all classifications are complete. During this review, the technicians will complete any additional manual edits necessary to correct any remaining classifications issues that require a visual QC to identify. This includes a comprehensive manual edit of classifications to ensure accuracy.
- Detailed manual editing will be required to achieve the classification accuracy. Though there have been some improvements in automated filtering macros in software such as Terrascan, automation cannot account for every possible scenario and feature combination. We anticipate that the following issues on this project will need to be manually corrected once the automated filters are run:
- With under-aggressive filtering, a good automated filter will do a relatively sound job of retaining subtle ground features such as berms, banks, and ditches. However, the filters may not perform as well in areas obscured by dense vegetation or other above ground features. When terrain is "shaved", this requires manual intervention to correct.
- Conversely, an over-aggressive filter may also occur within obscured areas leaving minor above ground points in the ground classification. This also requires manual intervention to correct.
- Buildings and vegetation can require extensive manual editing, especially in areas where the two features are adjacent. Even with advanced filtering, automation may become confused by vegetation that is touching or is in close proximity to building rooflines. A building filter may also "see" what appears to be a planar feature in dense forest/vegetation and classify these points as building. The following figure depicts a cross section of a house with dense, overhanging vegetation that was included in the building classification by the automated filter. The technician has to fix this manually by drawing profiles such as the one below and reclassifying the erroneous points to the proper classification.

Surdex has a wide variety of tools available for the compilation of breaklines required for the hydro-flattening services. Surdex's process, developed and refined through numerous projects, includes both manual and automated procedures. Our R&D staff has developed software to assist and improve efficiency in the hydro-enforcement process.

Several sets of data are may be used to assist technicians in developing the hydro-enforcement breaklines. These include; LiDAR data, color hill-shade maps derived from the LiDAR data, National Hydrographic Dataset and intensity images are all useful developing hydro breakline data.

Breakline collection will be conducted using custom tools which allow the technician to select specific line types such as river bank and islands as well as polygon types such as lakes and ponds. The interface gives the technician the flexibility to show the object vertices as they are drawing, constrain the line work to a fixed elevation or to use min/max/mean methods of determining elevations. Using a profile view the technician may also elect to choose an elevation based on their interpretation of the river bank.

Hydro Feature Collection Tool.



Pond and lake features will be collected at one elevation representing the mean elevation of the feature where it meets the bank around the edges. To ensure that only one elevation value is present on the pond/lake polygon, the technician is able to lock the elevation value in as they are drawing.

Our custom software contains a tool specifically designed to assist the technician in determining if an island or pond feature meets the minimum collection criteria. By utilizing this tool, the technician is able to apply a grid sized to the minimum unit required allowing quick identification of features that should be collected.

Rivers and streams are initially collected in 2D to ensure that the line work lines up in the x and y with the edges of river banks. The technician then sets a starting elevation at the head of the water feature and an ending elevation at the end of the water feature by drawing profiles at the edges of the banks to ensure that a proper starting and ending elevation is determined. The bank lines are then buffered, reclassifying ground points that are directly on or immediately next to the lines. This prevents the line work from following the minute up and down elevation changes from point to point that is inherent to all LiDAR data. While these minute elevation variations in LiDAR would be within the acceptable vertical accuracy threshold of the project, they may still adversely affect the ability of the line work to "flow" downhill properly.

Once the line work has been buffered, the technician revisits the entire length of the water feature, drawing profiles and inspecting the elevations to ensure that they match the LiDAR ground class. Using the hydro feature collection tool, the technician is able to view the elevations of all vertices to check that they present gradient downhill values (enforced monotonically) and to ensure that the feature is flat from bank to bank.

As a final QA/QC check of the hydro breaklines, the technician is able to visualize a TIN surface on the fly, that incorporates the ground surface and the line work so that the technician can ensure that the line work will properly hydro-flatten the surface. This eliminates costly rework that could be caused by erroneous line work identified at the end of the process and allows the technician to make corrections while collecting the line work. The figure at the right depicts an example of what the technician sees while using this QA/QC method.

Example of On-The-Fly Tin Generation Incorporating Hydro-Flattening Line Work.

d) Creation of Digital Elevation Model from LiDAR

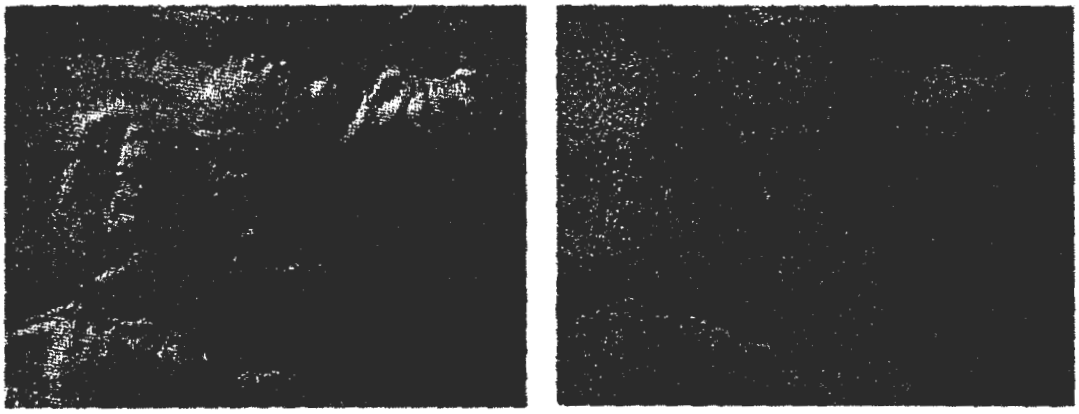
The final Digital Elevation Model (DEM) will be created once the data has been calibrated, edited and filtered using our workflows. This DEM will represent the ground surface, interpolated using the gridded network from the bare-earth surface. Bodies of water (ponds and lakes), wide streams and rivers, and other non-tidal water bodies will be hydro-flattened within the DEM.

Hydro-flattening will be applied to all water impoundments, natural or man-made, generally those that are larger than two acres in size (equivalent to a round pond ~350' in diameter), to all streams wider than 100', and to all non-tidal boundary waters bordering the project area regardless of size. Areas outside survey boundary will be coded as "No Data." Internal voids (such as open water areas) will be coded as "No Data" and placed into another class of data so the raw data are available for future use, if so desired.

e) Creation of Contours Lines

Following the collection and verification of LiDAR bare-earth and breaklines, we will process the resulting DTM and generate the contours. The points in the DTM are related and connected to each other by creating a Triangulated Irregular Network (TIN). Developing 3-D triangles whose corners are the DTM points creates the TIN. When the points in the DTM are collected "on the ground" and in a sufficient density, the legs of the triangles that connect the points accurately represent the surface of the terrain. The triangles that are created to make the TIN are "drawn" within the contour interpolation (CIP) software according to certain rules.

Bare-earth LiDAR surface (left) and contours (right.



The principle rule is that breaklines act as a "hinge" for any interpolation that would pass through them. That is, any triangulation that tries to get past a breakline by going over or under it is forced to go up or down to that breakline and then continue on from there. This prevents inconsistencies in the TIN through ridges or "bridging" over drains, valleys, and headwalls. A final, gridded DTM surface is created off the TIN and is the source from which the contours are created.

The next step is to create the 2-foot contours using interpolation software. After processing, attributes for elevation and line type are automatically populated for each line. Contour data will be interpolated across sheet (tile) edges to form a continuous line. This will create an exact edge match of contours along the tile boundaries. Each contour line will be given a feature attribute, designating it as one of these types of contours.

The contour data will be attributed as specified in the RFP:

- Index contours.
- Index depression.
- Intermediate contours.
- Intermediate depression.

Creating an aesthetic cartographic contour map is the next step in the process. At the editing workstation, contours are smoothed, enhanced, and verified to be within the tolerances of the accuracy specifications.

Surdex has developed four "levels" of contours based on varying levels of technician editing and QA/QC. Following is a brief description of the four levels of contour data available from Surdex.

- Level 1: In this dataset the LiDAR is gridded to the appropriate GSD and processed through Surdex software to generate contours. The contour attribution for Level 1 contours includes index, intermediate and depression feature codes. Index text is also provided for the index contours. Level 1 features, (contours and text) do not receive manual edits for smoothing or text placement. Level 1 contours are considered a raw or automated product.
- Level 2: Level 2 contours are generated from gridded LiDAR and processed similar to Level 1 contours. However, Level 2 contours receive a manual cartographic edit. Technicians perform edits that make the contours more aesthetically pleasing. Anomalies introduced by LiDAR, such as false tops and depressions, and chatter in areas of predominantly flat terrain, are eliminated. Contour spikes and rubber banding caused by LiDAR points with elevations very close to the contour interval are smoothed out. Multiple contours at the same elevation are merged to form one contour, as in contours representing a ditch channel. Additional editing includes removal of chatter and spikes on large bodies of water and placement of index text.

- Level 3: Level 3 contours are generated from the gridded LIDAR and supplemented with derived breaklines collected from the LIDAR surface. Derived breaklines are collected for hydrological features. Edges of larger rivers, lakes and ponds will be processed to produce contours that represent hydrological features accurately. The surface is contoured using Surdex software and the output receives an aggressive cartographic edit. Edits will ensure that contours follow stream edges without meandering in and out of the banks and cross at only one location. Contours around lakes and ponds will be classified as depressions and will follow the edge of the feature. All cartographic smoothing and text placement from level 2 contours are carried through to level 3 contours.
- Level 4: These contour datasets are comprised of both discrete elevation points and surface breaklines. Combined together this is called a DTM (Digital Terrain Model). The source of a DTM can be from LiDAR or from photogrammetry (stereo compilation) or a combination of the two. Breaklines are manually created to more accurately define the surface at abrupt slope changes. Examples of breaklines would be road shoulders, escarpments, hydrological feature, etc. Discrete elevation points are strategically placed at structures such as hilltops, saddles and road intersections. The DTM surface is viewed and edited in 3D by stereo complication technicians. Contours are generated from the DTM using software algorithms and are also viewed and edited by the stereo technicians. The data is then passed on to Surdex's finishing department for final contour generation and edits. The contours receive a cartographic edit, proper coding for depression contours, and index label text from technicians in the finishing department. This dataset receives the highest level of manual cartographic edits.

f) Planimetric Mapping

Planimetric updates will be accomplished utilizing existing planimetric mapping data overlaid on the newly acquired stereo imagery. Surdex can create a shaded relief map from the existing DEM/DTM data allowing technicians to further determine areas of change indicating a reasonable possibility of planimetric change. Experience has shown that a substantial amount of the time required for updates is spent locating probable areas of change.

Surdex uses an in-house GIS tool to guide the stereo compilation process. This tool, called the Vector Management System (VMS), allows the compilation manager to define the specific features that are required for a client, along with the specific database design parameters. With this tool the operators can only digitize the specific features defined by a project and the defined attributes.

Prepare Source Data for Update

Surdex can provide a geodatabase and data dictionary to ensure all attributes and capture conditions are understood before feature update begins. The CAPTUREACTION attribute will be added, and corresponding domain created if not present in the source geodatabase. Surdex will validate all features are attributed as EXISTING before feature update commences.

Create Project Tracking Environment

Surdex will set up collection and tracking environment to facilitate the management of the project throughout the lifecycle. An ESRI project .mxd is created that will contain several feature classes to track project status and help identify areas of change. These features include the stereomodel footprints for status tracking, inspection grids used to methodically cover all areas within a stereomodel during feature capture, and any additional supplemental data available.

Identifying Areas of Change

Surdex will generate preliminary orthophotos from the new imagery and existing LiDAR from previous project updates or commercially available NED. The preliminary orthophotos will be loaded into the project tracking .mxd along with the source vectors within the geodatabase. Surdex staff will review the planimetric features over the imagery to determine large areas of change, identifying rudimentary areas of change where updates are required. This process will help assign staff correctly based on the initial level of effort required within an update area.

Feature Update and Collection

The Surdex compilation team can update and collect all features in a 3D stereo environment to ensure positional accuracy for all features. Compilers will work within stereomodels and use the inspection grids to systematically step through the entire model capturing new features, updating existing features and retiring features no longer visible in the photography. Systematically reviewing the entire project area with skilled compilers is the only method that will produce a truly updated product. This method allows an operator to review the data at the correct mapping scale and the ability to identify the small changes that occur on individual features. For example, additions to buildings, extended driveways and parking features can be easily identified and updated accordingly while working at map scale within the stereo environment. These same examples are easily missed or overlooked when using automated change detection to determine candidate areas for update.

The collection environment will contain advanced symbology to represent all features within the source dataset along with their current CAPTUREACTION status. By maintaining and displaying this level of symbology, compilers are able to verify both the geometry and the attribution of the feature are correct. As stereomodels are completed, senior compilers will perform a QC check on the model to further validate capture completion and accuracy. Once this review has taken place and the model has passed the QC checks, it is ready for the next phase of production.

Vector Processing

When delivery blocks are completed within compilation they are ready for Map Finishing. The Finishing team begins reviewing the captured planimetric features overlaid on the orthoimagery. This first round QC allows finishing staff to review the data for completeness and isolate any potential omissions\commissions before the vector processing begins. Any errors that are identified at this stage will be returned to compilation for corrections.

The finishing team employs both automated and manual routines during the vector processing phase of production. Automated routines include running several geoprocessing tasks to prepare the dataset for topological tests. These tasks include clipping features inside of polygons, extending linear features to meet adjacent features and dissolving short segments into single features. To accomplish these tasks efficiently and consistently, Surdex uses ESRI's model builder environment to create and store geoprocessing routines that will be used over the life of the project.

After the dataset has been run through these automated processes, it is ready for topological processing. The Surdex team will start with the topology rules provided by the client and ensure that these rules are correctly applied to all feature classes and that the correct cluster tolerance is applied when the topology is created. The topology will be validated, and finishing technicians will use automated and manual steps to cycle through all topology errors to make the necessary corrections. This level of processing is required to maintain the correct relationships as listed with the RFP. Automated routines alone are unable to resolve complex topological relationships.

The next phase of production will further address topological relationships within the dataset. Surdex will run several geoprocessing routines to clean up all remaining geometry issues. These routines will be run on all linear and polygon features. Dissolve routines will remove feature segmentation that occurs at model or tile boundaries. All features will be dissolved into single large features based upon their attribute values. An example of this process includes creating a single linear feature from several short segments that were captured or processed in segments such as sidewalk features. Additional geoprocessing tasks include checking for multipart features, duplicate points and running check geometry tools.

The final stage of vector processing involves the data attribution. Surdex will run several automated tasks to check for valid attribute values. These tasks will generate reports that isolate attributes that are null or incorrect for each feature. After the reports have been generated, finishing technicians will step through any invalid attribute entry and make the appropriate correction. Frequency tables will be generated again to ensure only valid attribute combinations exist after the corrections were performed.

Quality Assurance

Senior finishing analysts will perform quality checks on all feature classes within the geodatabase. Analysts will review the data for completeness and accuracy using several different methods.

- Manual inspection of the feature classes overlaid on the orthophotos.
- Generate Topology Reports and review summary statistics for errors and exceptions.
- Create Frequency Reports and validate attribute combinations per feature class.
- Validate geodatabase structure to include correct feature dataset and corresponding feature classes.

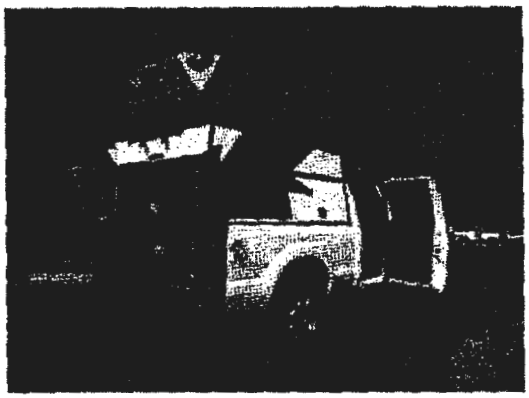
g) Mobile LIDAR

ESP offers multiple methods to acquire terrestrial topographic surveys. ESP has experience in using traditional topographic survey methods to meet state and federal specifications on small to large local projects as well as the specialized experience in acquiring county/statewide projects

ESP has 33 conventional survey crews. Our survey crews are equipped with data-collectors, cell phones, laptop computers with internet connectivity where available and total stations or robotic total stations. Most crews have GPS tracking on their field vehicles. Our team has adopted a uniform attribute field code library to seamlessly integrate field data into rough draft maps. CAD protocols and levels are adhered to strictly. Lastly, all field crews are equipped with digital cameras that are used to document features found in the field to ensure proper communication with office personnel and to help archive field conditions at the time of surveys.

Our team also has ability to provide services in emerging survey methodologies that, when used on the appropriate projects, can prove highly efficient and cost effective.

The ESP Mobile Terrestrial LIDAR vehicle.



ESP has provided Mobile Terrestrial LIDAR (MTL) to multiple clients in North and South Carolina. MTL - 3D laser scanning/mapping is the technology used to collect mass quantities of terrestrial LIDAR at both mapping grade and survey grade accuracies. The concept of mounting two 3D lasers, 6 cameras, a military grade IMU and two GPS receivers to a vehicle and collecting continuous point cloud data at highway speeds provides the most efficient, safe and accurate method of data collection along highways, secondary roads, beaches and other routes permitting vehicle access.

Our largest user for this technology is the transportation industry. Highway designers and engineers use our point clouds, TINs, DEMs and DTMs to develop high accuracy base mapping. This technology has also been used to

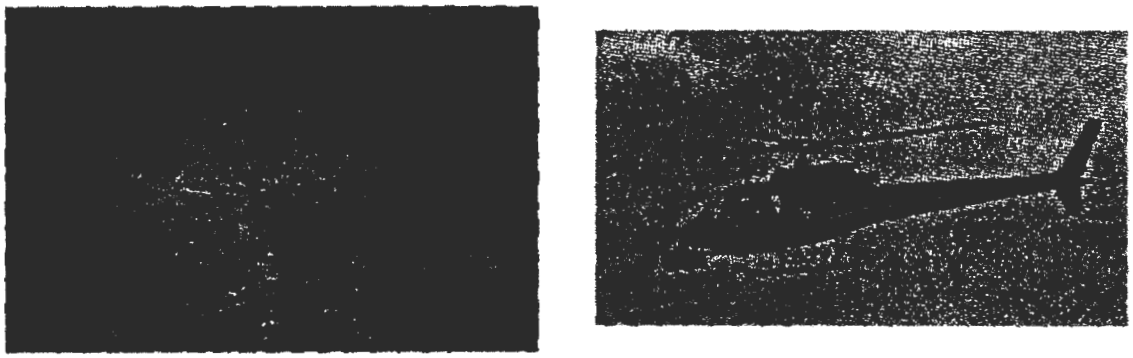
capture first floor elevations, provide beach primary dune surveys, topographic surveys of lakes, dams, and levees, asbuilt/topographic surveys on quarries and construction sites for progress drawings.

ESP has additionally merged technologies by using the MX8 MTL Scanner with our tripod mounted scanner, the Leica C10, our hydro boat Eridanus, and conventional surveys to provide asbuilt topographic surveys for volumes on ash ponds for Duke Energy.

h) Helicopter LiDAR

To support high-density LiDAR collection, Merrick & Company (Merrick) will utilize its Optech ALTM Orion C200 (200 kHz Corridor LiDAR Airborne Scanner) sensor mounted on a Eurocopter (Aerostar) 350BA helicopter. Additionally, Merrick's Eurocopter rotor platform is equipped with a Trimble TAC 60 MP nadir RGB digital camera, GSI nadir CIR digital camera, GSI forward/aft oblique RGB digital cameras, an Applanix POS AV 510 GPS and Inertial Measurement Unit, Aventech AvSTAR (real-time flight tracking), and an Aventech AIMMS-20 airborne weather sensor. Merrick's sensor array was specifically designed/configured to offer best-in-class data for high-density LIDAR helicopter based collections and offers TVA an optimal configuration for conductor and tower surveys.

Merrick's helicopter LIDAR vehicle.



One of the most beneficial aspects of the Orion C200 for high-density LIDAR projects is that it provides lowest minimum pulse separation (0.7m) as compared to any other sensor (non-waveform) on the market. The minimum pulse separation can be defined as the minimum distance that the pulse travels before providing the next return. This offers greater vegetation penetration and vertical fidelity in the LiDAR data set, vertical fidelity is also an important factor in feature mapping.

Merrick is presenting an aerial system that is a medium format digital camera that allows the photography to be taken simultaneously with the LiDAR. Merrick owns two types of medium format digital cameras; the Digital Airborne Camera System (DACS™) and the Trimble TAC Pro 60 megapixel RGB camera.

Because of the simultaneous collection of LiDAR and digital imagery, many times costs are lower because there is only one aircraft that must mobilize to the project area, the LiDAR and imagery is collected in one flight, and one GPS and one IMU is integrated into one system instead of needing the same equipment in two different aerial platforms. In addition, the simultaneous collection of digital imagery and LiDAR provides a one to one relationship between the two technologies, which is better for the filtering of the LiDAR data and for breakline development. Additionally, Merrick can co-mount hyperspectral imaging systems to collect this data rich content in the same acquisition.

Recent projects that show these aerial imagery capabilities include:

- **Missouri River Color IR Project, Omaha Corps of Engineers** - Merrick collected and processed color infrared photography utilizing a film camera, and multispectral satellite imagery from DigitalGlobe for a

300-river mile linear project along the Missouri River in Iowa and Nebraska. Digital orthophotography was generated and delivered in 1-ft resolution Tiff and MrSID format. Merrick performed analytical aerotriangulation on the CIR imagery and processed the data and produced the Tiff and MrSID deliverables.

- **USACE Omaha District/Salt Creek** - Merrick & Company was contracted to acquire, process, and deliver digital color imagery for 10 separate areas (Branched Oak, Pawnee, Twin Lakes, Conestoga, Yankee Hill, Bluestem, Olive Creek, Holmes Lake, Wagon Train, and Stagecoach) totaling 99.7 square miles, distributed over Eastern Nebraska. Merrick acquired simultaneous airborne data that enabled the production of 1' resolution orthophotography with a horizontal positional accuracy equivalent to 1" = 200' or 1:2400 ASPRS Class 2 specifications.

f) Geiger LiDAR

Harris Corporation will perform the LiDAR data acquisition and automated (base) processing to generate calibrated LiDAR point clouds. Harris subcontracting partner Dynamic Aviation will support Harris with aerial platform and collection services. Team members Surdex, David Mason and EFK Moen will support collection of Ground Survey points and GPS data for data calibration. Surdex will provide value added processing services for manual editing and classification of point clouds, and generation of LiDAR derived (DTM, DEM and contour) products as required for this project. Surdex will be responsible for all aerial imagery collection, processing, ground survey and delivery of the required products for this project. Harris will perform final QA/QC of all products and deliver them to the customer.

Harris brings a unique expertise in Geiger-mode LiDAR data acquisition, high volume LiDAR data processing, and quality product generation. Their Geiger-mode LiDAR has the ability to collect higher resolution data, up to 8-30 points per square meter (ppsm), in less time from higher altitudes compared to current Linear-mode data collection systems. Harris Geiger-mode aerial LiDAR is proven to map land features at area collection rates of several hundred km^2 per hour in certain operational conditions, penetrates foliage better to map the underlying ground and structures to support Digital Elevation Map production, hydrological modeling, flood plain mapping, and 3D building boundaries and structures that are of interest to the customers.

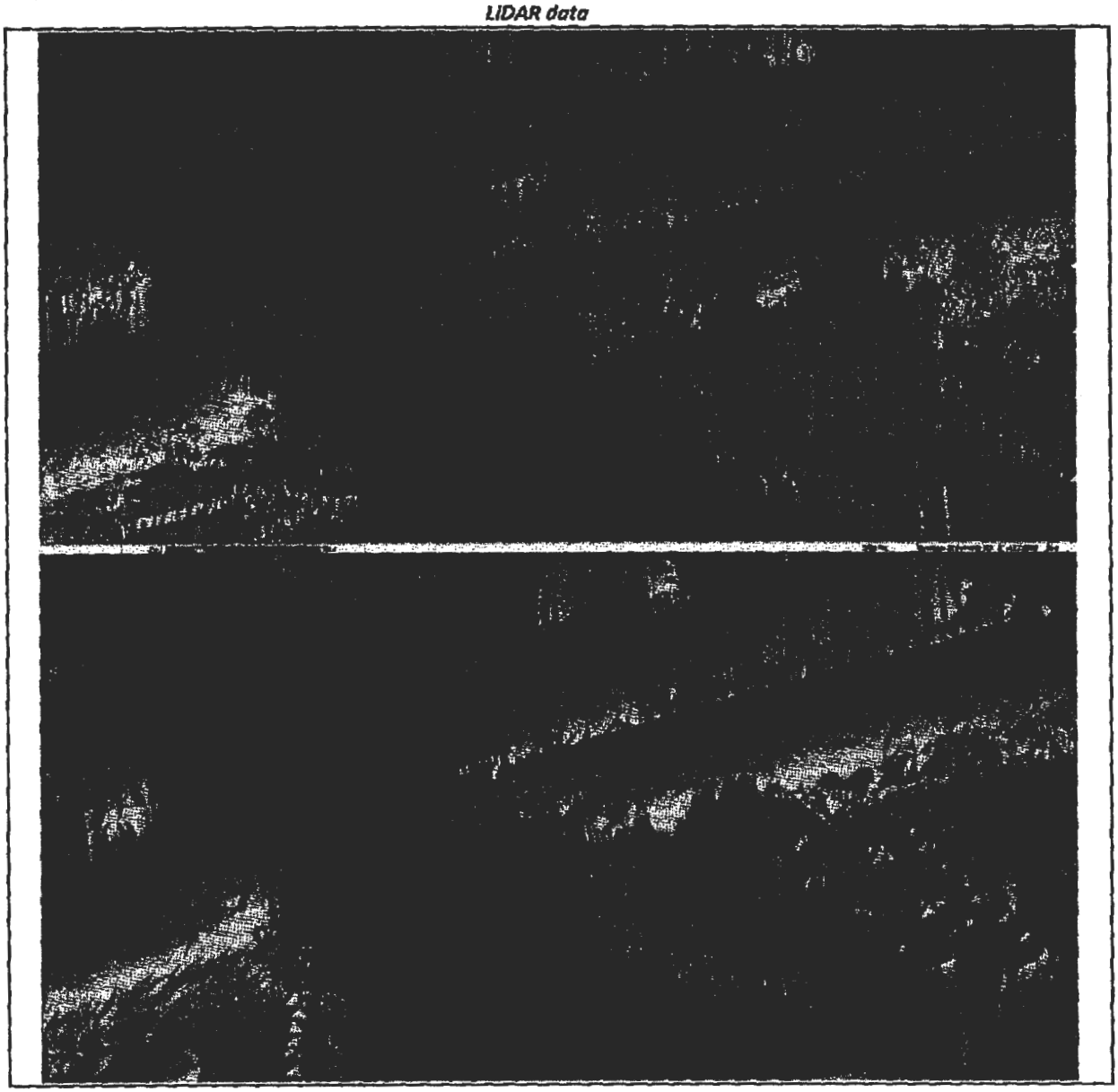
Harris' approach to Geiger-mode LiDAR data collection for this project supports the delivery of LiDAR data products at 8ppsm (QL1) point density when compared to the 2ppsm/4ppsm (QL2/QL2+), albeit at a market price comparable to 2ppsm. Higher point density data provides following benefits to the State of Missouri customers:

- QL1 data can delineate the ground (surface details, contours) and above ground features (building footprints, vegetation, etc.) much better compared to QL2 (2 ppsm) or QL2+ (4 ppsm) data.
- As the density improves from 2 to 8 ppsm, not only do the edges of buildings become crisper, but also other structures come into clear focus.
- Higher point density LiDAR data greatly improves relative accuracy of bare-earth DEM elevation; In addition 8ppsm data improves stream level detailed delineations to support mapping and flood analysis.
- Impervious features are better defined in QL1 data where curb and gutter impact water conveyances. Other benefits of QL1 data include high detailed feature extraction for transportation, utilities, and other critical assets that may impact evaluation and planning of environmental and public impact.
- Higher point density LiDAR data greatly improves detection of the ground under trees for improved bare-earth DEM mapping and flood analysis.

Harris owns and operates three Geiger-mode LiDAR sensors mounted on three dedicated King Air 200 aircrafts operated by Harris' partner Dynamic Aviation. The aircrafts can operate at a maximum ceiling of 8.2km above Mean Sea Level (MSL) altitudes. The Geiger-mode LiDAR sensor scans a rectangular laser beam in a circular pattern, imaging the ground, using a 4096-detector array at a collection rate of 50,000 times per second. This collects photon measurements many times over every ground point. The ~4-5 km swath width (at ~8 km flight

altitude) scans every ground point, from the forward arc to the rear arc. In addition, they collect using a 5-50 percent (depending on point density requirement) swath overlap, which results in every ground point being illuminated multiple times from four directions. This eliminates voids and shadows in dense urban areas and enables greater foliage penetration for optimal ground measurements.

Comparison of 8ppsm (QL1) Geiger-mode LiDAR data of a bridge and roadways (top) with a 2 ppsm (QL2) Linear-mode LiDAR data



Paired with high volume batch automated data processing, semi-automated 3D building modeling, and power-line detection algorithm, Harris' affordable collection at 20-30 ppsm opens up new opportunities for flood plain management, water resource management, stream restoration, feature extraction, electrical utility mapping and urban transportation. Figure 1.0-3 shows some examples of the power utility line mapping from 30ppsm data collected with our Geiger-mode LiDAR data.

Harris has developed a Geiger-mode LiDAR Mission Planner software tool that we will use to facilitate our planning of all aerial survey activities. The collection sorties will be planned in execution increments called planning bricks, with multiple flight lines per brick. Each flight line typically will cover a few km wide and 75-200 km long, with 55-percent swath overlap. Each night we propose to fly up to a maximum of 5-6 hours, contingent on prevailing local weather condition at the time of collection.

GPS/GNSS base station data is needed to determine accurate position of the aircraft and to ensure required product vertical accuracy can be met for this project. A temporary network should be established when there are no permanent Continuously Operating Reference Station (CORS) network is available or when there are gaps in CORS coverage within the AOI collection area. To meet the data accuracy, we will need a network of GPS stations with ≤1s epochs and operating ≤40 km distance from the aircraft. A number of such uniformly distributed GPS base stations, with 100-percent coverage overlap, will be required to ensure ≤10cm vertical data accuracy.

Field procedures consistent with the U.S. National Geodetic Survey Guidelines for Real Time GNSS Networks will be followed for the ground surveys. These procedures include making redundant occupations under different satellite configurations and field conditions for each point. The points will be distributed throughout the project area and LiDAR identifiable (LID). The points will be located in open and flat terrain where there is a high probability that the sensor will have detected the ground surface without influence from surrounding vegetation. LID points will be visible in the LiDAR data for x, y, and z axes. Point accuracy will satisfy a local network accuracy of 5cm or better at a 95% confidence level both horizontally and vertically. Accuracy will be tested using U.S. National Standard for Spatial Data Accuracy (NSSDA) guidelines.

The GCPs will be used to facilitate calibration of LiDAR data and perform bundle adjustment. Another set of survey points will be used as ECPs to support processing and product quality assessment. The ECPs will be used for testing the final Root Mean Square vertical ($RMSE_z$) accuracy and Horizontal Accuracy ($RMSE_r$) of the deliverable data products. Two sets of ECPs will be collected: Non-vegetated Vertical Accuracy (NVA) points and Vegetated Vertical Accuracy (VVA) check points; the number and distribution of these check points will follow the ASPRS recommended guidelines for digital elevation data quality assessment.

Geiger-mode Aerial LiDAR Data Production Center

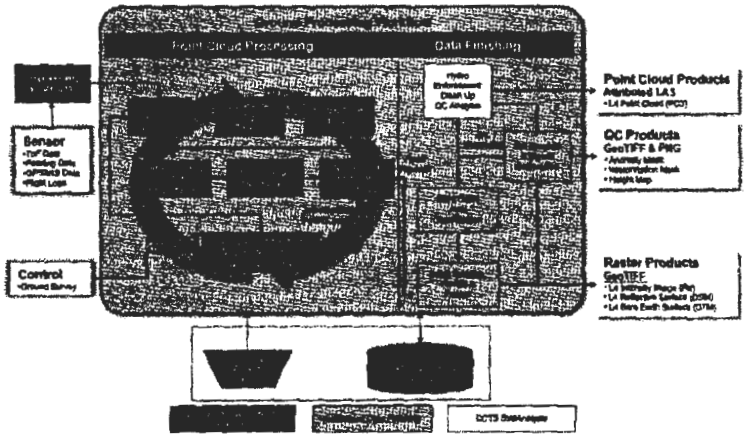
Volume Processing Infrastructure – Harris has developed and refined the processing of large volumes of LiDAR data at their massively parallel grid computing facility in Melbourne, Florida. This state-of-the-art Geospatial production center is dedicated to end-to-end processing, product creation, quality control, and product delivery and supports government and commercial programs. Their processing infrastructure will support: 1) mission and daily collection planning, 2) collection data ingest and storage, 3) point cloud processing and product creation, and 4) data management. The processing hardware will support fully automated preprocessing and generation of georeferenced LiDAR point clouds, manual post-processing and editing, and quality control and verifications.

Automated Point Cloud Generation – Once LiDAR data is collected, it is delivered to Harris' Melbourne production center. Data processing will commence immediately upon arrival of the data at the processing center. The automated processing will transform the raw LiDAR data to ground georeferenced point clouds.

To start the process, a work project is created that enables us to track status as the data moves through the production system. Once created, the LiDAR data is processed, the process is tracked, and the project status is tracked to completion. Analysts then use ground check points to verify the accuracy of the adjustment.

Our fully automated processing produces the calibrated point cloud data first. This process step consists of preprocessing and calibrations, coordinate transformations, swath registrations, and noise filtering to quickly generate the calibrated point cloud product.

Harris fully automated processing steps from raw data to point cloud and terrain elevation model generation



The Geiger-mode LiDAR sensor equipment proposed for collection for this project is owned and operated by Harris. Harris has ongoing lease agreement with its aerial platform partner, Dynamic Aviation, to support the aerial surveys. Dynamic Aviation Group is a major aircraft operator in the United States and has a fleet of aircraft and staff pilots available for quick deployment in a short timeframe. Should any aircraft requires modification or maintenance DAG has maintenance crew available for doing the fixes with a quick turn-around time.

Their sensor operators are well trained staff from Harris. Harris personnel also performs mission planning for all their collections and supports re-planning if required. These personnel are regular full-time employees of Harris and are available on demand 24/7/365.

Harris also has a capable Engineering team which designed and developed the Geiger-mode sensor systems. Their team routinely evaluates the system, performing system calibration and maintenance. The team is available for any system troubleshooting and repairs.

J. Web Hosting

There are three Surdex web hosting services of interest to the State, all available as WMS (Web Map Service) and image services that are OGC-compliant:

- Generalized web hosting of imagery and vector data.
- "Early access" web services used to present automatically-processed orthoimagery shortly after acquisition is completed – allowing clients to assess whether the imagery was acquired under the proper conditions.

It is important to emphasize that GIS applications, such as the ESRI ArcMAP application, are able to access multiple WMS services simultaneously from multiple sources. For example, data hosted by Surdex can be viewed with any State service that may be in existence.

The "early access" image service provides orthorectified imagery during the acquisition season and shortly following each day's flight and inspection, augmenting textual and graphical reports. This is automatically-processed imagery with sufficient accuracy and quality to assess progress to date. This service can be updated with final product as it becomes available, or the final product provided via a parallel image service.

The contractors on the USDA NAIP program, including Surdex, prototyped an Early Access Web Service (EAWS) solution in 2013 and it is now standard for all NAIP states. The standard solution consists of:

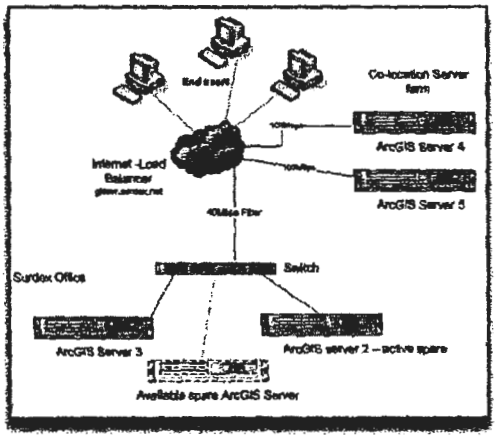
- An early access service of orthorectified imagery processed and posted within 5 business days of acquisition. This imagery is of sufficient accuracy (<10 meters CE95) and quality (automatically process to basic NAIP image metrics) for use before the final product is generated. This includes a shape file
- A parallel "product service" that includes final DOQQs as they are being shipped. This service meets the accuracy requirements and quality of the final product.

In both services:

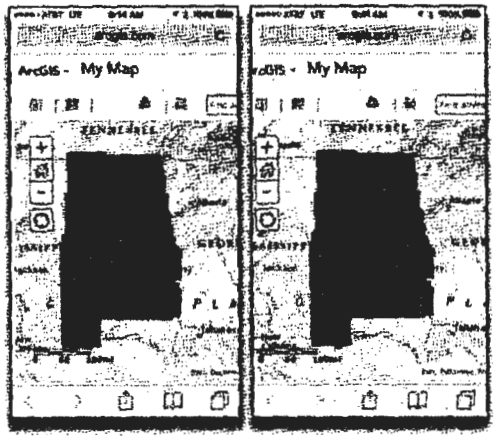
- Each includes 4-band imagery for use as natural color and/or color infrared (CIR) renditions
- A vector overlay portrays the image bounds (or seamlines in the case of the product service), complete with acquisition time/date, aircraft tail number, camera make/model/serial number, etc.
- Each is a REST (REpresentational State Transfer) service that can be viewed by a user in several ways, including:
  a. As an ArcGIS Java viewer for simple viewing
  b. Within ESRI ArcMAP
  c. Within ESRI ArcGIS.com
  d. Google Earth

Surdex's current web-hosting configuration consists of 3 mirrored Dell 720 64-bit Windows Servers with ArcGIS server Standard 10.2 and Image Extension ("ImageServer"). One server is located at Surdex's main office and 2 are in our Co-location server farm in Maryland Heights, MO. Two additional ArcGIS servers are available in reserve to support unplanned downtime on the primary servers. A Cloud-based load balancer will distribute service requests to the best available ArcGIS server. The Surdex office based server has a 40 Mbps fiber service and the Co-location servers have redundant 100Mbps service to multiple Tier-1 fiber service providers.

Surdex's Current Web-Hosting Architecture.

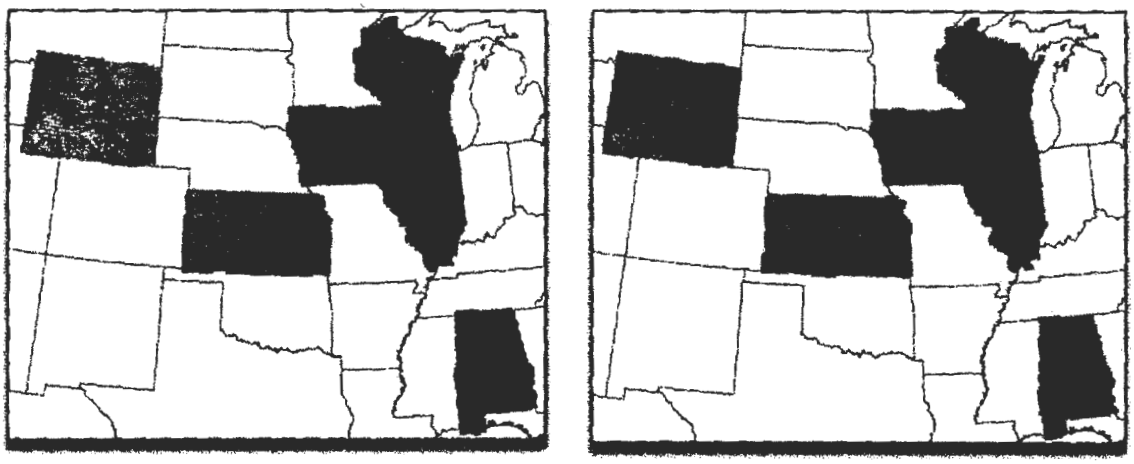


NAIP EAWS on IPhone (Alabama 2015)

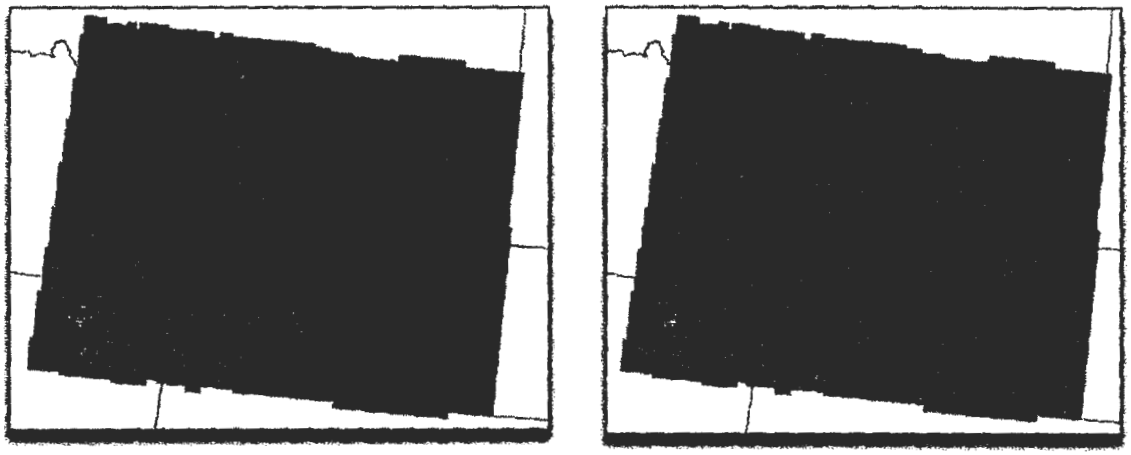


Our ArcGIS servers provide both WMS and WCS OGC compliant imagery services. Our load-balanced server configuration is designed for up to 1,000 concurrent users with a capacity of 200,000 image requests per hour. Service availability and response is monitored by a third party service and has been reported at 99.9+% uptime and consistent 1.5-2.5 sec worse case(1920x1080 image size) download response during high demand periods.

The following figures show EAWS and the production EAWS for all of Surdex's states for the 2015 NAIP. These images were simply exported from an ArcMAP session.



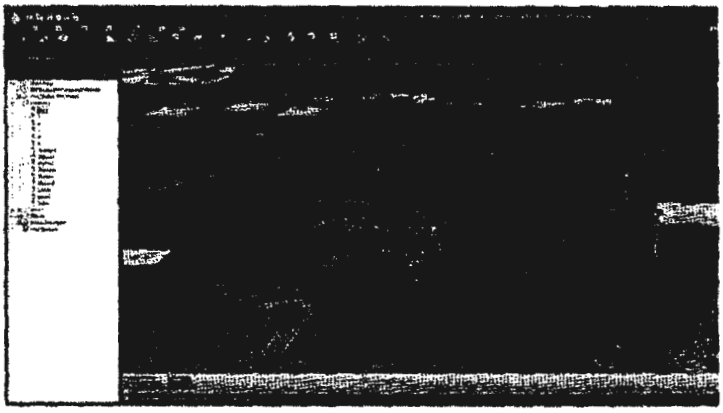
The next figures portray the state of Wyoming in the production EAWS in color and CIR renditions.



k) Oblique Imagery Capture and Processing

Surdex can produce, 3D mesh, 3D point cloud, Digital Elevation Model (DEM) and Triangulated Irregular Network (TIN) in ESRI format readily from each flight. The files created with automated processing produces a high quality product for a very low price. Further labor can be applied to incrementally improve the products across the entire County or in select areas. All products will be analogous to LiDAR first surface data. A bare earth DEM or TIN would require substantial processing and is difficult in forested areas as there is little or no penetration of the canopy. The 3D mesh can be exported to ESRI format for use in desktop and web solutions.

TerraExplorer 3D Mesh viewer



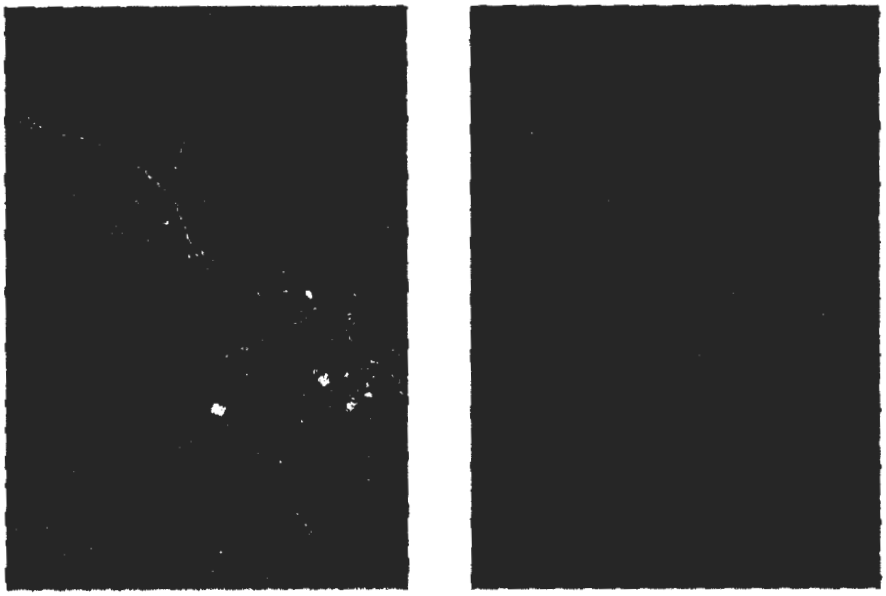
Bentley Context Capture 3D Mesh viewer

Point cloud files will be delivered in standard LiDAR file formats, LAS and compressed LAZ. Both RGB and false color infrared band combinations will be delivered.

1) Photogrammetric Point Clouds

A number of our clients are increasingly interested in "photogrammetric point clouds", analogous to LIDAR first-return data. This solution does not replace higher-quality LiDAR data, but is a small cost addition to projects/clients that may have an interest. Surdex uses the Leica Semi-Global Matching (SGM) software. This approach yields very high integrity surface models by essentially matching every pixel in the forward, aft, and nadir arrays to create the point cloud. This data can be delivered in LAS format and can include colorization of each pixel, including color infrared/4-band.

Surdex SGM results with ADS100: image drape (left) and color-coded heights (right).



Perspective View of SGM Point Cloud (Wyoming, 2015 NAIP).

2.2 Expedite Completion of Project

The vendor should highlight any portion of their approach that would expedite completion of projects.

Very much in parallel with the response to the previous section (Innovative approaches, cost minimization), our Team is able to expedite project completion in numerous ways:

- With Surdex's geographic location within the State, for all but the very largest projects we will have all acquisition resources within an hour of any project site. With this advantage over out-of-state competitors, we can optimize acquisition around weather and climate issues. With our proximity, we are able to capture data in the smallest windows Mother Nature affords us.
- With Surdex handling nearly all digital orthophoto and LiDAR production and services, we are fully in control of resources and can dictate our own priorities. This results in faster completion of projects by eliminating or reducing logistics dealing with subcontractors that cost time.
- With technologies such as the ADS100 digital camera and the Galaxy LiDAR, performance is optimized. With this optimization comes quicker completion of acquisition and the ensuing production steps. With this reduction in schedule, we will provide data to the State faster.
- Surdex's proprietary tools provide heavily automated solutions to such tasks as image processing and orthoimagery production. With this replacement of manual labor, production schedules are accelerated. Our use of "reference images" acquired early in the acquisition phase to partner with clients in determining image "colorimetry" (color, tone, balance, etc.) before production even starts produces a time savings. This is because we rarely need to make colorimetry adjustments late in the digital orthoimagery production process, saving time at the end of the production cycle.
- Use by the State of Surdex's web-based QC tool results in time savings by eliminating exchange of data on media and by performing QC and remedial actions in parallel. We prefer to post imagery for review in an incremental fashion. As this is reviewed by clients and call-outs are isolated, we work off the issues as production for other areas are in process. Thus, as the last area is produced for QC, all other areas are already accepted and ready for delivery. This results in an accelerated review and remedial action phase.
- Surdex also has the capability to host imagery for review shortly after it is acquired. This allows our clients to better visualize our progress and assess the quality of the final result. Although this imagery will not have undergone final image processing against colorimetry targets, it allows assessment of leafing conditions and the like. Typically, imagery can be processed and offered for display within 3-5 working days after acquisition.

2.3 State Agency Involvement Plan

The vendor should provide a description of their plan to keep state agency personnel involved and informed of project progress and decision points.

Surdex employs personnel with the sole responsibility of managing our projects. Surdex's organization structure is unique in the aspect that our project management staff directly reports to the Vice President of Sales and Marketing. This was done to ensure that our sales/business development staff and project managers are focused on meeting the expectations of our clients. Project managers previously reported to Production and Operations.

The project managers are managed by Mr. Tim Bohn, who has over 20 years of experience at Surdex and in the industry. He is a Certified Photogrammetrist and a Certified Project Manager. Mr. Bohn works closely with all project managers reporting to him.

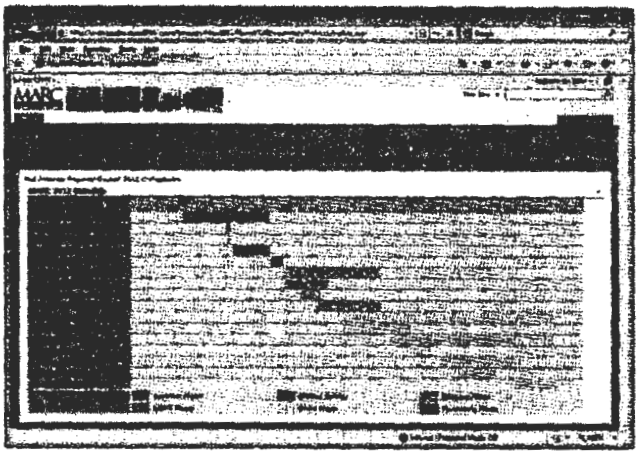
Surdex's project managers are focused on providing information and communicating with our clients. As such, numerous reports are available to our clients – both Surdex-standard and tailored – and each project manager must prove that they communicate with each of their clients at least once a week. In addition to client-required activities, each project manager is required to:

- Complete a Project Scope document that fully details each project. This fully describes all elements of a traditional Project Plan document as well as specific internal guidance.
- Host an internal Kick-Off Meeting to review all project requirements.
- If a client does not require a Kick-Off meeting, we offer one.
- Maintain a SharePoint site that encapsulates project status, project documents, etc.
- For selected large projects or projects pushing the envelope of success, project managers are required to brief Surdex's Executive Team at their weekly meetings. The Executive Team includes the President and the heads of all major functions (Sales, Operations/Production, Facilities, Human Resources, Finance, Business Development, Aircraft Operations, etc.).
- For selected large or important projects, hold weekly or bi-weekly internal status meetings with all applicable department heads and senior management.
- Maintain information in our Enterprise database:
- Weekly updates of project cost-to-complete for each task.
- Weekly updates of internal schedules.
- For selected large projects, perform a Project Close-Out both internal to Surdex and with the client. The focus of this meeting is to assess our performance and draft "lessons learned" that may improve our performance in the future.

Surdex has developed proprietary software based on an Enterprise database implementation that provides real-time status to our internal production and management staff. This includes tracking acquisition designs, acquisition progress, and inspection results for both imagery and LiDAR. It also includes extensive tracking of aerotriangulation, DEM extraction, orthoimagery, planimetric and topographic products, delivery, and QC. This software has been tailored for specific projects and the results made available on a daily basis to all of our clients. When awarded this contract, Surdex's project manager will work with the State to devise an acceptable portrayal of status.

The Project Manager will create a SharePoint site for each specific project. This is a container for all information about the project and can be loaded by both the client and the Project Manager. The site is username and password protected. Information that is generally retained in the site includes, but is not limited to:

Example Sharepoint site and status information.

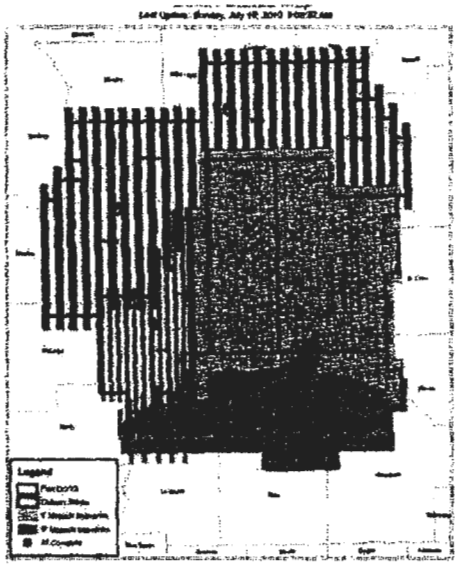


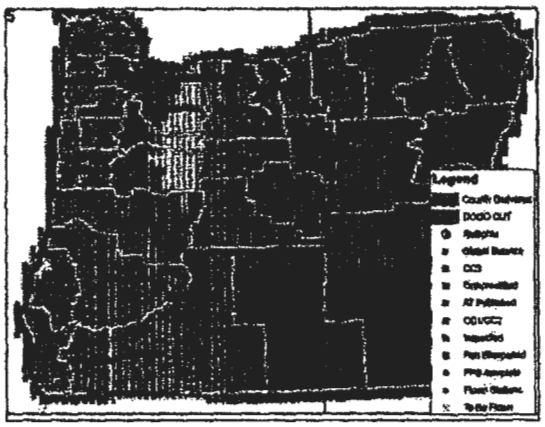
General details of the CPMS mechanism are:

- Username/password access to the site. State representatives can determine who within the organization has access to the system.
- Mutually agreed-upon contents of the site.
- Retention of key documents – up-linked by Surdex and the State.
- Minimal content of status reports, key documents, key communications, etc.
- All documents transmitted by Surdex via email or fax will be retained on the site.

The graphics below illustrate an example SharePoint site and status map.

Example of status graphics that can be found on the Sharepoint site.





2.4 Quality Assurance Plan and Quality Control process(es)

The vendor should include their proposed Quality Assurance Plan and Quality Control process(es). The vendor should include a flowchart illustrating the process(es).

Surdex is committed to providing its services "first time right, on time." Surdex's quality process is constantly under review and refinement rather than waiting for wholesale changes if the need arises. Surdex has developed extensive Quality Assurance (QA) and Quality Control (QC) mechanisms for orthoimage projects accuracy and quality are thoroughly reviewed before delivery to our clients.

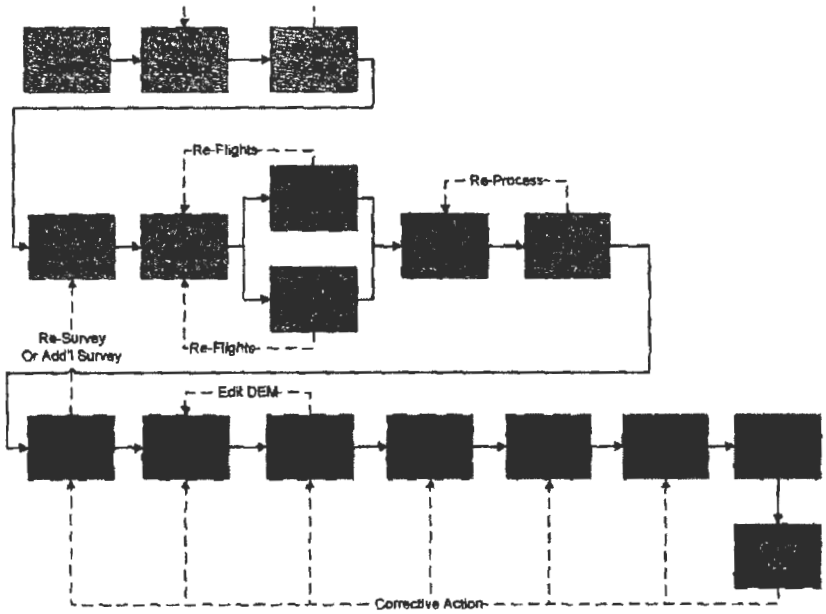
Building upon achieving ISO Certification for specific geospatial products for the National Geospatial-Intelligence Agency, Surdex has embarked on a goal of achieving company-wide ISO Certification by December, 2017. Much work on documentation, such as work instructions, is well underway.

Surdex's personnel have extensive experience and credentials that apply to the QA/QC mechanism:

- Most of our Project Managers (PM) are Certified Photogrammetrists (CP).
- The Director of Project Management, Mr. Tim Bohn, is certified by the Project Management Institute (PMI).
- Our Team includes numerous Registered Land Surveyors (RLS).
- Aerotriangulation personnel and/or reviewers include numerous Certified Photogrammetrists.

Our QA/QC mechanism addresses the processes involved in the production of digital orthoimagery. The following figure highlights the key steps in the process. Red flow lines illustrate loop-backs in the process due to rejection/failure of a step.

Surdex's QA / QC process overview.



The following table presents an overview of the key phases of the project and QA/QC approaches.

Summary of QA / QC Phases and Approaches	
Phase	Approach
Project design	Internal design reviewed by Project Manager, Certified Photogrammetrist, and Registered Land Surveyor Reviewed by client
Ground control acquisition	Field survey operations and processing under the supervision and review of a Registered Land Surveyor
Imagery acquisition	Updating of aircraft inspection, maintenance, and repair prior to and during project Updating of sensor calibrations if required Boresighting of sensors prior to use and/or after installation/re-installation Reporting of detailed progress by each aircrew at end of acquisition day Nightly updating of flight plans incorporating progress and results of inspection
Imagery inspection	100% inspection – each image graded and reported in Enterprise database Inspection against the following factors, at a minimum: ■ Season window(s) and client start/stop work orders ■ Sun angle and/or timeframe specifications ■ Project specifications for ground conditions (flooding, smoke, haze, etc.) ■ ABGPS/IMU accuracy and quality ■ Camera misfires ■ Image motion/smear ■ Agreement with flight plans ■ Clouds/cloud shadow ■ Specular reflection noted for use by ortho technicians ■ Automated analysis of smear and/or occlusion in rugged terrain for use by ortho technicians

Aerotriangulation	ABGPS/IMU processing reviewed by a Certified Photogrammetrist / Registered Land Surveyor Tailored aerotriangulation reports for client review Dependent upon accuracy requirements, graded against such as: ■ Ground control, ABGPS/IMU, and image residuals ■ Agreement with check points ■ Distribution an placement of pass/tie points in final solution
Elevation modeling	Visual review Comparison of aerotriangulation points to the elevation surface to determine areas of change or problems
Ortho/mosaic	Ortho technicians inspect one another's work and perform edits Depending upon resolution of imagery, planimetric data such as roads, bridges, rail lines, buildings, etc. may be used to focus attention on seamline review/edit
Product QC	Use of pilot project(s) with client to assess: ■ Color, tone, balance specifications/expectations of client ■ Form and format of deliverables ■ Metadata compliance Accuracy analysis using AccuracyAnalyst

Project planning involves design of the imagery acquisition and the control survey network which ensures accuracy requirements are met and that total product coverage is ensured. The flight plans are generally developed by Surdex's Chief Pilot and are approved by the Project Manager, a Certified Photogrammetrist. When the flight plans are approved, the Aerotriangulation and Survey Departments design the ground control network against the flight plans. A Certified Photogrammetrist from Aerotriangulation and a Registered Land Surveyor from Survey are responsible for the design. The design is final-approved by the Project Manager.

Ground survey is performed by a Registered Land Surveyor (RLS) or technicians under the direct supervision of an RLS. All calculations are performed by an RLS and reviewed by a Certified Photogrammetrist in the Aerotriangulation Department.

Sensor calibration is performed prior to use on a project, and aerotriangulation personnel update all sensor calibration information to ensure all systems are up-to-date. The following is also required of each aircraft/camera combination prior to use in processing.

- GPS antennas.
- Dual-frequency receivers.
- Surveys accurately portraying the relationship between the camera lens nodal point and the antennas.
- Radiometric and geometric calibration files for each DMC sensor.

Review/update of the elevation model is generally the largest contributor to final product accuracy. Various techniques are used to examine the surface, but the most telling has proven to be viewing relief-shaded representations of the surface. This often points out suspicious areas to experienced technicians. If suspicious areas are found, they are noted for examination by the ortho department during production. If necessary, these areas are updated with stereoscopic compilation before use.

Acquisition information arrives at Surdex from all of the acquisition aircrews, it is inserted into the Enterprise database. The status is updated each evening, and new flight plans are issued via ftp and/or e-mail. Results from image inspection are incorporated, and the Enterprise database is updated. If re-flights are required, they are re-tasked at high priority to ensure they are acquired quickly to minimize changes in ground conditions with surrounding imagery. The Enterprise database can automatically issue daily acquisition status reports to project managers and clients. At the end of each day, aircrews e-mails and/or faxes flight logs to Surdex. The log file

includes aircrew, aircraft, and sensor information along with reports of possible problems – such as camera misfires that required re-flights, possible cloud cover issues or extreme turbulence. This information is available to support imagery inspection.

Image inspection is taken very seriously, employing 100% inspection, reviewing and grading all imagery and updating the Enterprise database with the results. If re-flights are determined, they are immediately prioritized to the acquisition aircrews. Should any question arise about the quality of the imagery or adherence to project specifications, Surdex's Project Manager will consult with the client on the proper course of action. ABGPS/IMU data is processed and approved by a Certified Photogrammetrist and stored in the Enterprise database. Missing or problematic data may require a re-flight at the discretion of the Project Manager.

Image processing is guided by reference imagery from a Pilot Project that provides a target appearance (tone, brightness, contrast, etc). All imagery is processed to this target. All information from image processing is retained in the Enterprise database, which serves as evidentiary records available for analysis and review by anyone in the production chain. The complete lineage of image data can be traced from acquisition to incorporation in final products (via the seamline shape file).

Aerotriangulation requires numerous checks throughout this critical phase. These include, but are not limited to:

- Each AT block is independently reviewed by a Certified Photogrammetrist not involved in the specific block under review.
- Surveyed check points are carried through the AT process as "floating" points (not constrained to their known positions) and these points are checked against the known (surveyed) positions.
- All residuals (sensor position, ground control points, image points) are inspected to ensure they are within the estimated precision of each. This also includes ensuring the "sigma naught" of each bundle adjustment is within statistical norms.
- All AT points (pass, tie, control) are checked against the existing DEM data to search for obvious disjoints with the elevation model. This is sometimes helpful in finding errors in datums, projections, etc. associated with both the AT and the DEM.

Orthorectification and mosaicking includes the use of several key reports by technicians to guide review and generation of each mosaic block. These are intended to provide focus for the technicians and direct them to situations that may require editing – as opposed to technicians having to visually search and detect each of them.

- An analysis of the effects of disagreements between the elevation model and the heights of aerotriangulation points (AT points are viewed as the "control" item in this sense). This is provided in shape file format and, if large discrepancies are found, the area is reviewed for possible DEM update.
- Adherence of the products to the desired imagery appearance established in the Pilot Project.
- Surdex's ray trace module can generate a shape file for rugged areas that isolate known occlusions and possible smearing caused by steep slopes. Technicians can "work off" each of these shapes, tracking which have been dealt with.
- Inspection reports from the Enterprise database are incorporated into a shape file for technicians to isolate possible cloud/cloud shadow and specular reflection areas that may require editing imagery in from overlapping lines or images.
- Seamline shape files generated by the automatic seamline editor are overlaid to examine the quality of the seamlines. Technicians can edit these polygons to ensure a seamless product.
- Seamline polygon files are passed through a topologic processor which checks polygons for completeness, overlap (not allowed), and size. If polygons are flagged by the processor, technicians resolve each one.

Technicians review the orthoimagery for:

- Seamless appearance (against seamline shape files).
- Image processing artifacts.
- File naming.
- Overall color balance against the target appearance from the Pilot Project.

Surdex uses the Accuracy Analyst software from CompassData for assessment of digital orthoimagery accuracy. ASPRS and National Standard for Spatial Data Accuracy (NSSDA) procedures require:

- Accuracy check points are used that are:
  - Independent of the points used in production
  - At an accuracy equal to or better than the target product accuracy.
- A sufficient number of points in the project area are utilized, based on ASPRS and/or NSSDA guidelines.

To assist our clients with the inspection of their orthoimagery, Surdex provides clients with – free of charge – our web-based image inspection tool, SurCheck℠. This tool is the result of over five years of continuous improvement and has met with outstanding reviews. It is implemented in HTML5, JavaScript, php, and the ArcGIS API for JavaScript, providing flexibility for enhancements in the future.

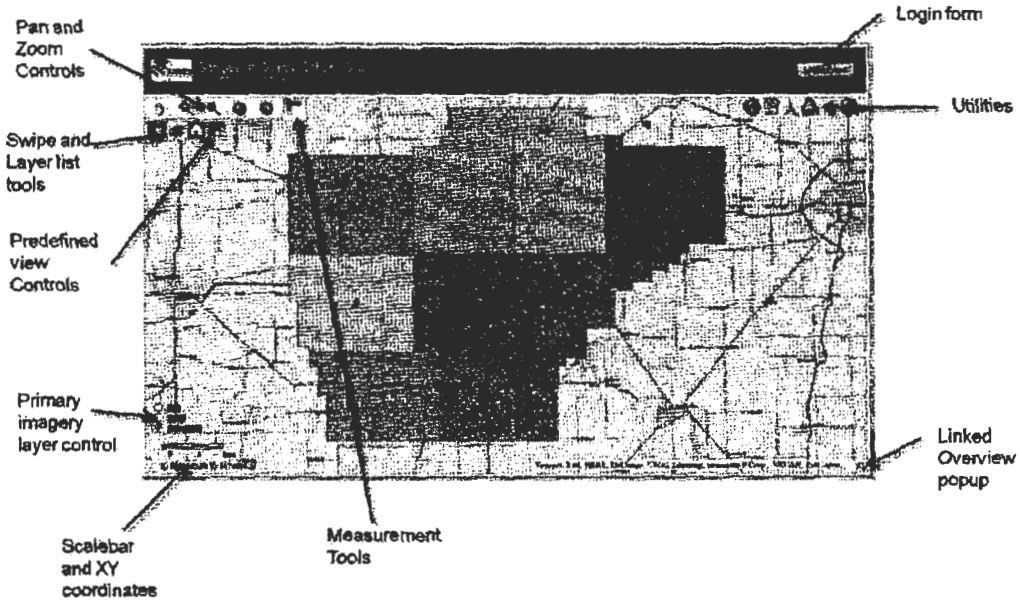
SurCheck greatly streamlines the inspection, remedial action, and delivery timelines. As call-outs are reported by reviewers, Surdex resolves each and notifies reviewers so they may confirm the correction. Since Surdex works off call-outs in parallel with the inspection process, in most cases the reviewers receive corrections within 1-2 weeks. When all call-outs are resolved for the project, or a delivery area, the data can be shipped on hard drives for final delivery. In many cases, clients choose to have orthoimagery added to SurCheck incrementally, further expediting inspection and allowing leveling of inspection resources.

Surcheck	
Feature	Benefit
Username and password login access.	Protected access for client and reviewers.
Client manager can assign reviewers to separate work zones within a project.	Multiple reviewers for each project to increase inspection rate and support multiple partners. Clients can assign multiple reviewers to specific work zones. Managers can view call-outs from reviewers to ensure a consistent approach.
Four (4) tiers of edit calls: 1. Standard inspector 2. Client manager 3. Surdex reviewer 4. Final client reviewer	Management of call-out resolution with appropriate levels of responsibility and authority within the client and within Surdex. Covers entire life cycle of inspection and resolution process, ensuring end product is fully inspected and accepted. Client manager can override client reviewers. Surdex reviewer dealing with disposition of a call-out (natural feature, out of scope, etc.).
Help menu for most options.	On-line assistance with operation reduces need for a manual or access to training guide, allowing session to continue uninterrupted.
Operates in Internet Explorer, Firefox, Chrome, Edge, and Safari. Works on smart tablets within individual interface limitations.	No browser plug-in required (prior versions required Silverlight). More flexibility for future enhancements requested by users or implemented by Surdex.
Single-page interface with no pop-up windows. Full-screen primary map window. Logical groupings of toolbars.	Simpler and cleaner interface. Maximizes screen real estate for viewing of larger areas. On-demand overview window.
Project start-up view showing basemap and work zones	Overview of assigned areas to ensure familiarization.

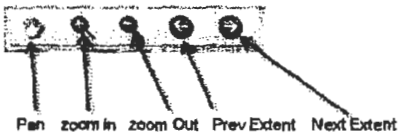
Feature	Benefit
Surdex-provided overlay of seamlines	Assists in searches for potential artifacts. Issues along seams or poor placement of seamlines are the most common problem found during inspection.
Ability for users to add their own map services.	Examples include historical imagery, vector overlays, control point overlays, parcels, ArcGIS Online layers, etc.
Swipe function with user-selectable layer.	Combined with user-added image services, provides a quick compare to historical imagery. Can swipe color and CIR renditions of 4-band products to review consistency and quality.
User-selectable layer list. Toggle layer visibility. Adjust layer opacity.	Customize view to suit reviewer preference.
Double-click magnifier window with adjustable zoom. Click and drag of magnifier box to other positions within window. Adjustable zoom level up to 9X, limited to 1:1 project resolution.	Quick toggling between magnifier and standard view allows reviewers to retain scale with close-up inspection of potential artifacts.
Generate graphical and quantitative histogram of current window, including: 1. Red, green, blue, NIR, and luminosity (red+green+blue). 2. Reporting of basic image metrics measures (contrast, clipping, brightness, etc.).	Aids in determining adherence to project-specific image metrics.
Defined tile scheme within each project that fits screen.	Simplifies inspection by focusing on full tile.
Progressive inspection of each tile in "snail trail" sequence. Simple acceptance of tiles any key press or mouse click. Accepted tiles are high-lighted.	Methodical approach streamlines inspection and portrays status.
"Acceptor" function provides completely random sampling of tiles to a percentage desired by the client.	Supports less than full inspection or a management review of work to date.
User-selectable rectangle, polygon, circle.	Enhanced tools to simplify delineation of artifacts.
Select from list of typical call-out types.	
Comments can be added by users for repeated use between sessions.	Essentially adds a project-specific call-out type.
Table view of call-outs, status, and action.	Tabular review of status.
Ability to walk through list of call-outs, re-centering view to each one.	Review of existing call-outs for status and consistency.
Save call-outs to a shape file or CSV files.	Export call-outs to non-SurCheck users for review. View within other applications (ESRI ArcMap, AutoCAD, etc.) CSV easily imported into Excel.
Measurement tool (points, distance, and area). User-selectable units (i.e.: feet, meters, miles, kilometers, etc.)	Supports investigation of call-outs against specifications (such as seamline shear, size of artifact, etc.).
Print current screen to printer or PDF.	Simplifies creation of samples, bug reporting, etc.

The following pages portray selected aspects of SurCheck.

SurCheck layout and tools.

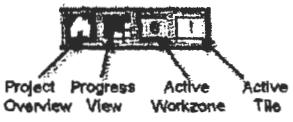


Pan and Zoom Controls

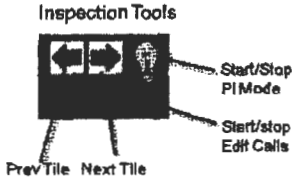


Utilities

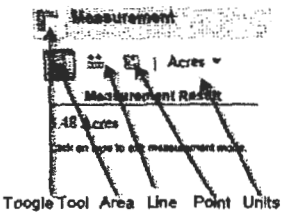
Predefined view Controls



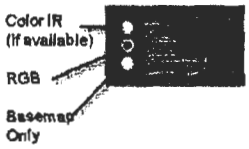
Inspection Tools



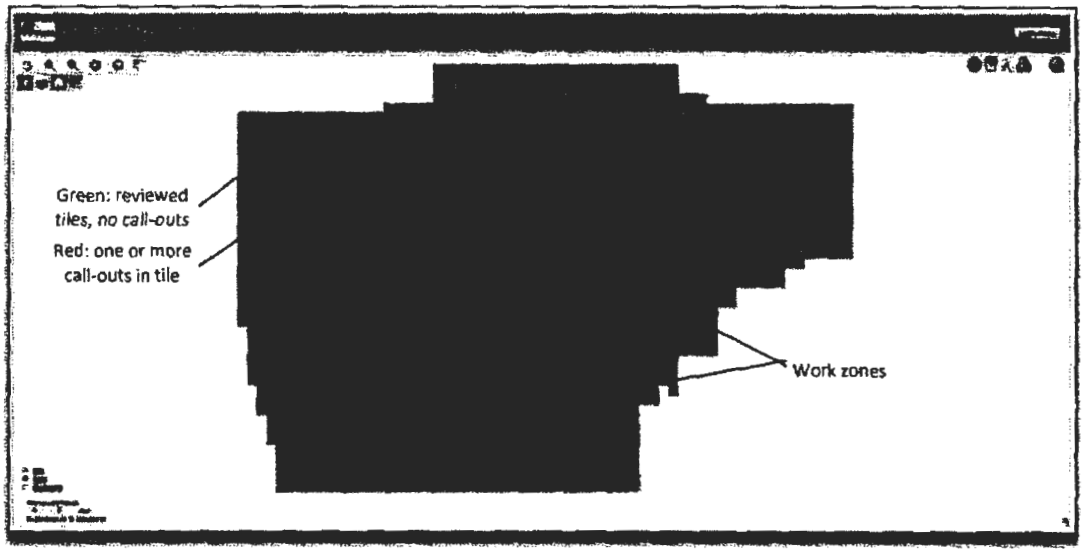
Measurement Tools



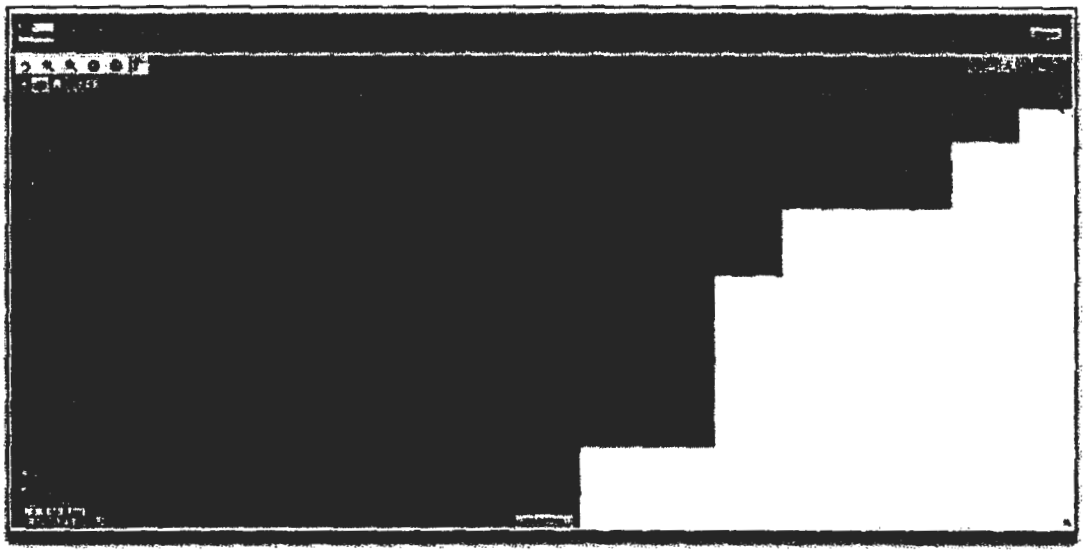
Primary imagery layer control



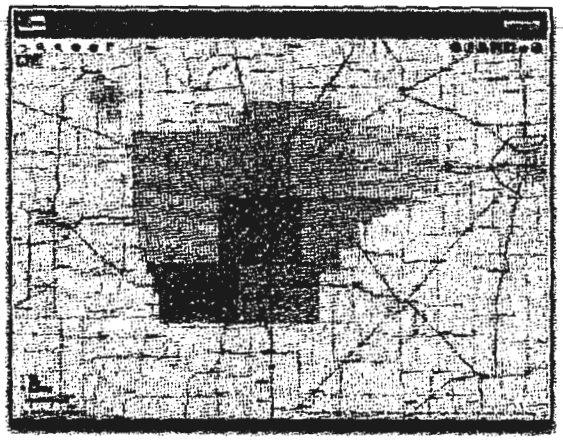
Manager View Showing Progress in all Work Zones.



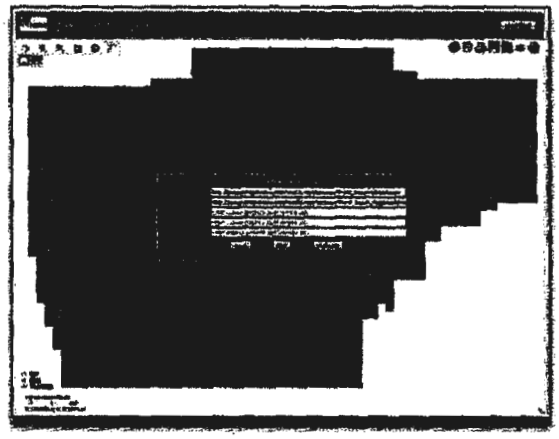
Work Zone Progress.



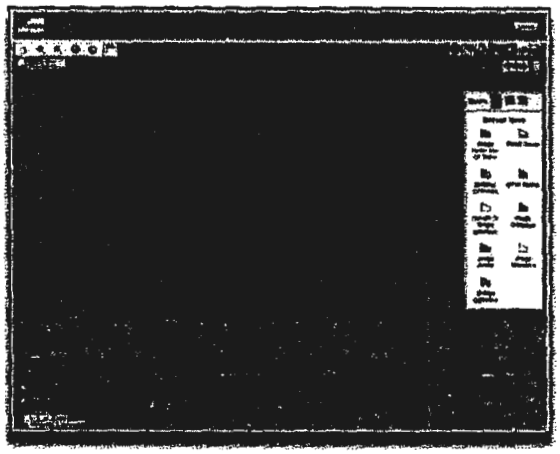
Initial Screen Showing AOIs.



Custom Settings Form.

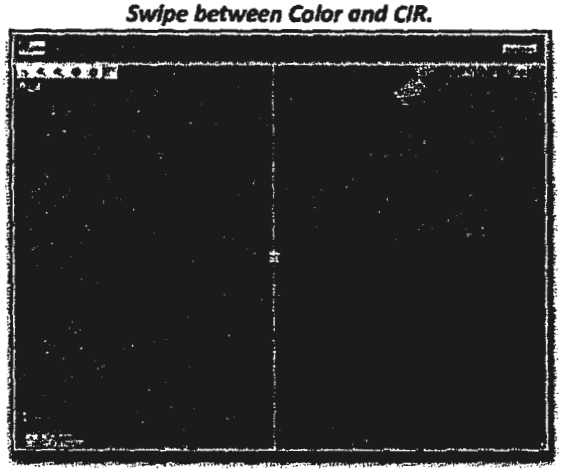


Edit Calls Template.

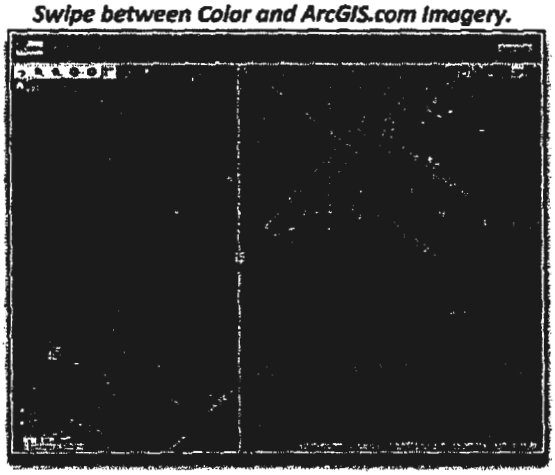


Edit Comments.

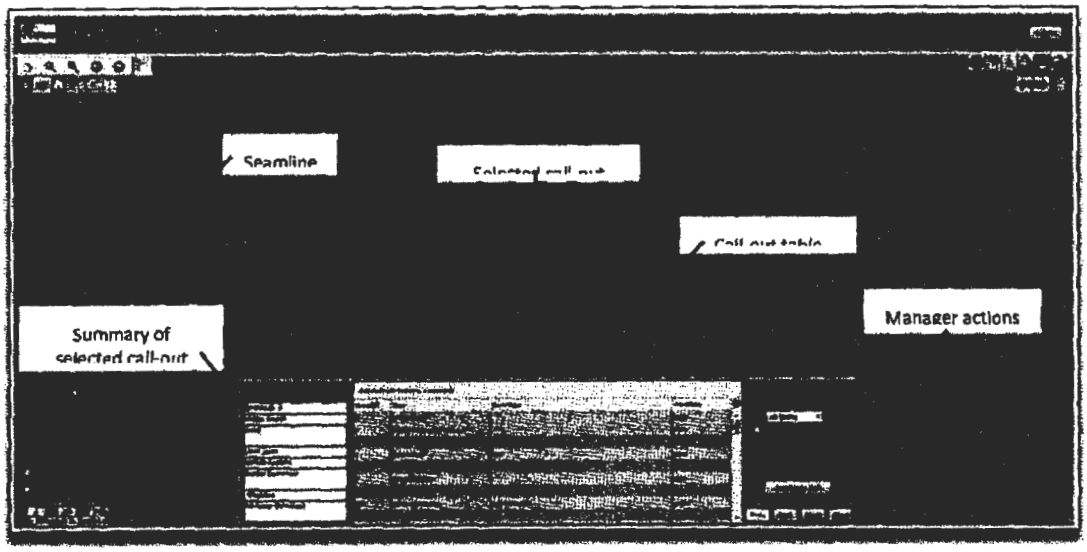
Swipe between Color and CIR.



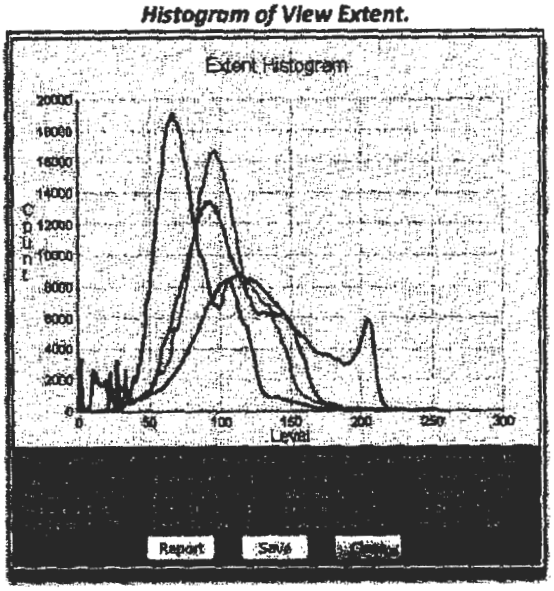
Swipe between Color and ArcGIS.com Imagery.



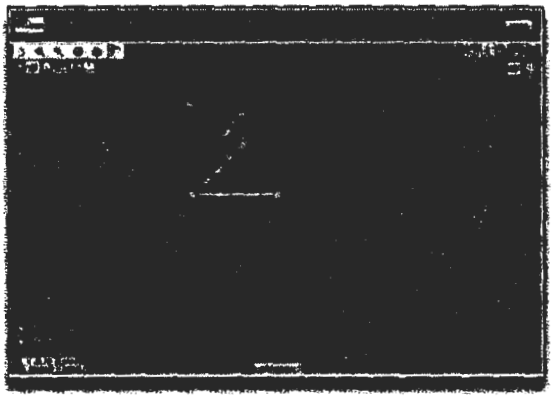
Manager call-out review, checking each in turn.



Histogram of View Extent.



Magnifier Tool.



3. EQUIPMENT AND SOFTWARE PROPOSED

The vendor should state whether a digital sensor camera or an analog (film) camera will be utilized in performance of the contract requirements.

a) Digital Sensor Camera

Surdex brings several digital imaging sensors to the program:

- Leica ADS100 pushbroom sensors (5)
- Leica DMC-1 frame sensors (3)
- Leica RCD30 oblique camera addressing either 5-way or 3-way imaging (1).
- Leica ADS100 Pushbroom Sensor

The Leica ADS100 Airborne Digital Sensor is one of the industry's premier sensors; our installation the largest in the United States and one of the largest in the world. The pushbroom imaging geometry of the ADS100 includes sets of arrays in the forward, nadir, and back configurations, collecting imagery simultaneously to produce a "pixel carpet" of the ground scene and providing alternative views of the ground scene and stereoscopic coverage. Each set of arrays acquires in red, green, blue, and near infrared at full (same) resolution.

Pushbroom systems present optimal imaging geometry for digital orthoimages and support highly efficient production:

- With the image displacement only varying across the format – and not radial from the center as with frame-format film and digital cameras – the amount of elevated feature lean in the final product is dramatically reduced.
- The pixel carpet acquired by the ADS100 substantially reduces the amount of seamlines required to mosaic the orthoimages together, reducing the production effort and minimizing the possibility of seamline artifacts. Correspondingly, the orthoimagery inspection effort is reduced since there are fewer seamlines to be validated.
- The ADS100 stereoscopic geometry yields the highest attainable horizontal and vertical accuracies and can meet the most stringent ASPRS standards. This also supports robust elevation data collection using such approaches as Leica's SGM (Semi-Global Matching) software. The stereoscopic geometry is even superior to the 9"x9" film photography relied upon for decades.
- With the telecentric lens design of the ADS100, all light rays strike the focal plane normal to the arrays, resulting in the same radiometric response for all pixels. This avoids the well-known "fall-off" issues at the edge of the exposure encountered by the lenses of conventional frame-format digital cameras. This simplifies balancing during the mosaicking step by minimizing the image-to-image fall-off issue.
- With each band (R,G,B,NIR) in each array collecting at full resolution, features imaged by the ADS100 do not exhibit the blooming and smearing attributed to the pan-sharpening approach taken by virtually every large-format digital frame camera on the market today. This enhances interpretation and results in an aesthetically pleasing rendition of color.
- The spectral responses of the bands do not overlap, promoting ideal automated image classification.

Leica ADS100 Specifications	
Parameter	Value
Sensor type	Pushbroom
Pan-sharpening	None
Cross-track pixels	Forward: 16,000 Nadir: 20,000 Backward: 18,000
Focal length	62.5 mm
F-number	f4
Pixel size	5.0 um
Pixel resolution (radiometric accuracy)	1 um
Integration time	≥ 0.5 ms
Height: GSD ratio	12,500:1
Cross-track field of view (FOV)	77.3°
Along-track field of view (FOV)	Fwd: 25.6° Back: 19.4° Stereo: 45°
B/H Ratio	*0.80* *(Traditional film cameras: 0.6)*
Radiometric resolution	14 bits/pixel
Imaging arrays R = red G = green B = blue N = near-infrared	13 Arrays: Fwd: RGBN Nadir: RGGBN Back: RGBN
Radiometric response (nm) Red Green Blue Near-infrared (NIR)	619-651 525-585 435-495 808-882

Using a calibration range near our headquarters, each ADS100 is "bore-sighted" to determine the alignment and position of the sensor with respect to the GPS antenna and Inertial Measurement Unit (IMU). Flight lines are designed to limit the operation of the ABGPS/IMU within 20-30 minutes during on-line acquisition. ABGPS/IMU information is collected at fine intervals that support the derivation of sensor attitude and position for each line that is acquired. The automatic exposure mechanism is monitored by the sensor operator to avoid over-reaction to ground scenes that bias the settings for the project area. At the end of each day, aircrews transfer data from the on-board mass memory unit to hard drives which are shipped overnight to Surdex's production center.

Surdex uses the standard Leica workflow to capture and process the GPS and IMU data. ADS100 carries the Novatel SPAN GPS/GNNS inertial navigation system in the aircraft. Surdex uses Trimble R8 model receivers to collect ground base station GPS and GLONASS data during each flight. The position of the ADS100 sensor and the GPS antenna are measured within the coordinate system defined by the central axis of airplane. These measurements along with the GPS and IMU data captured on each flight are processed using Leica IPAS TC software. Leica IPAS produces a differential solution for the airborne positions and attitude more than a hundred times a second for the duration of the flight. As the Leica ADS100 is a line scanner there are no individual stations, but rather a stream of epochs or fixes are produced at a rate of 128 per second. Only during aerial triangulation are discrete fixes calculated at a spacing dictated by image measurement density.

Leica DMC-1 Frame Sensor

The Leica DMC-1 was one of the first large-format digital cameras, introduced into the marketplace by Z/I Imaging (now owned by Leica Geosystems). It is a frame camera utilizing pan-sharpening to blend full-resolution panchromatic images with lower-resolution multispectral (red, green, blue, near infrared). Surdex has owned and operated three (3) DMC-1 systems starting with the first purchase in 2004.

Each DMC contains eight individual cameras using off-the-shelf matrix CCDs. This includes four divergent panchromatic cameras and four multispectral cameras: red (R), green (G), blue (B), near infra-red (NIR).

Leica DMC-1 Specifications			
All Sensors are 12 bits/pixel			
Panchromatic	Size	Response	Lens
[illegible]	4,096w X 7,168h	400-850nm	120mm/f4.0
Multispectral	Size	Response	Lens
Red (R)	3,072w X 2,048h	590-675nm	25mm/f4.0
Green (G)	3,072w X 2,048h	500-650nm	25mm/f4.0
Blue (B)	3,072w X 2,048h	400-580nm	25mm/f4.0
Near Infrared (NIR)	3,072w X 2,048h	675-850nm	25mm/f4.0
[illegible]			
RGB	13,824w x 7,680h 8 or 12bpp		
CIR			
Pseudo			
[illegible]	4.75:1		
Shutters	Continuously variable 1/50-1/300 sec f/4-f22		
Detector size	12 microns		
Maximum frame rate	2.1 sec/image		
Cross-track FOV	69.3°		
[illegible]	10,000:1		
Typical AGL for 1' GSD	32,800'		
Typical AGL for 6" GSD	10,000'		
Typical AGL for 3" GSD	5,000'		

Leica RCD30 Oblique System

The Leica Geosystems RCD30 oblique camera system is a medium format system designed for high accuracy 3D urban mapping and 3D corridor mapping applications. The system offers several unique features that offer superior image quality and high accuracy, coupled with a high degree of flexibility.

- Can be operated in standalone mode.
- Choice of color or 4-band camera heads.
- Single camera controller with integrated GNSS/IMU system.
- Can be paired with a LiDAR system for simultaneous collection of imagery and elevation data.
- Operable in two configurations, depending on application:

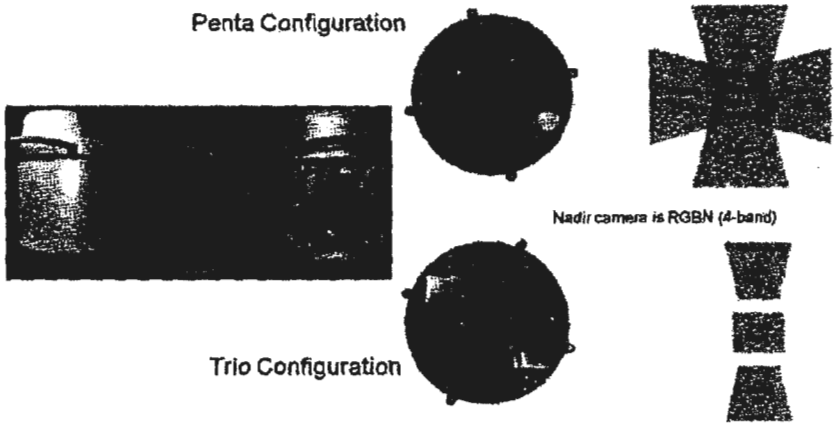
- "Penta" configuration: Five RCD30's for nadir, forward, backward, left, and right imaging directed at city applications.
- "Trio" configuration: Three RCD30's for nadir, forward, and backward imaging suitable for corridor applications.

The RCD30 costs less than one-third the price of a large-format digital camera and, therefore, is cost-effective for corridor work, as well as relatively large block area projects. In such situations, clients receive not only digital orthoimages meeting the most exacting standards for quality and accuracy, but also oblique views useful in appraisal work, building of 3D models, support for security planning, and other similar uses.

The entire system (camera, controller, storage, power, etc.) has a very low weight, making it attractive as a companion to a LiDAR system for concurrent acquisition. Its small size also makes it suitable for operation within even the smallest aircraft.

Leica RCD30 Specifications	
Parameter	Value
Number of Cameras	5 / 3
Format Category	Medium
Sensor Type	Frame
Pan-sharpening	No (Bayer filter)
Cross-track Pixels	8,956
Along-track Pixels	6,708
Focal Length	50.0 mm
Pixel Size	6.0 um
Height: GSD ratio	8,333:1 (1' GSD acquired at 8,333 AGL)
Cross-track FOV	56.5°
Along-track FOV	43.9°
Imaging	RGBN matrices
Color Bands	Red, Green, Blue, Near Infrared (4 bands)
Spectral Response (nm) P = Panchromatic R = Red G = Green B = Blue N = Near Infrared	R: 610-660 G: 530-580 B: 435-495 N: 840-900
Radiometric Resolution	12-16 bits/pixel
GSD: 3" (0.25')	
Flying Height (AGL)	2,083'
Swath Width	2,239'
GSD: 6" (0.50')	
Flying Height (AGL)	4,167'
Swath Width	4,478'
GSD: 12" (1.00')	
Flying Height (AGL)	8,333'
Swath Width	8,956'

It is not only cost-effective for corridor work, but even for relatively large block area projects in some situations. The very low weight of a complete system (camera, controller, storage, power, etc.) makes it attractive as a companion to a LiDAR system or operation within even the smallest aircraft.



The figure below shows the five views from a set of imagery captured over the Clayton, Missouri area.

Imagery with the RCD-30 captured over the Clayton, Missouri area.

Merrick & Company Sensors

Merrick & Associates Image Sensor and LiDAR Sensors		
Digital Camera Systems	Airborne LiDAR	Other Sensors Technology
2-Trimble TAC 80 1-Trimble TAC 60	1-Optech Pegasus HA-500 1-Optech Orion 200 1-Leica ALS50-II+ 1-Leica ALS50	2-Optech CS-4800 Oblique Cameras 1-Optech CS-MS1920 CIR Camera

b). LiDAR Sensors

Surdex Corporation

The Galaxy uses innovative LiDAR technology enhancements and incorporated flight and calibration software that significantly increases sensor performance, collection efficiency, improved data quality, and greatly simplifies the collection process.

Optech Suite of software includes FMS (Flight Management Software) and LMS (LiDAR mapping software). Both of these packages are integrated with the Galaxy sensor. These systems allow for better mission planning and automated sensor calibration which increases the point accuracies and quantifies deliverable product accuracies.

Optech's new technologies are PulseTrak and SwathTrack. These new technologies enable the sensor to collect data with more precision and efficiency. PulseTrak improves collection by eliminating coverage gaps and inconsistencies in point density by creating a continuous operating envelope. SwathTrak enables the Galaxy to operate a real-time dynamic FOV. This technology generates fixed width swaths even in varying terrains. This improves data quality by maintaining point densities in varying height regions and provides flight efficiencies by creating constant fixed width swath footprints, eliminating the need to fly additional lines in rugged terrain.

Surdex's Optech Galaxy LiDAR Sensor Specifications	
Laser Configuration	
[illegible]	1064-nm near-infrared
[illegible]	Class IV (US FDA 21 CFR 1040.10 and 1040.11; IEC/EN 60825-1)
[illegible]	0.25 mrad (1/e)
[illegible]	150-4700 m AGL, nominal
[illegible]	Programmable, 35-550 kHz
[illegible]	< 0.008 m, 1 σ
[illegible]	Programmable, 0-60°
[illegible]	Programmable, 0-115% of AGL
[illegible]	Programmable, 0-120 Hz advertised (0- 240 scan lines/sec)
[illegible]	2000 maximum
[illegible]	1/ 10,000 × altitude; 1 σ
[illegible]	< 0.03-0.20 m RMSE from 150-4700 m AGL

Surdex's Optech Galaxy LiDAR Sensor Specifications	
Sensor Configuration	
Position and orientation system	POS AV™ AP60 (OEM); 220-channel dual frequency GNSS receiver; GNSS airborne antenna with Iridium filters; high-accuracy AIMU (Type 57); non-ITAR
Flight line hexagon system	Optech FMS
SwathTRAK™	Dynamic field of view
PulseTRAK™	Continuous operating envelope
Range capture	Up to 8 range measurements, including last
Intensity capture	Up to 8 intensity returns for each pulse, including last (12-bit)
Roll compensation	Programmable; ±5° at 50° FOV; increasing as FOV is reduced from 50°
Minimum target separation distance	< 0.7 m (discrete)
Data storage	Internal solid state drive SSD (SATA II)
Power requirements	28 V; 300 W; 12 A
Dimensions and weight	Sensor: 0.34 × 0.34 × 0.25 m, 27 kg — PDU: 0.42 × 0.33 × 0.10 m, 6.5 kg
Operating temperature	0 to +35°C

Merrick & Associates

Merrick & Associates Digital Imaging and LiDAR Systems		
Digital Camera Systems	Airborne LiDAR	Other Sensor Technology
2-Trimble TAC 80	1-Optech Pegasus HA-500	2-Optech CS-4800 Oblique Cameras
1-Trimble TAC 60	1-Optech Orion 200	1-Optech CS-M51920 CIR Camera
	1-Leica ALS50-II+	
	1-Leica ALS50	

Harris Corporation (Geiger-mode LiDAR)

Harris Corporation Geiger-Mode LiDAR Systems			
No.	Equipment	Manufacturer / Operator	Description
2	Geiger-mode LiDAR Camera	Harris (Proprietary) / Harris Laser Wavelength: 1064 nm Array Size: 128x32 elements Scanners: Palmer ±15deg	Geiger-mode Aerial LiDAR sensor for wide area and corridor mapping

c) Aircraft

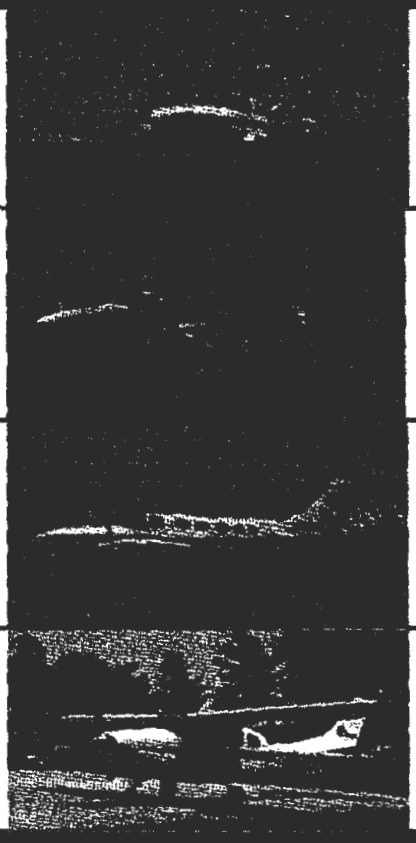
Acquisition of imagery is the most critical phase of the project. Surdex brings over a half-century experience collecting image data and understands the limited opportunities for image acquisition. The most important facet of acquisition is the focus on an extremely high degree of communication between Surdex's Chief Pilot and all aircrews. Flight plans are updated each evening by our Enterprise database and re-distributed to aircrews via the Internet and/or e-mail.

Surdex is widely regarded by clients and colleagues as one of the premier aerial acquisition companies in North America.

- All aircraft are made by Cessna, standardizing maintenance, repair, inspection, and operation.
- Ability to host each of our aerial data acquisition instruments (film cameras, digital imaging sensors, LiDAR).
- A mix of slower/lower and faster/higher aircraft to address our versatile acquisition equipment and maximize our resources.

Since weather/acquisition conditions heavily impact the acquisition of a project, it is imperative that assets be available and "ready to go" when favorable weather conditions prevail. Our aircraft are based at Spirit of St. Louis Airport, only blocks from Surdex's headquarters in the St. Louis area. From this with this centralized location, we can efficiently handle projects throughout North America.

Surdex's Acquisition Aircraft

No.	Aircraft Type	Category	Specifications	Image
3	Cessna 441 Conquest II (2) With RVSM*	Twin-Turbine Pressurized	Flight Range: 2,193 nm Altitude: 1,200 - 35,000 AGL Certified Altitude: 35,000 MSL Approximate Cruise Speed: 310 knots	
1	Cessna 414A Chancellor III	Twin-Piston Pressurized	Flight Range: 900 nm Altitude: 1,200 - 25,000 AGL Certified Altitude: 30,200 MSL Approximate Cruise Speed: 235 knots	
1	Cessna 335 II	Twin-Piston	Flight Range: 928 nm Altitude: 1,200 - 18,000 AGL Certified Altitude: 26,800 MSL Approximate Cruise Speed: 215 knots	
4	Cessna TU-206F Turbo Stationair	Single-Engine	Flight Range: 720 nm Altitude: 1,000 - 10,000 AGL Certified Altitude: 26,300 MSL Approximate Cruise Speed: 148 knots	

* RVSM: Reduced Vertical Separation Module. This FAA-certified equipment allows operation above 28,000' (MSL).

The Cessna 441 (Conquest) aircraft are the highest performing and most versatile aircraft in the fleet for imagery acquisition operations. They can fly slow (less than 150 knots) or fast (300+ knots) and stay aloft for up to 7 hours. Their pressurized environment ensures comfortable conditions for the crew as well as a stabilized environment for the sensors. Most importantly, the RVSM equipment and advanced radar allow us to ferry safely at night, whereas most piston aircraft are ferried during daylight hours. With its ability to quickly move around the country, the Conquests handle the widely diverse projects during the hectic spring and summer flying seasons. Our Conquests can ferry non-stop to any point in the lower 48 from our home base.

Merrick & Associates Aircraft

Merrick & Associates Acquisition Aircraft with ABGPS						
No.	Aircraft Type	Ceiling	Photo	LiDAR	HIS Capable	TIR Capable
[redacted]	[redacted]	24,000'	Y	Y	Y	Y

Harris Corporation Aircraft

Harris leases three Beachcraft, Fixed-wing, Turbo-prop, King Air 200 model aircrafts from its aerial platform service partner Dynamic Aviation Group (DAG), which provides the planes and pilot services for all Harris data collections in the North American region.

Harris Corporation Acquisition Aircraft with ABGPS				
No.	Aircraft Type	Equipment Manufacturer / Operator	Flight Information	Description
[redacted]	[redacted]	Beachcraft / Dynamic Aviation	Ceiling: 27,000 ft Endurance: 6 hours Nominal Speed: 200-240 knots	Fixed-wing Turbo prop; Harris Geiger-mode LIDAR is integrated in the aircraft fuselage

d) Software

Surdex's orthoimagery software is a mix of custom-developed software (Group Tool), an Enterprise database, and a number of camera manufacturer software and GIS software.

Surdex Corporation Software and Tools			
Phase	Tool	Ancillary Tools	Surdex Enterprise Database
[redacted]	Leica MissionPro	ESRI ArcMap Surdex Group Tool PhotoShop Global Mapper	Flight plans Flight data ABGPS/IMU results Image inspection results Aerotriangulation results Image metrics Seamlines Client inspection results
[redacted]	Leica FlightPro		
[redacted]	Novatel Inertial Explorer		
[redacted]	Leica XPro		
[redacted]	Surdex Group Tool		
[redacted]	Intergraph Image Station Automatic Triangulation (ISAT)		
[redacted]	Surdex Group Tool		
[redacted]	AccuracyAnalyst		
[redacted]	Surdex SurCheck		

Merrick & Associates LiDAR (elevation) Processing Software		
Software Type	Current Version	Number
Merrick Advance Remote Sensing Software (MARS®)	8.0.6	Unlimited
Applanix POSPac	7.1	2
Optech LIDAR Mapping Suite (LMS)	3.2.0	4
Leica IPAS PPP & CO	1.3	1
Leica IPAS Pro	1.35	1
Leica IPAS TC	3.2	1
Novatel Inertial Explorer	8.60	1
Leica Geosystems ALS Post Processor	2.75	Unlimited
Leica CloudPro	1.2.2	1
Blue Marble Geographic Calculator	2016	5
TerraScan	16.006	5
TerraModeler	16.004	5
TerraMatch	16.003	4
QT Modeler	7.1.3	1

Merrick & Associates CADD Software		
Software Type		Number
PLS-CADD - Standard Edition	10.60x64	2
Autodesk AutoCAD	2012+	10
CADMAP-DGN		6
Bentley MicroStation 7.1, 8.0, 8 XM, Connect	V8+	10

Merrick & Associates Photogrammetry (planimetric and topographic) & GIS Software		
Software Type	Current Version	Number
Inpho Match-AT	7.1.1	1
Inpho InBlock	7.1.1	1
Leica LPS	9.3	1
Esri ArcGIS for Desktop Basic (ArcView)	10.4.1	18
Esri ArcGIS for Desktop Standard (ArcEditor)	10.4.1	4
Esri ArcGIS for Desktop Advanced (ArcInfo)	10.4.1	10
Esri Spatial Analyst	10.4.1	9
Esri ArcGIS 3D Analyst	10.4.1	8
Esri ArcServer, ArcIMS, ArcSDE	10.0	1-1-0
Esri ArcServer, ArcIMS, ArcSDE	10.4.1	1-0-0
Esri Publisher	10.4.1	6
Esri ArcGIS FMV	10.4.1	3
Esri ArcGIS Data Reviewer	10.4.1	5
Esri ArcGIS Schematics	10.4.1	5
Esri Tracking Analyst	10.4.1	5

Esri Workflow Manager	10.4.1	5
Esri VBA	10.4.1	1
Esri Geostatistical Analyst	10.4.1	5
Esri Data Interoperability	10.4.1	5
Esri Network Analyst	10.4.1	5
Global Mapper	16	1

Merrick & Associates Digital Orthophotography / Imaging Software		
Software Type	Current Version	Number
Inpho OrthoMaster	7.1.1	2
Inpho OrthoVista with Seamline Editor	7.1.1	4
Leica ERDAS Imagine	9.3	1
Leica Image Equalizer	9.3	1
ERDAS Imagine Professional	9.1	1
ERDAS Imagine Viewer	7.2	1
ERDAS Imagine Compressor	7	1
ER Mapper	7.2	4
LizardTech GeoExpress (MrSID)	8	2
Adobe Photoshop	CS5	10

Harris Corporation Software		
Equipment / Software Name	Manufacturer / Operator	Description
Geiger-mode LiDAR Mission Planner SW	Harris (Proprietary)	Software for generating mission plans, flight plans, and sensor operations
Geiger-mode LiDAR automated processing	Harris (Proprietary)	Harris developed software for volume automated processing to generate calibrated point clouds and other derivative LiDAR products
LiDAR QA/QC SW	Various Commercial SW packages (e.g., TerraScan, ArcGIS, QT Modeler, ESP Analyst etc.)	Commercial Software to support QA/QC of all products (LAS files, metadata, NPS, DEM etc.)

Surdex's processing uses a heavily distributed processing environment. Coupled with our custom software, each workstation in the facility can be used for computation. Between image processing, ortho/mosaic, and aerotriangulation, over one hundred workstations are available for use.

Surdex Data Storage Architecture		
Tier	Storage	Comments
Violin Memory 3205 NexStar Shared SAN	110 TB	Data currently in production. Flash memory better than 400,000 IOPS and 6,000 MB/sec throughput
Infortrend StorNext Shared SAN	1 PB	Data currently in production. Drives in a RAID6 configuration.
Windows NTFS Direct Attached Storage (DAS)	1 PB	Raw images – also backed up on LTO6 tapes. The files are distributed across 72 servers and managed by the database

Surdex uses a tiered approach to storing data, providing a means to have primary data (data in production) stored on the fastest storage with files migrating down through the tiers to successively slower access as the likelihood of frequent access goes down. This minimizes the need for expensive, high-speed storage and allows us to keep the data on-line longer. Since many processes are compute-bound, this reduces the need for expensive, high-speed disks. Ultimately, all data is backed up to LTO6 tape for long-term storage.

The security of source imagery and related data is based on a "data in two places" rule. As raw data is received from the crews in the field a LTO6 tape is created immediately and a second copy is stored on the production storage systems. After inspection and GPS processing a second copy is made to tape. All of the parameters used to process the images are archived three times a day onsite and weekly offsite. Disaster recovery is simplified by the use of a database that stores the majority of processing parameters. All final products are archived to LTO6 tape after delivery.

In the spring of 2016, Surdex installed a diesel-powered backup generator that can fully sustain all production operations in the event of the loss of power; the fuel can be replenished indefinitely. This ensures that adequate time is provided to restore power without interrupting normal operations, ensuring production schedules are maintained.

4. EQUIPMENT AND PERSONNEL AVAILABILITY

The vendor should provide information related to the availability of equipment and personnel to provide services for the categories of services the vendor proposes to provide.

4.1 Deployment of Surveying Personnel

The vendor should provide details regarding their ability to deploy surveying personnel to complete projects in a timely manner.

With both of our surveying subcontractors based in the State of Missouri (David Mason & Associates (MBE) and EFK Moen (WBE)), we do not anticipate any difficulty in having one or both of them on-site for ground control survey operations. In fact, for the largest envisioned project, either one of the subcontractors could handle the survey operations alone.

4.2 Deployment of Aerial Photography Equipment and Personnel

The vendor should provide details regarding their ability to deploy equipment and personnel to provide the photogrammetric mapping products and services in a timely manner.

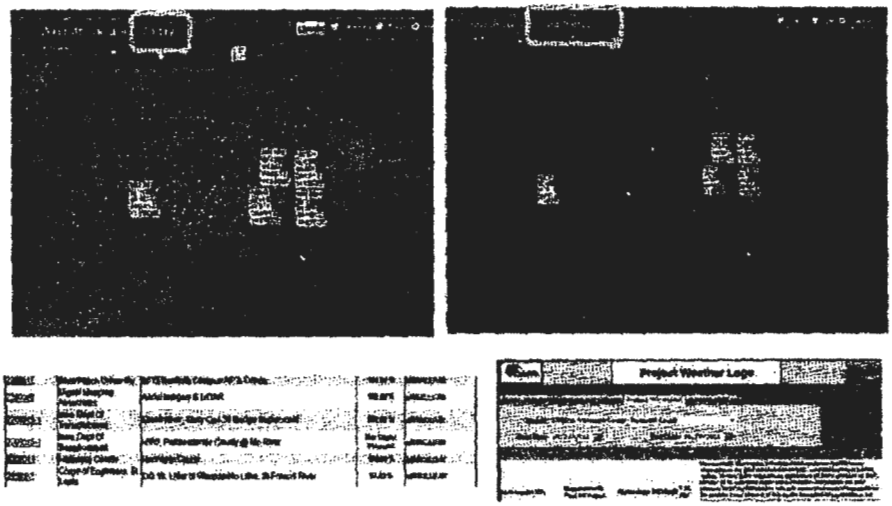
Surdex is proud of the fact that we have virtually never failed at acquiring imagery in the requisite timeframe. Additionally, we believe our imaging sensors and LIDAR sensor capacity are likely at least twice the capacity required for the largest envisioned project. With our aircraft based in the St. Louis area, we have several distinct advantages over competing teams based outside of the state:

- We are no more than 1 ½ hours from any site in the state. Since the adage "more bad days turn good than vice versa" is quite true in imagery capture, we can quickly move to a site to capture imagery in the precious few hours the spring (leaf-off) season affords.
- We are certainly familiar with the fickle spring weather that typifies the State of Missouri. Especially given the trend of recent years for very short leaf-off spring days, capacity and proximity are very important for successful capture.
- With our aircraft maintenance, inspection, and repair staff, we can maximize the productivity of our aircraft. We do not rely on costly and time-consuming third party support.
- With our aircraft moving to/from projects out of our own hangar facility, we also have the luxury of off-loading data at our headquarters and will not have to rely on priority delivery nor the concern of not shipping data over weekends to a processing site.

- Surdex and is aircraft are well-known to ATC personnel staffing the centers in the State. Since clearance to fly over some metro areas and MOAs (Military Operations Areas) sometimes involves fickle FAA personnel, it is always better to have a history of successful cooperation to draw upon.

Surdex uses several weather services to forecast and monitor both long-term (1-2 months) and short-term (up to 2 weeks) patterns. We track and retain weather information about each project in our Enterprise database. Our internal web site provides the ability to track aircraft using services provided by Guardian Mobility. Each aircraft is equipped with transmitters that provide real-time location. Our internal website also allows us to monitor movement over periods of time.

Tracking Aircraft and Weather – Surdex Internal Website.



Surdex will consult with the State to determine when to start and stop acquisition based on the climate and weather each season. As we have done in the past, imagery that appears to be on the verge of capturing leafing conditions will be forward to the State for review.

The aircrews begin each day by inspecting the aircraft and all instruments to ensure all are operating properly. In addition, glass portholes are inspected for dirt, oil, etc. to ensure a clean surface. Each aircrew sets up a base station to support the ABGPS/IMU collection during acquisition, most of the time at the airfield. The aircrew is also responsible for establishing the position of the base station for processing and review by a Registered Land Surveyor. Our Team will also utilize any existing 1-second frequency CORS stations to process our ABGPS/IMU data.

After verifying the weather is amenable for acquisition, the pilot files flight plans and communicates with the FAA and other cognizant authorities prior to flight. During heavy acquisition, it is not unusual for more than one mission to take place, with either re-fueling in between or waiting for the clearing of the weather. After completion of a day of acquisition, the aircrew is responsible for checking the aircraft and instrumentation.

Aircrews operate off updated flight plans sent by e-mail and/or ftp from the main office each night/evening. Surdex's Enterprise database merges inspection results with progress reports transmitted by the aircrews at the end of each acquisition day. Thus, the updated flight plans work acquisition to do along with any re-flights isolated by inspection. In general, re-flights are prioritized over new flights to ensure a minimal time delay between the initial capture and re-flight to minimize changes in the terrain or land cover during the elapsed time period.

4.3 Ability to Maintain Available Personnel and Equipment for Individual Projects

The vendor should provide information regarding their ability to keep the same personnel and equipment available on each phase of an individual project.

A Project Manager is assigned to each specific project and is responsible for working with Surdex's Senior Vice President of Production/Operations to ensure adequate resources for each phase of a project are in place.

Within a production department (e.g.: Ortho), the department manager assigns personnel to each project, keeping the same personnel working a project throughout its life cycle, helping ensure that requirements and specifications are understood and consistently applied. Should additional personnel be added to a project to address bursts of effort, the department manager ensures that these people work alongside personnel already engaged in the effort.

5. ECONOMIC IMPACT TO MISSOURI

Economic Impact to Missouri - the vendor should describe the economic advantages that will be realized as a result of the vendor performing the required services. The vendor should respond to the following:

5.1 Missouri Products and Performance by Missourians

Provide a description of the proposed services that will be performed and/or the proposed products that will be provided by Missourians and/or Missouri products.

While our Team includes five additional firms (three of which are headquartered out of state), it is important to know that almost all the labor will be provided within the State of Missouri. Should the State request mobile LiDAR, our Team member ESP (headquartered in South Carolina) will acquire the data, and it will be delivered to Surdex for processing. Should the State request Geiger LiDAR, our Team member Harris Corporation (headquartered in Florida, but with an office in Missouri with over 130 Missouri employees) will acquire and process the imagery. As such, by far the lion's share of the work performed under this project will provide employment to citizens of the State of Missouri.

5.2 Economic Impact to the State of Missouri through Tax Revenue Obligations

Provide a description of the economic impact returned to the State of Missouri through tax revenue obligations.

Surdex is located in Chesterfield, Missouri, and contributes significantly to the Missouri economy through taxes and employment. The following table summarizes the average taxes paid, by category, over the 3-year period from 2014 – 2016.

Surdex Tax Revenue into the State of Missouri	
Surdex Taxes Paid	2014 - 2016
Employment taxes	$730,461
Missouri Income Tax Liability to Owners on Company Profits	$431,786
Real Property Taxes Paid	$128,581
Personal Property Taxes Paid	$113,639
Missouri Unemployment Tax Remitted	$90,768
Missouri Sales/Use Tax Remitted	$22,926
Total Taxes Remitted/Collected by Surdex	$1,518,161

5.3 Company's Economic Presence in State of Missouri

Provide a description of the company's economic presence within the State of Missouri (e.g., type of facilities: sales offices; sales outlets; divisions; manufacturing; warehouse; other), including Missouri employee statistics.

Surdex Corporation has headquarters in Chesterfield, Missouri, and has been in existence for more than 60 years. Currently, over 95% of Surdex's employees are Missouri Citizens. We also lease a hangar facility at Spirit of St. Louis Airport (in St. Louis County) that houses our flight personnel, aircraft and maintenance staff.

Harris Corporation maintains a facility in the St. Louis Blanke Building (23,342 sq. ft.) at 1310 Papin Street, St. Louis Missouri 63103. They currently employ 60 full-time Harris employees at this facility who support of geospatial services being provided for NGA.

In addition, Harris Corporation is providing full-time employment for 35 full-time employees of three subcontractor companies they engage as the prime contractor. In total, Harris Corporation is employing approximately 95 fulltime employment personnel as a positive economic impact to the State of Missouri.

Team members EFK Moen and David Mason & Associates both maintain offices in St. Louis, Missouri, and their employees are primarily Missouri citizens.

EXHIBIT E: Participation Commitment

Minority Business Enterprise/Women Business Enterprise (MBE/WBE) and/or Organization for the Blind/Sheltered Workshop and/or Service-Disabled Veteran Business Enterprise (SDVE) Participation Commitment – If the vendor is committing to participation by or if the vendor is a qualified MBE/WBE and/or organization for the blind/sheltered workshop and/or a qualified SDVE, the vendor must provide the required information in the appropriate table(s) below for the organization proposed and must submit the completed exhibit with the vendor's proposal.

For Minority Business Enterprise (MBE) and/or Woman Business Enterprise (WBE) Participation, if proposing an entity certified as both MBE and WBE, the vendor must either (1) enter the participation percentage under MBE or WBE, or must (2) divide the participation between both MBE and WBE. If dividing the participation, do not state the total participation on both the MBE and WBE Participation Commitment tables below. Instead, divide the total participation as proportionately appropriate between the tables below.

MBE Participation Commitment Table		
(The services performed or the products provided by the listed MBE must provide a commercially useful function related to the delivery of the contractually-required service/product in a manner that will constitute an added value to the contract and shall be performed/provided exclusive to the performance of the contract.)		
Name of Each Qualified Minority Business Enterprise (MBE) Proposed	**Committed Percentage of Participation for Each MBE** (% of the Actual Total Contract Value)	**Description of Products/Services to be Provided by Listed MBE** *The vendor should also include the paragraph number(s) from the RFP which requires the product/service the MBE is proposed to perform and describe how the proposed product/service constitutes added value and will be exclusive to the contract.*
1. David Mason & Associates	10%	Product/Service(s) proposed: RFP Paragraph References:
2.	%	Product/Service(s) proposed: RFP Paragraph References:
3.	%	Product/Service(s) proposed: RFP Paragraph References:
4.	%	Product/Service(s) proposed: RFP Paragraph References:
Total MBE Percentage:	**10%**	

WBE Participation Commitment Table		
(The services performed or the products provided by the listed WBE must provide a commercially useful function related to the delivery of the contractually-required service/product in a manner that will constitute an added value to the contract and shall be performed/provided exclusive to the performance of the contract.)		
Name of Each Qualified Women Business Enterprise (WBE) proposed	**Committed Percentage of Participation for Each WBE** (% of the Actual Total Contract Value)	**Description of Products/Services to be Provided by Listed WBE** *The vendor should also include the paragraph number(s) from the RFP which requires the product/service the WBE is proposed to perform and describe how the proposed product/service constitutes added value and will be exclusive to the contract.*
1. EFK Moen	5%	Product/Service(s) proposed: RFP Paragraph References:
2.	%	Product/Service(s) proposed: RFP Paragraph References:
3.	%	Product/Service(s) proposed: RFP Paragraph References:
4.	%	Product/Service(s) proposed: RFP Paragraph References:
Total WBE Percentage:	**5%**	

EXHIBIT F: Documentation of Intent to Participate

EXHIBIT F

DOCUMENTATION OF INTENT TO PARTICIPATE

If the vendor is proposing to include the participation of a Minority Business Enterprise/Women Business Enterprise (MBE/WBE) and/or Organization for the Blind/Sheltered Workshop and/or qualified Service-Disabled Veteran Business Enterprise (SDVE) in the provision of the products/services required in the RFP, the vendor must either provide a recently dated letter of intent, signed and dated no earlier than the RFP issuance date, from each organization documenting the following information, or complete and provide this Exhibit with the vendor's proposal.

~ Copy This Form For Each Organization Proposed ~

Vendor Name: Surdex Corporation

This Section To Be Completed by Participating Organization:

By completing and signing this form, the undersigned hereby confirms the intent of the named participating organization to provide the products/services identified herein for the vendor identified above.

Indicate appropriate business classification(s):

X MBE ___ WBE ___ Organization for the Blind ___ Sheltered Workshop ___ SDVE

Name of Organization: (Name of MBE, WBE, Organization for the Blind, Sheltered Workshop, or SDVE)	David Mason & Associates, Inc.		
Contact Name:	Taylor B. Mason	Email:	tmason@davidmason.com
Address (If SDVE, provide MO Address):	800 S. Vandeventer Ave.	Phone #:	314.534.1030
City:	Saint Louis	Fax #:	314.534.1053
State/Zip:	Missouri 63110	Certification #	M000070
SDVE's Website Address:		Certification Expiration Date:	(or attach copy of certification) 3/1/2018
Service-Disabled Veteran's (SDV) Name: (Please Print)		SDV's Signature:	

PRODUCTS/SERVICES PARTICIPATING ORGANIZATION AGREED TO PROVIDE

Describe the products/services you *(as the participating organization)* have agreed to provide:

Survey Services

Authorized Signature

Authorized Signature of Participating Organization (MBE, WBE, Organization for the Blind, Sheltered Workshop, or SDVE)

3/7/2016
Date (Dated no earlier than the RFP issuance date)

EXHIBIT F

DOCUMENTATION OF INTENT TO PARTICIPATE

If the vendor is proposing to include the participation of a Minority Business Enterprise/Women Business Enterprise (MBE/WBE) and/or Organization for the Blind/Sheltered Workshop and/or qualified Service-Disabled Veteran Business Enterprise (SDVE) in the provision of the products/services required in the RFP, the vendor must either provide a recently dated letter of intent, signed and dated no earlier than the RFP issuance date, from each organization documenting the following information, or complete and provide this Exhibit with the vendor's proposal.

~ Copy This Form For Each Organization Proposed ~

Vendor Name: Surdex Corporation

This Section To Be Completed by Participating Organization:

By completing and signing this form, the undersigned hereby confirms the intent of the named participating organization to provide the products/services identified herein for the vendor identified above.

Indicate appropriate business classification(s):

___ MBE X WBE ___ Organization for the Blind ___ Sheltered Workshop ___ SDVE

Name of Organization: EFK Moen, LLC
(Name of MBE, WBE, Organization for the Blind, Sheltered Workshop, or SDVE)

Contact Name:	Linda Moen	Email:	llmoen@efkmoen.com
Address (If SDVE, provide MO Address):	13523 Barrett Parkway Dr. Suite 250	Phone #:	314-394-3100
City:	St. Louis	Fax #:	
State/Zip:	MO 63021	Certification #	REDWOSB15842
SDVE's Website Address:		Certification Expiration Date:	(or attach copy of certification) July 14, 2017
Service-Disabled Veteran's (SDV) Name: (Please Print)		SDV's Signature:	

PRODUCTS/SERVICES PARTICIPATING ORGANIZATION AGREED TO PROVIDE

Describe the products/services you *(as the participating organization)* have agreed to provide:

Field Surveying

Authorized Signature:

Linda Moen

Authorized Signature of Participating Organization
(MBE, WBE, Organization for the Blind, Sheltered Workshop, or SDVE)

3/9/2016
Date
(Dated no earlier than the RFP issuance date)

EXHIBIT G: Business Entity Certification (E-Verify)

BUSINESS ENTITY CERTIFICATION AND ENROLLMENT:

(Complete the following if you DO NOT have the E-Verify documentation and a current Affidavit of Work Authorization already on file with the State of Missouri. If completing Box B, do not complete Box C.)

BOX B – CURRENT BUSINESS ENTITY STATUS

I certify that Surdex Corporation (Business Entity Name) **MEETS** the definition of a business entity as defined in section 285.525, RSMo pertaining to section 285.530.

Ronald C. Hoffmann	R. C. Hoffmann
Authorized Business Entity Representative's Name (Please Print)	*Authorized Business Entity Representative's Signature*
Surdex Corporation	March 13, 2017
Business Entity Name	Date
RonHCrop@surdex.com	
E-Mail Address	

As a business entity, the vendor must perform/provide each of the following. The vendor should check each to verify completion/submission of all of the following:

☑ Enroll and participate in the E-Verify federal work authorization program (Website: http://www.uscis.gov/e-verify; Phone: 888-464-4218; Email: e-verify@dhs.gov) with respect to the employees hired after enrollment in the program who are proposed to work in connection with the services required herein;

AND

☑ Provide documentation affirming said company's/individual's enrollment and participation in the E-Verify federal work authorization program. Documentation shall include EITHER the E-Verify Employment Eligibility Verification page listing the vendor's name and company ID OR a page from the E-Verify Memorandum of Understanding (MOU) listing the vendor's name and the MOU signature page completed and signed, at minimum, by the vendor and the Department of Homeland Security – Verification Division. If the signature page of the MOU lists the vendor's name and company ID, then no additional pages of the MOU must be submitted;

AND

☑ Submit a completed, notarized Affidavit of Work Authorization provided on the next page of this Exhibit.

E-VERIFY MEMORANDUM OF UNDERSTANDING (MOU)

Provided below is the E-Verify Employment Eligibility Verification page listing the vendor's name and company ID OR a page from the E-Verify Memorandum of Understanding (MOU) listing the vendor's name and the MOU signature page completed and signed, at minimum, by the vendor and the Department of Homeland Security – Verification Division.

E-Verify

Company ID Number: 183675

To be accepted as a participant in E-Verify, you should only sign the Employer's Section of the signature page. If you have any questions, contact E-Verify at 888-464-4218.

Employer ***Surdex Corporation***

Robert Berger	
Name (Please Type or Print)	Title
Electronically Signed	**01/23/2009**
Signature	Date

Department of Homeland Security – Verification Division

USCIS Verification Division	
Name (Please Type or Print)	Title
Electronically Signed	**01/23/2009**
Signature	Date

Page 11 of 13 | E-Verify MOU for Employer | Revision Date 10/2/09 | www.dhs.gov/E-Verify

RFPS30034901700285
Photogrammetric Mapping Products and Services

EXHIBIT G, continued

AFFIDAVIT OF WORK AUTHORIZATION:

The vendor who meets the section 285.525, RSMo, definition of a business entity must complete and return the following Affidavit of Work Authorization.

Comes now Ronald C. Hoffmann, Surdex Corporation (Name of Business Entity Authorized Representative) as President (Position/Title) first being duly sworn on my oath, affirm Surdex Corporation (Business Entity Name) is enrolled and will continue to participate in the E-Verify federal work authorization program with respect to employees hired after enrollment in the program who are proposed to work in connection with the services related to contract(s) with the State of Missouri for the duration of the contract(s), if awarded in accordance with subsection 2 of section 285.530, RSMo. I also affirm that Surdex Corporation (Business Entity Name) does not and will not knowingly employ a person who is an unauthorized alien in connection with the contracted services provided under the contract(s) for the duration of the contract(s), if awarded.

In Affirmation thereof, the facts stated above are true and correct. (The undersigned understands that false statements made in this filing are subject to the penalties provided under section 575.040, RSMo.)

Authorized Representative's Signature	Debra Trautman Printed Name
Human Resource Manager Title	March 15, 2017 Date
debrat@surdex.com E-Mail Address	183675 E-Verify Company ID Number

Subscribed and sworn to before me this 15 (DAY) of March 2017 (MONTH, YEAR). I am commissioned as a notary public within the County of St. Louis County (NAME OF COUNTY), State of Missouri (NAME OF STATE), and my commission expires on June 13, 2020 (DATE).

Signature of Notary — *Date*: March 15, 2017

LORIE THOMAS
Notary Public - Notary Seal
State of Missouri, St Louis County
Commission Number 09416041
My Commission Expires Jun 13, 2020

State of Missouri Page | 108

EXHIBIT H: Certification

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION LOWER TIER COVERED TRANSACTIONS

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 29 CFR Part 98 Section 98.510, Participants' responsibilities. The regulations were published as Part VII of the May 26, 1988, Federal Register (pages 19160-19211).

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS FOR CERTIFICATION)

(1) The prospective recipient of Federal assistance funds certifies, by submission of this proposal, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective recipient of Federal assistance funds is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Surdex Corporation	00-633-2415
Company Name	DUNS # (if known)
Ronald C. Hoffmann	President
Authorized Representative's Printed Name	Authorized Representative's Title
Authorized Representative's Signature	March 13, 2017
	Date

Instructions for Certification

1. By signing and submitting this proposal, the prospective recipient of Federal assistance funds is providing the certification as set out below.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective recipient of Federal assistance funds knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the Department of Labor (DOL) may pursue available remedies, including suspension and/or debarment.
3. The prospective recipient of Federal assistance funds shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective recipient of Federal assistance funds learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective recipient of Federal assistance funds agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the DOL.
6. The prospective recipient of Federal assistance funds further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may but is not required to check the List of Parties Excluded from Procurement or Nonprocurement Programs.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntary excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the DOL may pursue available remedies, including suspension and/or debarment.

EXHIBIT I: Miscellaneous Information

Outside United States: If any products and/or services offered under this RFP are being manufactured or performed at sites outside the United States, the vendor MUST disclose such fact and provide details in the space below or on an attached page.

Are any of the vendor's proposed products and/or services being manufactured or performed at sites outside the United States?	Yes ____	No X
If YES, do the proposed products/services satisfy the conditions described in section 4, subparagraphs 1, 2, 3, and 4 of Executive Order 04-09? (see the following web link: http://s1.sos.mo.gov/CMSImages/Library/Reference/Orders/2004/eo04_009.pdf)	Yes ____	No ____

If YES, mark the appropriate exemption below, and provide the requested details:

1.____ Unique good or service.
- EXPLAIN:_____

2.____ Foreign firm hired to market Missouri services/products to a foreign country.
- Identify foreign country: _____

3.____ Economic cost factor exists
- EXPLAIN:_____

4.____ Vendor/subcontractor maintains significant business presence in the United States and only performs trivial portion of contract work outside US.
- Identify maximum percentage of the overall value of the contract, for any contract period, attributed to the value of the products and/or services being manufactured or performed at sites outside the United States: ___%
- Specify what contract work would be performed outside the United States: _____

Employee/Conflict of Interest:

Vendors who are elected or appointed officials or employees of the State of Missouri or any political subdivision thereof, serving in an executive or administrative capacity, must comply with sections 105.450 to 105.458, RSMo, regarding conflict of interest. If the vendor or any owner of the vendor's organization is currently an elected or appointed official or an employee of the State of Missouri or any political subdivision thereof, please provide the following information:

Name and title of elected or appointed official or employee of the State of Missouri or any political subdivision thereof:	None
If employee of the State of Missouri or political subdivision thereof, provide name of state agency or political subdivision where employed:	None
Percentage of ownership interest in vendor's organization held by elected or appointed official or employee of the State of Missouri or political subdivision thereof:	_____%

Registration of Business Name (if applicable) with the Missouri Secretary of State: The vendor should indicate the vendor's charter number and company name with the Missouri Secretary of State. Additionally, the vendor should provide proof of the vendor's good standing status with the Missouri Secretary of State. If the vendor is exempt from registering with the Missouri Secretary of State pursuant to section 351.572, RSMo., identify the specific section of 351.572 RSMo., which supports the exemption.

0082902	Surdex Corporation
Charter Number (if applicable)	*Company Name*
If exempt from registering with the Missouri Secretary of State pursuant to section 351.572 RSMo., identify the section of 351.572 to support the exemption:	

Proposed Subcontractors - The vendor should identify any subcontractor(s) proposed to provide any of the services required herein.

Proposed Subcontractor Name and Address	Service Proposed to be Provided by the Proposed Subcontractor
David Mason & Associates 800 South Vandeventer St. Louis, MO 63110	Field survey
EFK Moen 13523 Barrett Parkway, Suite 250 St. Louis, MO 63021	Field survey
Merrick & Associates Greenwood Village 5970 Greenwood Plaza Blvd. Greenwood Village, CO 80111	Fixed-wing and helicopter LiDAR acquisition and processing, mobile LiDAR acquisition and processing
Harris Corporation Harris Corporate Headquarters 1025 W. NASA Boulevard Melbourne, FL 32919	Geiger LiDAR acquisition and processing
ESP & Associates ESP & Associates 3475 Lakemont Blvd. Fort Mill, SC 29708	Mobile LiDAR acquisition and processing

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF PURCHASING (PURCHASING)
REQUEST FOR BEST AND FINAL OFFER (BAFO)
FOR REQUEST FOR PROPOSAL (RFP)

BAFO REQUEST NO.: 001
SOLICITATION/OPPORTUNITY (OPP) NO.: RFPS30034901700285
TITLE: Photogrammetric Mapping Products and Services
ISSUE DATE: 05/24/17

REQ NO.: NR 300 31957000001
BUYER: Jacqueline Satterlee
PHONE NO.: (573) 751-4925
E-MAIL: jacqueline.satterlee@oa.mo.gov

BAFO RESPONSE SHOULD BE RETURNED BY: 05/31/17 AT 5:00 PM CENTRAL TIME

MAILING INSTRUCTIONS: Print or type **RFP Number** and **Return Due Date** on the lower left hand corner of the envelope or package. Sealed BAFOs should be in Division of Purchasing office (301 W High Street, Room 630) by the return date and time.

RETURN BAFO RESPONSE TO:

(U.S. Mail)
PURCHASING
PO BOX 809
JEFFERSON CITY MO 65102-0809

or

(Courier Service)
PURCHASING
301 WEST HIGH STREET, RM 630
JEFFERSON CITY MO 65101-1517

CONTRACT PERIOD: Effective Date of Contract through One (1) Year

DELIVER SUPPLIES/SERVICES FOB (Free On Board) DESTINATION TO THE FOLLOWING ADDRESS:

State of Missouri
Various Agency Locations

The vendor hereby declares understanding, agreement and certification of compliance to provide the items and/or services, at the prices quoted, in accordance with all terms and conditions, requirements, and specifications of the original RFP as modified by any previously issued RFP addendums and by this and any previously issued BAFO requests. The vendor agrees that the language of the original RFP as modified by any previously issued RFP addendums and by this and any previously issued BAFO requests shall govern in the event of a conflict with his/her proposal. The vendor further agrees that upon receipt of an authorized purchase order from the Division of Purchasing or when a Notice of Award is signed and issued by an authorized official of the State of Missouri, a binding contract shall exist between the vendor and the State of Missouri.

SIGNATURE REQUIRED

VENDOR NAME	MissouriBUYS SYSTEM ID (SEE VENDOR PROFILE - MAIN INFORMATION SCREEN)
MAILING ADDRESS	
CITY, STATE, ZIP CODE	

CONTACT PERSON	EMAIL ADDRESS
PHONE NUMBER	FAX NUMBER
VENDOR TAX FILING TYPE WITH IRS (CHECK ONE) ___ Corporation ___ Individual ___ State/Local Government ___ Partnership ___ Sole Proprietor ___IRS Tax-Exempt	
AUTHORIZED SIGNATURE	DATE
PRINTED NAME	TITLE

BEST AND FINAL OFFER (BAFO) #001 to RFPS30034901700285

TITLE: Photogrammetric Mapping Products and Services

CONTRACT PERIOD: Effective Date of Contract through One (1) Year

The following exhibit in RFPS30034901700285 contains changes: Exhibit D

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF PURCHASING (PURCHASING)
REQUEST FOR PROPOSAL (RFP)

SOLICITATION/OPPORTUNITY (OPP) NO.: RFPS30034901700285
TITLE: Photogrammetric Mapping Products and Services
ISSUE DATE: 02/22/17

REQ NO.: NR 300 31957000001
BUYER: Jacqueline Satterlee
PHONE NO.: (573) 751--4925
E-MAIL: jacqueline.satterlee@oa.mo.gov

RETURN PROPOSAL NO LATER THAN: 03/15/17 AT 2:00 PM CENTRAL TIME (END DATE)

VENDORS ARE ENCOURAGED TO RESPOND ELECTRONICALLY THROUGH HTTPS://MISSOURIBUYS.MO.GOV BUT MAY RESPOND BY HARD COPY (See Mailing Instructions Below)

MAILING INSTRUCTIONS: Print or type **Solicitation/OPP Number** and **End Date** on the lower left hand corner of the envelope or package. Delivered sealed proposals must be in the Purchasing office (301 W High Street, Room 630) by the return date and time.

	(U.S. Mail)		(Courier Service)
RETURN PROPOSAL TO:	**PURCHASING**	**or**	**PURCHASING**
	PO BOX 809		**301 WEST HIGH STREET, RM 630**
	JEFFERSON CITY MO 65102-0809		**JEFFERSON CITY MO 65101-1517**

CONTRACT PERIOD: Effective Date of Contract through One (1) Year

DELIVER SUPPLIES/SERVICES FOB (Free On Board) DESTINATION TO THE FOLLOWING ADDRESS:

State of Missouri
Various Agency Locations

The vendor hereby declares understanding, agreement and certification of compliance to provide the items and/or services, at the prices quoted, in accordance with all requirements and specifications contained herein and the Terms and Conditions Request for Proposal (Revised 10/19/15). The vendor further agrees that the language of this RFP shall govern in the event of a conflict with his/her proposal. The vendor further agrees that upon receipt of an authorized purchase order from the Division of Purchasing or when a Notice of Award is signed and issued by an authorized official of the State of Missouri, a binding contract shall exist between the vendor and the State of Missouri. The vendor shall understand and agree that in order for their proposal to be considered for evaluation, they must be registered in MissouriBUYS. If not registered at time of proposal opening, the vendor must register in MissouriBUYS upon request by the state immediately after proposal opening.

SIGNATURE REQUIRED

VENDOR NAME	MissouriBUYS SYSTEM ID (SEE VENDOR PROFILE - MAIN INFORMATION SCREEN)
MAILING ADDRESS	
CITY, STATE, ZIP CODE	

CONTACT PERSON	EMAIL ADDRESS
PHONE NUMBER	FAX NUMBER
VENDOR TAX FILING TYPE WITH IRS (CHECK ONE) ___ Corporation ___ Individual ___ State/Local Government ___ Partnership ___ Sole Proprietor ___IRS Tax-Exempt	
AUTHORIZED SIGNATURE	DATE
PRINTED NAME	TITLE

Instructions for Submitting a Solicitation Response

The Division of Purchasing is now posting all of its bid solicitation documents on the new MissouriBUYS Bid Board (https://www.missouribuys.mo.gov). MissouriBUYS is the State of Missouri's web-based statewide eProcurement system which is powered by WebProcure, through our partner, Perfect Commerce.

For all bid solicitations, vendors now have the option of submitting their solicitation response either as an electronic response or as a hard copy response. As a means to save vendors the expense of submitting a hard copy response and to provide vendors both the ease and the timeliness of responding from a computer, vendors are encouraged to submit an electronic response. Both methods of submission are explained briefly below and in more detail in the step-by-step instructions provided at https://missouribuys.mo.gov/pdfs/how_to_respond_to_a_solicitation.pdf. (This document is also on the Bid Board referenced above.)

Notice: The vendor is solely responsible for ensuring timely submission of their solicitation response, whether submitting an online response or a hard copy response. Failure to allow adequate time prior to the solicitation end date to complete and submit a response to a solicitation, particularly in the event technical support assistance is required, places the vendor and their response at risk of not being accepted on time.

- **ELECTRONIC RESPONSES:** To respond electronically to a solicitation, the vendor must first register with MissouriBUYS by going to the MissouriBUYS Home Page (https://missouribuys.mo.gov), clicking the "Register" button at the top of the page, and completing the Vendor Registration. Once registered the vendor should log back into MissouriBUYS and edit their profile by selecting the organizational contact(s) that should receive an automated confirmation of the vendor's electronic bid responses successfully submitted to the state.

  To respond electronically to a solicitation, the vendor must login to MissouriBUYS, locate the desired solicitation on the Bid Board, and, at a minimum, the vendor must read and accept the Original Solicitation Documents and complete pricing and any other identified requirements. In addition, the vendor should download and save all of the Original Solicitation Documents on their computer so that they can prepare their response to these documents. Vendors should upload their completed response to these downloaded documents (including exhibits, forms, and other information concerning the solicitation) as an attachment to the electronic solicitation response. Step-by-step instructions for how a registered vendor responds to a solicitation electronically are available on the MissouriBUYS system at: https://missouribuys.mo.gov/pdfs/how_to_respond_to_a_solicitation.pdf.

  - Vendors are encouraged to submit their entire proposal electronically; however in lieu of attaching exhibits, forms, pricing, etc. to the electronic solicitation response, a vendor may submit the exhibits, forms, pricing, etc. through mail or courier service. However, any such submission must be received prior to the solicitation's specified end date and time. Be sure to include the solicitation/opportunity (OPP) number, company name, and a contact name on any hard copy solicitation response documents submitted through mail or courier service.

  - In the event a registered vendor electronically submits a solicitation response and also mails hard copy documents that are not identical, the vendor should explain which response is valid for the state's consideration. In the absence of such explanation, the state reserves the right to evaluate and award the response which serves its best interest.

Addendum Document: If an addendum document is subsequently issued, please follow these steps to accept the addendum document(s).

1. If you have not accepted the original solicitation document go to the **Overview** page, find the section titled, **Original Solicitation Documents**, review the solicitation document(s) then click on the box under **Select, and** then click on the **Accept** button.
2. To accept the addendum document, on the **Overview** page find the section titled **Addendum Document**, review the addendum document(s) then click on the box under **Select, and** then click on the **Accept** button.

Note: If you submitted an electronic response prior to the addendum date and time, you should review your solicitation response to ensure that it is still valid by taking into consideration the revisions addressed in the addendum document. If a revision is needed to your solicitation response and/or to indicate your acceptance of the addendum document, you will need to retract your response and re-submit your response by following these steps:

1. Log into **MissouriBUYS**.
2. Select the **Solicitations** tab.
3. Select **View Current Solicitations**.
4. Select **My List**.
5. Select the correct **Opportunity Number (Opportunity No)**; the **Overview** page will display.
6. Click on **Review Response** from the navigation bar.
7. Click on **Retract** if your response needs to be revised.
8. A message will come up asking, "Are you sure you want to retract the Bid". Click on **Continue** to confirm.
9. Click on **Respond** and revise as applicable.
10. Click on **Review Response** from the navigation bar and then click on **Submit** to submit your response.

- **HARD COPY RESPONSES**: Be sure to include the solicitation/opportunity (OPP) number, company name, and a contact name on any hard copy solicitation response documents.

End of Instructions for Submitting Solicitation Response

1. INTRODUCTION AND GENERAL INFORMATION

1.1 Introduction:

1.1.1 Organization - This document, referred to as a Request for Proposal (RFP), is divided into the following parts:

1) Introduction and General Information
2) Contractual Requirements
3) Proposal Submission Information
4) Pricing Page(s)
5) Exhibits A - I
6) Attachment 1 - 4
7) Terms and Conditions
8) Attachments 5, 6, and 7 - The vendor is advised that attachments exists to this document which provide additional information and instruction. The attachments are a separate link that must be downloaded from the MissouriBUYS Statewide eProcurement System at: https://missouribuys.mo.gov/bidboard.html. It shall be the sole responsibility of the vendor to obtain the attachments. The vendor shall not be relieved of any responsibility for performance under the contract due to the failure of the vendor to obtain copies of the attachments.

1.2 Background Information:

1.2.1 Member organizations of the Missouri Geographic Information Systems Advisory Committee (MGISAC), including agencies of the State of Missouri and the U.S. Geological Survey (USGS), have been contributors to previous statewide 2-foot imagery projects.

1.2.2 The State of Missouri has 10-meter Digital Elevation Model (DEM) coverage available for use by the contractor(s) as well as LiDAR-based elevation for select counties and areas.

1.2.3 Various state and local governmental agencies have expressed interest in the potential purchase of higher resolution imagery, including three-inch, six-inch, and one-foot pixel resolution imagery LiDAR, Digital Terrain Model, Digital Elevation, Contours Lines, and Planimetric Mapping.

1.2.4 Definitions and acronyms pertaining to the requirements of the RFP are included in Attachment 1.

1.2.5 The current contracts for aerial photography and mapping services are expiring. The contract numbers are C213036001 through C213036004.

a. Viewing the Contracts - Copies of the contracts can be viewed and printed from the Division of Purchasing's Awarded Bid & Contract Document Search System located on the internet at: http://oa.mo.gov/purchasing . In addition, all proposal and evaluation documentation leading to the award of the contracts may also be viewed and printed from the Division of Purchasing's Awarded Bid & Contract Document Search System. Please reference the Bid number B2Z13036 or the contract number(s) shown above when searching for these documents.

b. State Expenditures – The Missouri Accountability Portal (MAP) located on the internet at: http://mapyourtaxes.mo.gov/MAP/Expenditures/ provides financial data related to the purchase of the services under the contract. Be sure to read the information provided in the links to "Site Information" and "Disclaimer". Then search by the contract number shown above when searching for the financial information.

1.2.6 Although an attempt has been made to provide accurate and up-to-date information, the State of Missouri does not warrant or represent that the background information provided herein reflects all relationships or existing conditions related to this Request for Proposal.

2. CONTRACTUAL REQUIREMENTS

2.1 General Requirements:

2.1.1 The contractor shall provide photogrammetric mapping products and services for various state agencies throughout the State of Missouri (hereinafter referred to as the state agency).

a. For purposes of the contract, a state agency shall be defined as a division, section, bureau, office, program, board, regional/district office, etc., that exists within a department of Missouri State Government. For the purposes of this document, this shall also include the University of Missouri system and the Judicial and Legislative branches of the State of Missouri.

b. State agencies anticipated to utilize the contracts include but are not necessarily limited to:

1) Missouri Department of Conservation (MDC);
2) Missouri Department of Natural Resources (DNR);
3) Missouri Department of Transportation (MoDOT);
4) Missouri State Emergency Management Agency (SEMA); and
5) Missouri Department of Public Safety (DPS).

2.1.2 The contractor must provide an American Society of Photogrammetry and Remote Sensing (ASPRS) certified Photogrammetrist as the contractor's Project Manager.

2.1.3 The contractor shall provide one or more of the following photogrammetric mapping products and services as requested by the state agency. However, the State of Missouri does not guarantee that the following list is inclusive of all the photogrammetric mapping products and services that may be required by the state agency. The State of Missouri reserves the right to request related photogrammetric mapping products and services.

a. Acquisition of Digital Orthoimagery;
b. Acquisition of LiDAR Elevation Data;
c. Creation of Digital Terrain Model from LiDAR;
d. Creation of Digital Elevation Model from LiDAR;
e. Creation of Contours Lines; and
f. Planimetric Mapping.

2.1.4 The contractor shall understand and agree that the photogrammetric mapping products and services required herein will not require prevailing wage determinations or utilization of professional land surveyors as defined in section 327.272, RSMo.

a. The contractor shall not perform any services requiring payment of prevailing wage pursuant to section 290.250, RSMo. At any time during the effective period of the contract, if any requested or required services would involve prevailing wage, the contractor shall not perform the service and shall notify the state agency in writing of the reason. In such event, the State of Missouri shall obtain the needed services through alternative means in accordance with state law and regulations.

b. The contractor shall not perform any services requiring utilization of a professional land surveyor, as defined in section 327.272, RSMo, as the ground control surveyors performing work under the contract shall not be required to establish land boundary lines which would affect real property rights. At any time during the effective period of the contract, if any requested or required services would require utilization of a professional land surveyor, the contractor shall not perform the service and shall notify the state agency in writing of the reason. In such event, the State of Missouri shall obtain the needed services through alternative means in accordance with state law and regulations.

2.1.5 The contractor shall not provide raw or processed imagery or metadata obtained or created in performance of work related to this contract to any facility or individual located outside the United States.

2.1.6 The contractor shall not utilize individuals or facilities located outside the United States to perform services related to the contract.

2.1.7 The contractor shall provide all photogrammetric mapping products on mutually agreed upon media such as a portable hard drive. Interim, verification imagery may be verified by on-line verification tools. Partial deliveries may be made on DVD as appropriate. The state agencies may supply their own hard drives for all photogrammetric mapping products.

2.1.8 The contractor shall provide the services on an as needed, if needed basis. The State of Missouri does not guarantee any usage of the contract whatsoever. The contractor shall agree and understand that the contract shall be construed as a preferred use contract but shall not be construed as an exclusive arrangement. Preferred use means that any state agency needing the services should use the established contract unless it is determined to be in the best interest of the State of Missouri for a state agency at its own discretion, to obtain alternate services elsewhere.

2.1.9 All photogrammetric mapping products shall be in UTM, NAD83, ZONE 15 projection.

2.1.10 Cooperative Procurement Program - The contractor shall participate in the State of Missouri's Cooperative Procurement Program. The contractor shall provide photogrammetric mapping services and products as described herein under the terms and conditions, requirements, and specifications of the contract, including prices, to other government entities in accordance with the Technical Services Act (section 67.360, RSMo, which is available on the internet at: http://www.moga.mo.gov/mostatutes/stathtml/06700003601.html?&me=67.360.) The contractor shall further understand and agree that participation by other governmental entities is discretionary on the part of that governmental entity and the State of Missouri bears no financial responsibility for any payments due the contractor by such governmental entities.

a. Such governmental entities may include but are not limited to; counties, municipalities, school districts, fire departments, first aid squads, colleges, and universities. A list of entities eligible to purchase via the cooperative procurement program is available by clicking on the "Cooperative Procurement Members Listing" file located at the following link: http://oa.mo.gov/purchasing/cooperative-procurement-services.

b. The contractor shall agree and understand that it is possible that various governmental entities may partner to share costs of obtaining the photogrammetric mapping products and services available.

c. All photogrammetric mapping products acquired via the contract, that are jointly funded by the state and an authorized cooperative procurement entity(ies), including but not limited to:1 digital orthoimagery, digital elevation models, digital terrain models, metadata, etc. shall be the joint property of the State of Missouri and the cooperative procurement entity(ies) providing funds, without restrictions. All such photogrammetric mapping products shall be deemed to be in the public domain.

d. All photogrammetric mapping products acquired via the contract, that are acquired without the use of state agency funds, including but not limited to: digital orthoimagery, digital elevation models, digital terrain models, metadata, etc. shall be the sole property of the public entity acquiring the product. Such photogrammetric mapping products shall not be considered to be in the public domain.

2.1.11 The contractor shall perform all services in accordance with the provisions and requirements stated herein and to the sole satisfaction of the state agency.

2.2 Work Plan Requirements:

2.2.1 When the state agency has a need for photogrammetric mapping products and services (hereinafter referred to as "project," in this section), the state agency shall seek a work plan from all contractors as a means to (1) competitively bid a specific project, (2) to identify the specific tasks to be performed, and (3) to establish the total price to be paid to the awarded contractor upon completion of the specified tasks. The work plan process shall occur in a controlled sequence of proposals and approvals by the state agency's designated Project Manager as outlined below.

a. State agencies may decide to break up projects into multiple work plans. In that event, subsequent work plans may be issued to the contractor that was awarded the initial work plan without requesting competitive work plans provided (1) the state agency clearly indicates their intent to do so in the initial work plan request and (2) the scope of the entire project is considered in the evaluation of the initial work plan.

b. At the time the state agency needs to purchase a project, current pricing and availability to perform the work will be requested of all contractors, and the state agency will award the purchase to the "lowest and best" contractor at the time, in accordance with the requirements stated herein.

2.2.2 Work Plan Request- The state agency's designated Project Manager will present a written request for each work plan to all contractors for the project required, in a standard format. The state agency's request must explain the scope of the project and the tasks the state agency desires to be performed, including applicable business and technical specifications. In addition, the state agency will specify the evaluation criteria that will be utilized to determine the work plan award. If the contractor cannot provide services according to the state agency's needs or if the contractor does not provide the type of services required by the state agency, the contractor must immediately notify the state agency. The contractor shall make every effort to meet the needs of the state agency. The state agency shall document each instance of the contractor's inability to provide the required services. If the contractor continually or consistently is unable to provide the required services, the Division of Purchasing may elect to cancel the contract.

2.2.3 At a minimum, the state agency's work plan request should include the following information:

a. Introduction/Overview: Brief description of the project. Information provided to acquaint the contractor with the planned acquisition. In addition, the following information shall be provided:
   1) state agency name/address
   2) state agency designated Project Manager name, email, and phone number
   3) brief title of specific work plan project
   4) Work plan issue date
   5) Work plan response due date

b. Background: A description of how the project came to be, a description of why the project is being pursued and how it relates to other projects, summarization of any statutory authority or regulations affecting the overall requirement; and identification of any background materials attached to the work plan.

c. Objectives: Specific objectives that the project will achieve. This section should provide a concise overview of the project effort goals and objectives, and how the results or end products will be used.

d. Requirements/Tasks: Listing of specifications/performance requirements, standards, locations, tasks, deliverables, schedule, and assumptions. This section defines the tasks that the contractor must complete for the project. This section should provide a detailed itemization and description of all of the project tasks which shall be completed by the contractor (i.e. project work), including requirements for and specified frequency of any required status reports. The specified project tasks must be clearly stated and must be quantifiable.

e. Deliverables: This section should clearly state what the contractor must deliver. If different tasks have different delivery requirements, they must be clearly identified along with times within which the contractor must deliver. A description of the acceptance criteria as well as what documentation the contractor will obtain from the state agency to verify the state agency's receipt and approval of the deliverable work product.

f. Government Furnished Property: This section will identify any government-furnished property provided to the contractor such as Digital Elevation Model (DEM), specific data/information, etc.

2.2.4 Work Plan Response – By the date specified by the state agency in the work plan request, the contractor must respond with a work plan response which provides a statement of firm, fixed cost for the project and technical/service solution to fulfill the work plan request. At a minimum, the contractor's work plan response should include the following:

a. Project Overview: Statement of the contractor's understanding of the photogrammetric mapping project and the technical needs of the project.

b. Resources: A description of the contractor's resources that shall be provided to fulfill the work plan project to include but not limited to: personnel resources to be provided, facility/supply resources, aircraft and other equipment availability, etc. A description of the minimum qualifications for an individual including description outlining the skills, experience, and knowledge/education of the contractor's staff being offered for the work plan project.

c. Approach/Methodology: A description of how the contractor shall specifically go about completion of the work for the project. This description should include:

1) Project Management Plan, project tracking and reporting the progress of the project, etc.
2) Functional definition of requirements that outlines how the services and/or products shall be provided by the contractor. This description should describe how the requirements/specifications will be fulfilled by the proposed service offerings and to what degree the requirements are met and/or exceeded. This description should also include by whom, when, with what, why, where, etc., the requirements shall be satisfied by the contractor's proposed solution for the project.
3) Change Control Plan,
4) Issue Tracking Plan,
5) Assumptions, and
6) Quality Assurance (QA) Plan: A description should be included of the contractor's QA process to be utilized for the project tasks, schedule, deliverables, and testing in order to ensure that work related to the production of acceptable deliverables is on track and expectations are met or exceeded. The QA process shall be expected to be proactive to ensure not only that the schedule is met, but also that product and service quality is maintained.

d. Cost Response: Firm, fixed price(s) to fulfill the project defined in the work plan. All expenses, including travel-related expenses, must be included within the firm, fixed price(s). No separate or additional reimbursement shall be made for travel related expenses.

1) The firm, fixed price stated in the awarded work plan shall not be increased unless the state agency requests a corresponding increase in the scope of work under the work plan. In no event shall the contractor charge more than the total firm, fixed price for all deliverables as approved in the work plan by the state agency, unless the state agency later amends the work plan to increase the scope of work. Federally funded projects may require added levels of work plan cost response detail such as delineation of hourly rates and the number of hours used to derive the firm, fixed work plan project cost(s).

2) Work plan pricing shall be based on specific deliverable components of the project and shall not be based on monthly billing. If the contractor fails to deliver all the products/services specified in the work plan for a given deliverable, the payment for the deliverable shall be withheld until the deliverable has been provided to and accepted by the agency. Payment shall not be made in advance for any deliverable; all payments shall be made in arrears (i.e., upon delivery and acceptance of a deliverable).

2.2.5 Evaluation Of Work Plan Responses - Each competitive work plan shall be evaluated based on a 200 evaluation point scale with the cost analysis representing fifty percent (50%) of the evaluation points. The state agency shall document in writing their evaluation justification regarding their award determination. The state agency will choose the "lowest and best" among the contractors at the time each photogrammetric mapping product or service is needed.

a. The state agency shall have the right to reject a work plan proposal for a product/service due to, but not limited to, noncompliance with the following: proposed method, availability, delivery time, etc. If the unit of measure specified by the state agency is different than the manner in which the contractor offers the product/service, the contractor must clearly identify the proposed unit of measure in the contractor's cost quote. A unit price conversion will be done, by the state agency at the time of quotation, to fairly evaluate proposed prices.

b. Evaluation of Cost - The following evaluation point formula shall apply to determine cost evaluation points for each specific purchase:

Lowest Responsive Contractor's Price / Compared Contractor's Price	x	100 Maximum Cost Evaluation Points	=	Awarded Cost Evaluation Points

c. Evaluation of Subjective ("best" score) - For each work plan response received, the state agency shall conduct a subjective analysis in conducting a comparative assessment of the work plan responses and shall subjectively assign a point value of up to 100 points for the subjective portion of the evaluation. The state agency shall document in writing their evaluation justification regarding their assignment of points.

2.2.6 Approval and Award of Work Plan

a. For each work plan response, the state agency shall total (1) the cost points derived from the cost analysis and (2) the subjective evaluation score ("best" score) awarded during the work plan response evaluation process. The contractor with the highest total points shall be awarded the specific project.

b. The awarded contractor and the state agency's designated Project Manager must indicate mutual acceptance of the project by signing and dating the work plan response document. The state agency's designated Project Manager (1) must retain one signed copy; and(2) must send one copy of the signed and awarded work plan to the contractor awardee. The state agency will inform all responding contractors as to who received the award.

2.2.7 Implementation/Execution of Work Plan - After receipt of state agency written acceptance of a work plan for the project, the contractor shall perform the services required in accordance with the approved work plan accepted by the state agency. Unless otherwise specified in the work plan, the contractor shall furnish all material, labor, facilities, equipment, and supplies necessary to perform the services.

2.2.8 Modifications to Work Plan - After implementation/execution of a work plan, modifications to the approved work plan shall be permitted due to changing economic conditions, changes to state and federal laws or regulations, or for other reasons pursuant to the following conditions:

a. State Agency Requested Changes – If the state agency determines that modifications to the approved work plan are necessary or desired, the state agency will document the requested changes to the contractor with any new instructions for the project. Based on the written instructions provided by the state agency, the contractor must revise the work plan according to the requirements for the work plan specified herein, including any resulting changes in the timeline, amount to be paid to the contractor, etc.

b. Contractor Requested Changes - If, after implementation of services, the contractor determines that modifications to the approved work plan are necessary, the contractor must submit a written request to the state agency for changes. The written request must include the reason for the modification and must detail the contractor's proposed changes to the approved work plan, including any resulting changes in the timeline, amount to be paid to the contractor, etc. The contractor shall agree and understand that the state agency will review the written request of the contractor and the contractor shall be notified in writing by the project manager of approval or disapproval of the request.

c. The contractor shall agree and understand that the state agency shall have the final approval of all individual components of the approved work plan revised as specified herein and reserves the right to require modifications (including changes in the price, completion date, etc), deletions, and or additional elaboration to the approved work plan. The contractor shall agree and understand that the decision by the state agency shall be final and without recourse.

d. The contractor shall not proceed with implementation of services related to the modifications until final written approval of the state agency is obtained.

2.2.9 Termination of Work Plan - The state agency shall have the right to terminate any project at any time at the sole discretion of the state agency, without penalty or recourse, by giving written notice to the contractor at least five working days prior to the effective date of such termination. However, the state agency will make every attempt to provide the contractor with more than five working days notice. In the event of termination pursuant to this paragraph, all documents, data, reports, and accomplishments prepared, furnished or completed by the contractor pursuant to the terms of the contract shall, at the option of the State of Missouri, become the property of the State of Missouri. The contractor shall be entitled to receive just and equitable compensation for work completed in accordance with the work plan prior to the effective date of the termination.

2.3 Acquisition of Digital Orthoimagery Requirements: If the state agency's work plan request is for digital orthoimagery, the contractor shall comply with the following when providing digital orthoimagery services:

2.3.1 Upon request of the state agency, the contractor shall provide complete, true color, CIR, or 4-band near infrared, leaf-off digital orthoimagery services and metadata for one, some, or all of the Missouri counties listed in Attachment 2.

a. The leaf-off flying season for Missouri shall be considered as the period February 15th through April 15th. All leaf-off imagery must be acquired during this period unless otherwise approved, in writing by the ordering state agency, by the Director of the Office of Geospatial Information (OGI) or his/her designee.

b. All imagery shall be two (2) foot pixel resolution meeting the ASPRS Accuracy Standards at 1" = 400' scale, unless a higher resolution is specified by the state agency.

c. The contractor must deliver full tiles for all imagery of areas on and within the State of Missouri's borders.

1) The contractor should provide full tiles for all imagery that includes the State of Missouri's borders. However, at the sole discretion of the state agency, tiles with partial image coverage

may be allowed for specific projects that include areas along the State of Missouri's borders. In the event the state agency allows tiles with partial image coverage, the tiles must include a minimum 600 meter buffer outside the State of Missouri's borders.

d. The contractor's survey control shall be considered part of the deliverable product. All survey control performed by the contractor must be done by a surveyor registered in the state of Missouri. The contractor shall be responsible for providing surveyors when needed to meet the requirements of a project.

e. All metadata records, including those from any buy-ups, shall become part of the State Clearinghouse hosted by the Missouri Spatial Data Information Service (MSDIS).

f. The contractor must provide the actual dates that imagery was collected. This information must be incorporated in the metadata and may also be supplied in a separate shapefile, or geodatabase for incorporation into mapping systems.

g. All imagery shall be delivered in a MrSid and GeoTIFF format. GeoTIFFs will include an infotag as describe in Attachment 3.

2.3.2 The contractor should use a digital sensor camera to acquire the imagery; however, the contractor may utilize an analog (film) camera for smaller areas of higher resolution based on the contractor's best judgment and subject to the state agency's approval. The contractor shall not mix digital and analog cameras at the same resolution (e.g. 2-foot).

a. If digital sensors are utilized by the contractor, the digital sensors should be of the same type and model to ensure homogeneous coverage throughout the entire project.

b. The contractor shall collect elevation data, at no charge to the State of Missouri, where required to prepare digital imagery that meet the requirements contained in this document. The State of Missouri has 10 meter Digital Elevation Model (DEM) coverage that can be provided for use by the contactor. In addition, LiDAR data for select areas is available through MSDIS to supplement the elevation base.

c. The contractor shall ensure all bridges and highway overpasses are in the correct position on each tile delivered.

d. The contractor shall ensure all divided highways in the coverage area are properly controlled to eliminate wavy linear features on the tile.

2.3.3 The contractor shall deliver imagery tiles meeting all mandatory requirements, specifications, and guidelines of the Digital Orthoimagery, FGDC-STD-014.2-2008: http://www.fgdc.gov/standards/projects/FGDC-standards-projects/framework-data-standard/GI_FrameworkDataStandard_Part2_DigitalOrthoimagery.pdf

2.4 Acquisition of LiDAR Elevation and Terrain Data Requirements: If the state agency's work plan request is for LiDAR Acquisition, the contractor shall comply with the following when providing LiDAR Acquisition services:

2.4.1 Unless specified otherwise in a state agency work plan, the contractor shall deliver LiDAR imagery meeting all mandatory requirements, specifications, and guidelines of the National Geospatial Program LiDAR Guidelines and Base Specification Version 1: https://pubs.usgs.gov/tm/11b4/pdf/tm11-B4.pdf

2.4.2 The contractor shall collect LiDAR data using a fully calibrated system capable of collecting multiple echoes per pulse with a minimum of a first, last, and one intermediate return. The contractor's system must also be able to collect the intensity (LiDAR pulse signal strength) for each return signal.

2.4.3 Quality Assurance –The contractor shall provide two (2) copies of an accuracy report. The contractor shall produce, for the state agency, an accuracy report in the form of a letter type report detailing all aspects of the LIDAR flight, including a description of the fieldwork and detailed office data processing procedures. The contractor's description shall include location, navigation and control, operations, all survey logs and data sheets used or acquired under the task order, any difficulties encountered, (including discrepancies with maps, etc.), and how the discrepancies were resolved. The contractor's accuracy report shall include interpretation and analysis of the results of the survey, including data quality, coverage of the area, and a summary of the findings. The accuracy report summary shall be included in the transmittal letter documenting the electronic data delivered as a result of the survey.

2.4.4 Quality Control Plan – The contractor shall have a Quality Control Plan in place that the contractor's assigned individual of the contractor must implement. The contractor's Quality Control Plan must have parameters in place to assure that all services required by the project are performed and provided in a manner that meets professional architectural and engineering quality standards. At a minimum, competent, independent reviewers shall technically review all documents. Performance of the independent technical review (ITR) should not be accomplished by the same element that produced the product.

a. The contractor's person assigned to carry out the Quality Control Plan must be present during the times work is in progress and shall be responsible for assuring that all documents on the project have been coordinated. This individual shall possess extensive, verifiable LiDAR and photogrammetric experience. The contractor shall notify the state agency, in writing, of the name of the individual and the name of an alternate person assigned to the position.

2.4.5 Metadata and Reports for LiDAR

a. The contractor must submit metadata compliant with the Federal Geographic Data Committee's (FGDC) Content Standard for Digital Geospatial Metadata in extensible markup language (.xml) format. The contractor must create Metadata on a sub-project tile level for each product deliverable.

b. Metadata shall include as a minimum the following sections:

1) Identification Information
2) Data quality information (this section of the Metadata may be updated after the quantitative assessment) and must include all process steps.
3) Spatial Data Organization Information
4) Spatial Reference Information
5) Entity and Attribute Information
6) Metadata Reference Information
7) Date of acquisitions
8) System type and system collection parameters (flying height, Scan FOV full angle, pulse rate, scanner frequency, side-lap percentage, point density etc.)
9) Nominal point density
10) Calibration procedures
11) Base station control information

c. Metadata shall be supplemented with projects reports where the report conveys additional information not suitable for metadata. If surveying to establish new stations was performed, a survey report that includes the following information must be provided by the contractor:

1) Collection Report (detailing mission planning and flight logs)
2) Survey Report (detailing the collection of control and reference points used for calibration and QA/QC).
3) Processing Report (detailing calibration, classification, and product generation procedures)

4) QA/QC Reports detailing the analysis, accuracy assessment, and validation of:
   - The point data (absolute, within swath, and between swath)
   - The bare-earth surface (absolute)
   - Other optional deliverables as appropriate
   - Control and Calibration points: All control and reference points used to calibrate, control, process, and validate the LiDAR point data or any derivative products are to be delivered.
   - Geo-referenced, digital spatial representation of the extents of each delivered dataset. Polygon shapefile is preferred.
   - Deliverables metadata (FGDC compliant, XML format metadata).
5) One file for each: county, lift, and tiled deliverable product group (classified point data, bare-earth DEMs)

d. The contractor shall understand and agree that Metadata files for individual original tiles are not required.

2.5 Creation of Digital Elevation Models (DEM) and Digital Terrain Models (DTM) from the LiDAR Requirements: If the state agency's work plan request is for DEM/DTM, the contractor shall comply with the following when providing DEM services:

2.5.1 Unless specified otherwise in the state agency's work plan, the contractor shall deliver DEM/DTM meeting all mandatory requirements, specifications, and guidelines of the National Geospatial Program LiDAR Guidelines and Base Specification Version 1: https://pubs.usgs.gov/tm/11b4/pdf/tm11-B4.pdf .

2.6 Creation of Contour Line Requirements: If the state agency's work plan request is for contour creation, the contractor shall comply with the following when providing contour creation services:

2.6.1 The contractor shall develop contours that are certified to meet or exceed ASPRS Accuracy Standards at the state agency's requested scale. Contours must be delivered in the format approved by the state agency.

2.6.2 Unless specified otherwise in the state agency's work plan, the contractor shall deliver contours derived from DEM/DTM meeting all mandatory requirements, specifications, and guidelines of the National Geospatial Program LiDAR Guidelines and Base Specification Version 1: https://pubs.usgs.gov/tm/11b4/pdf/tm11-B4.pdf

2.7 Planimetric Mapping Requirements: If the state agency's work plan request is for planimetric mapping, the contractor shall comply with the following when providing planimetric mapping services:

2.7.1 The contractor's planimetric mapping task shall compile hydrographic and impervious features, using analytical stereo photogrammetric methods that meet ASPRS Class 1 accuracy standards at the state agency's requested scale.

2.7.2 The contractor shall compile any-and-or-all planimetric layers listed in Attachment 4 below as specified by the state agency.

2.7.3 The contractor shall compile features as coincident lines if more than one (1) line feature is coincident with another line feature.

2.7.4 The contractor's point, line, and polygon features shall be constructed as topologically correct geometries in ESRI geodatabase, DGN, DWG, or other format that will allow the state agency to easily integrate the layers with existing GIS layers.

2.7.5 The contractor must deliver all feature layers listed in Attachment 4 as separate layers. A tiling system approved by the state agency may be used by the contractor to facilitate the pilot area map and to check plot production.

a. The state agency reserves the right to request alternative deliverable options for the purpose of reducing cost, including limited data collection to collection of changed features only, mapping a reduced set of features, etc.

2.8 Buy-Up Requirements: If the state agency's work plan request is for buy-up services, the contractor shall comply with the following when providing buy-up services:

2.8.1 If requested by a state agency, the contractor shall deliver imagery that may be used for stereo coverage of a specified project area.

2.8.2 Buy-ups shall be defined as improvements over the standard two (2)-ft leaf-off True Color /CIR that may be purchased by a state agency.

a. The contractor's one (1)-foot imagery shall meet the accuracy specifications for 1"=400' mapping with a RMSE of 8.0 feet using ASPRS Accuracy Standard for Large Scale Maps, Class 1 Map Accuracy.

b. The contractor's file naming for higher resolution buy-up areas shall be determined by the state agency.

c. The contractor's six (6) inch imagery shall meet accuracy specifications for 1"=100' mapping with a RMSE of 2.0 feet using ASPRS Accuracy Standard for Large Scale Maps, Class 1 Map Accuracy.

d. The contractor's three (3)-inch imagery shall meet accuracy specifications for 1"=25' mapping with a RMSE of 0.5 feet using ASPRS Accuracy Standard for Large Scale Maps, Class 1 Map Accuracy.

2.8.3 Improved Elevation Data: If requested by a state agency, the contractor shall deliver any improved elevation model information collected for the buy-up project area. Any such adjusted elevation models delivered by the contractor shall be public domain. If specified in the state agency's work plan, the contractor shall provide an elevation model with the level of detail required for submission to the USGS National Elevation Dataset. At the sole option of the state agency, the state agency shall be responsible for submission of the elevation model to the USGS National Elevation Dataset as well as to the Missouri Spatial Data Information Service. The contractor shall not be required to submit elevation models to the USGS National Elevation Dataset and the Missouri Spatial Data Information Service.

2.8.4 The contractor shall provide prior notification to the Director of OGI when the contractor is requested to provide buy-up services.

2.9 Reporting Requirements:

2.9.1 The contractor must submit the reports electronically, in an analysis-ready format specified by the state agency, such as Microsoft Excel or Access. Reports in PDF or similar format shall be considered unacceptable unless specifically requested by or approved by the state agency.

2.9.2 The contractor must maintain financial and accounting records and evidence pertaining to the contract in accordance with generally accepted accounting principles and other procedures specified by the state agency.

a. The contractor shall make all such records, books, and other documents relevant to the contract available to the state agency and its designees and the Missouri State Auditor in a format acceptable to the state agency at all reasonable times during the term of the contract.

b. The contractor shall retain all such records according to the state agency's retention period or the completion of an independent audit, whichever is later. If any litigation, claim, negotiation, audit,

investigation, or other actions involving the records has been started before the expiration of the retention period, the contractor shall retain such records until completion of such action and resolution of all issues that arise from it.

c. The contractor shall permit the state agency, governmental auditors, and authorized representatives of the State of Missouri to audit or examine, copy, or investigate any of the contractor's records, procedures, books, documents, papers, and records recording receipts and disbursements of any of the funds paid to the contractor. Failure to retain adequate documentation for any service billed may result in recovery of payments for services not adequately documented. Any audit exception noted by governmental auditors shall not be paid by the state agency and shall be the sole responsibility of the contractor. However, the contractor may contest any such exception by any legal procedure the contractor deems appropriate. The state agency will pay the contractor all amounts which the contractor may ultimately be held entitled to receive as a result of any such legal action.

2.9.3 Missouri Statewide Contract Quarterly Administrative Fee:

a. The contractor shall pay a one percent (1%) administrative fee to the State of Missouri which shall apply to all payments received by the contractor for all products and services provided under the contract. Payment of the one percent administrative fee shall be non-negotiable.

b. The contractor shall pay the administrative fee at the end of each calendar quarter (i.e. March 31, June 30, September 30, December 31). The total administrative fee for a given quarter must equal one percent (1%) of the total payments (minus returns and credits) received by the contractor during the calendar quarter as reported on the contractor's Missouri Statewide Contract Quarterly Administrative Fee Report specified below. The administrative fee must be received by the Division of Purchasing (Purchasing) no later than the 15th calendar day of the month immediately following the end of the calendar quarter, unless the 15th is not a business day in which case the next business day thereafter shall be considered the administrative fee deadline.

1) Payments shall be made using one of the following acceptable payment methods:

- **Check:** Personal check, company check, cashier's check, or money order made payable to the "Missouri Revolving Information Technology Trust Fund" and sent to the following mailing address: Division of Purchasing, P.O. Box 809, Jefferson City, MO 65102 – 0809 OR Division of Purchasing, 301 West High Street, Room 630, Jefferson City, MO 65101-1517. The contractor's payment by check shall authorize the State of Missouri to process the check electronically. The contractor understands and agrees that any returned check from the contractor may be presented again electronically and may be subject to additional actions and/or handling fees.

- **Electronic Payment**: Instructions on how to submit payments electronically by automated clearing house (ACH) will be provided upon request by contacting the Division of Purchasing at (573) 751-2387.

c. All payments of the administrative fee shall include the contract number on any check or transmittal document. However, only one contract number must be entered on a check or transmittal document. If submitting an administrative fee payment for more than one contract, then a separate check or electronic payment and associated transmittal document must be submitted by the contractor for each contract.

2.9.4 Missouri Statewide Contract Quarterly Administrative Fee Report:

a. The contractor shall submit a Missouri Statewide Contract Quarterly Administrative Fee Report to the Division of Purchasing which shall identify the total payments (minus returns and credits)

received by the contractor from state agencies, political subdivisions, universities, and governmental entities in other states that were made pursuant to the contract.

b. The contractor shall prepare and submit the Missouri Statewide Contract Quarterly Administrative Fee Report at the end of each calendar quarter (i.e. March 31, June 30, September 30, December 31) for total payments (minus returns and credits) received by the contractor during the calendar quarter. The Missouri Statewide Contract Quarterly Administrative Fee Report must be received by the Division of Purchasing (Purchasing) no later than the 15th calendar day of the month following the reporting quarter entered on the report, unless the 15th is not a business day in which case the next business day thereafter shall be considered the reporting deadline. Even if there has been no usage of the contract during the reporting quarter, the contractor must still submit a report and indicate no payments were received by marking the appropriate box on the report form.

c. The Missouri Statewide Contract Quarterly Administrative Fee Report form may be downloaded from the following Purchasing website: http://oa.mo.gov/purchasing/vendor-information. The Missouri Statewide Contract Quarterly Administrative Fee Report is also included herein as Attachment 6. The Missouri Statewide Contract Quarterly Administrative Fee Report must be submitted using one of the following methods:

Mail: Division of Purchasing,
P.O. Box 809, Jefferson City MO 65102-0809

OR

Division of Purchasing,
301 West High Street, Room 630, Jefferson City, MO 65101-1517
Fax: (573) 526-9815
Email: ereports@oa.mo.gov

d. The contractor shall agree that the Division of Purchasing reserves the right to modify the requested format and content of the Missouri Statewide Contract Quarterly Administrative Fee Report by providing thirty (30) calendar days written notice to the contractor. The contractor shall also agree the Division of Purchasing may unilaterally amend the contract, with thirty (30) calendar days notice to the contractor to change the method of payment of the administrative fee, the timing for submission of the Missouri Statewide Contract Quarterly Administrative Fee Report, and/or timing for payment of the administrative fee. The contractor shall understand and agree that if such an amendment is issued by the Division of Purchasing, the contractor shall comply with all contractual terms, as amended.

2.9.5 Missouri Statewide Contract Quarterly Usage Report:

a. The contractor shall submit a Missouri Statewide Contract Quarterly Usage Report to the Division of Purchasing (Purchasing) and the Director of OGI which shall provide the Data Element information listed below:

Contractor Name	Contractor name as it appears on the contract.
Statewide Contract Number	Statewide contract number as listed on the cover page of your contract with the State of Missouri.
Report Contact Name	Name of the person completing the report on behalf of the contractor.
Contact Phone Number	Phone number for the person completing the report.
Contact Email Address	Email address for the person completing the report.
Date Report Submitted	Date the Missouri Statewide Contract Quarterly Usage Report is submitted

	to Purchasing.
Reporting Quarter	Quarter for which the contractor is reporting purchases on the contract.
Entity Type	Indicate the type of entity by entering "S" for Missouri state agency, "P" for Missouri political subdivision, "U" for Missouri university, or "O" for political subdivision or state entity from another state.
Customer Name	Customer's name. If the customer has multiple locations, please only use the main entity name.
Product or Service Description	Description of product or service purchased.
Purchase Authorization Number/Identifier	Purchase Authorization Number/Identifier supplied by customer to contractor. Enter PO or other authorization number/identifier. If procurement card used, enter "P-Card".
Contract Line Item Number	Line item number on the contract.
Quantity Delivered	Quantity (i.e. excluding returns) of products delivered. Enter a quantity of "1" for a service/project.
Unit Price Charged	Unit Price Charged (i.e. excluding credits) for the product or service purchased.
Extended Price	Quantity Delivered X Unit Price Charged.

b. The contractor shall prepare and submit the Missouri Statewide Contract Quarterly Usage Report at the end of each calendar quarter (i.e. March 31, June 30, September 30, December 31) for the purchases made under the contract during the calendar quarter. The Missouri Statewide Contract Quarterly Usage Report must be received by the Division of Purchasing no later than the 15th calendar day of the month following the reporting quarter entered on the Missouri Statewide Contract Quarterly Usage Report, unless the 15th is not a business day in which case the next business day thereafter shall be considered the reporting deadline. Even if there has been no usage of the contract during the reporting quarter, the contractor must still submit a report and indicate no purchases were made.

c. The contractor must submit a Missouri Statewide Contract Quarterly Usage Report electronically either utilizing the "Missouri Statewide Contract Quarterly Usage Report" worksheet included herein in Attachment 7 which is downloadable from http://oa.mo.gov/purchasing/vendor-information or utilizing another format which is Excel-exportable. The contractor must submit the Missouri Statewide Contract Quarterly Usage Report to the following email address: ereports@oa.mo.gov.

d. The contractor shall agree that the Division of Purchasing reserves the right to modify the requested format and content of the Missouri Statewide Contract Quarterly Usage Report by providing thirty (30) calendar days' written notice to the contractor. The contractor shall also agree the Division of Purchasing may unilaterally amend the contract, with thirty (30) calendar days' notice to the contractor to change the timing for submission of the Missouri Statewide Contract Quarterly Usage Report. The contractor shall understand and agree that if such an amendment is issued by the Division of Purchasing, the contractor shall comply with all contractual terms, as amended.

2.10 Invoicing and Payment Requirements:

2.10.1 Prior to any payments becoming due under the contract, the contractor must update their vendor registration with their ACH-EFT payment information at https://MissouriBUYS.mo.gov.

a. The contractor understands and agrees that the State of Missouri reserves the right to make contract payments through electronic funds transfer (EFT).

b. The contractor must submit invoices on the contractor's original descriptive business invoice form and must use a unique invoice number with each invoice submitted. The unique invoice number will be listed on the State of Missouri's EFT addendum record to enable the contractor to properly apply the state agency's payment to the invoice submitted. The contractor may obtain detailed information for payments issued for the past 24 months from the State of Missouri's central accounting system (SAM II) on the Vendor Services Portal at:
https://www.vendorservices.mo.gov/vendorservices/Portal/Default.aspx

2.10.2 Invoicing –

a. Within thirty (30) calendar days after completion of the project and in accordance with the mutually agreed work plan, the contractor shall submit an invoice to the state agency. The contractor shall submit all invoices to the invoice address noted on the authorized order received from the state agency requesting services.

2.10.3 Payments – Upon receipt and approval of any specific reports and the contractor's invoice, the contractor shall be paid in accordance with the approved invoice prices.

2.10.4 Other than the payments specified above, no other payments or reimbursements shall be made to the contractor for any reason whatsoever including, but not limited to taxes, travel expenses, shipping charges, insurance, interest, penalties, termination payments, attorney fees, liquidated damages, etc.

2.10.5 Notwithstanding any other payment provision of the contract, if the contractor fails to perform required work or services, fails to submit reports when due, or is indebted to the United States, the state agency may withhold payment or reject invoices under the contract.

2.10.6 Final invoices are due by no later than thirty (30) calendar days of the expiration of the contract. The state agency shall have no obligation to pay any invoice submitted after the due date.

2.10.7 If a request by the contractor for payment or reimbursement is denied, the state agency shall provide the contractor with written notice of the reason(s) for denial.

2.10.8 If the contractor is overpaid by the state agency, upon official notification by the state agency, the contractor shall provide the state agency (1) with a check payable as instructed by the state agency in the amount of such overpayment at the address specified by the state agency or (2) deduct the overpayment from the monthly invoices as requested by the state agency.

2.10.9 The contractor shall understand that each state agency utilizing the contractor's services shall be solely responsible for payment for only those services requested by that state agency.

2.11 Other Contractual Requirements:

2.11.1 Contract - A binding contract shall consist of: (1) the RFP, addendums thereto, and any Best and Final Offer (BAFO) request(s) with RFP changes/additions, (2) the contractor's proposal including any contractor BAFO response(s), (3) clarification of the proposal, if any, and (4) the Division of Purchasing's acceptance of the proposal by "notice of award". All Exhibits and Attachments included in the RFP shall be incorporated into the contract by reference.

a. A notice of award issued by the State of Missouri does not constitute an authorization for shipment of equipment or supplies or a directive to proceed with services. Before providing equipment, supplies, and/or services for the State of Missouri, the contractor must receive a properly authorized purchase order or other form of authorization given to the contractor at the discretion of the state agency.

b. The contract expresses the complete agreement of the parties and performance shall be governed solely by the specifications and requirements contained therein.

c. Any change to the contract, whether by modification and/or supplementation, must be accomplished by a formal contract amendment signed and approved by and between the duly authorized representative of the contractor and the Division of Purchasing prior to the effective date of such modification. The contractor expressly and explicitly understands and agrees that no other method and/or no other document, including correspondence, acts, and oral communications by or from any person, shall be used or construed as an amendment or modification to the contract.

2.11.2 Contract Period - The original contract period shall be as stated on the Notice of Award. The contract shall not bind, nor purport to bind, the state for any contractual commitment in excess of the original contract period. The Division of Purchasing shall have the right, at its sole option, to renew the contract for two (2) additional one-year periods, or any portion thereof. In the event the Division of Purchasing exercises such right, all terms and conditions, requirements and specifications of the contract shall remain the same and apply during the renewal period, pursuant to applicable option clauses of this document.

a. In addition, the Division of Purchasing shall have the right, at its sole option, to extend the contract as necessary to allow for the completion of photogrammetric mapping product and services that are assigned for completion beyond the expiration of the contract. Such photogrammetric mapping product and services must have been assigned to the contractor (1) prior to the expiration of the contract, and (2) prior to the award of any succeeding contract. In the event the Division of Purchasing exercises such right, all other terms and conditions, requirements and specifications of the contract, including prices, applicable to photogrammetric mapping product and services shall remain the same and shall apply during the extension period.

2.11.3 Termination - The Division of Purchasing reserves the right to terminate the contract at any time, for the convenience of the State of Missouri, without penalty or recourse, by giving written notice to the contractor at least thirty (30) calendar days prior to the effective date of such termination. In the event of termination pursuant to this paragraph, all documents, data, reports, supplies, equipment, and accomplishments prepared, furnished or completed by the contractor pursuant to the terms of the contract shall, at the option of the Division of Purchasing, become the property of the State of Missouri. The contractor shall be entitled to receive compensation for services and/or supplies delivered to and accepted by the State of Missouri pursuant to the contract prior to the effective date of termination.

2.11.4 Transition:

a. The contractor shall work with the state agency and any other organizations designated by the state agency to ensure an orderly transition of services and responsibilities under the contract and to ensure the continuity of those services required by the state agency.

b. Upon expiration, termination, or cancellation of the contract, the contractor shall assist the state agency to ensure an orderly and smooth transfer of responsibility and continuity of those services required under the terms of the contract to an organization designated by the state agency. If requested by the state agency, the contractor shall provide and/or perform any or all of the following responsibilities:

1) The contractor shall deliver, FOB destination, all records, documentation, reports, data, recommendations, or printing elements, etc., which were required to be produced under the terms of the contract to the state agency and/or to the state agency's designee within seven (7) days after receipt of the written request in a format and condition that are acceptable to the state agency.

2) The contractor shall discontinue providing service or accepting new assignments under the terms of the contract, on the date specified by the state agency, in order to ensure the completion of such service prior to the expiration of the contract.

3) If requested in writing via formal contract amendment, the contractor shall continue providing any part or all of the services in accordance with the terms and conditions, requirements and specifications of the contract for a period not to exceed sixty (60) calendar days after the expiration, termination, or cancellation date of the contract for a price not to exceed those prices set forth in the contract.

2.11.5 Contractor Liability - The contractor shall be responsible for any and all personal injury (including death) or property damage as a result of the contractor's negligence involving any equipment or service provided under the terms and conditions, requirements and specifications of the contract. In addition, the contractor assumes the obligation to save the State of Missouri, including its agencies, employees, and assignees, from every expense, liability, or payment arising out of such negligent act.

a. The contractor also agrees to hold the State of Missouri, including its agencies, employees, and assignees, harmless for any negligent act or omission committed by any subcontractor or other person employed by or under the supervision of the contractor under the terms of the contract.

b. The contractor shall not be responsible for any injury or damage occurring as a result of any negligent act or omission committed by the State of Missouri, including its agencies, employees, and assignees.

c. Under no circumstances shall the contractor be liable for any of the following: (1) third party claims against the state for losses or damages (other than those listed above); or (2) economic consequential damages (including lost profits or savings) or incidental damages, even if the contractor is informed of their possibility.

2.11.6 Insurance - The contractor shall understand and agree that the State of Missouri cannot save and hold harmless and/or indemnify the contractor or employees against any liability incurred or arising as a result of any activity of the contractor or any activity of the contractor's employees related to the contractor's performance under the contract. Therefore, the contractor must acquire and maintain adequate liability insurance in the form(s) and amount(s) sufficient to protect the State of Missouri, its agencies, its employees, its clients, and the general public against any such loss, damage and/or expense related to his/her performance under the contract. General and other non-professional liability insurance shall include an endorsement that adds the State of Missouri as an additional insured. Self-insurance coverage or another alternative risk financing mechanism may be utilized provided that such coverage is verifiable and irrevocably reliable and the State of Missouri is protected as an additional insured.

a. In the event any insurance coverage is canceled, the state agency must be notified at least thirty (30) calendar days prior to such cancelation.

2.11.7 Subcontractors - Any subcontracts for the products/services described herein must include appropriate provisions and contractual obligations to ensure the successful fulfillment of all contractual obligations agreed to by the contractor and the State of Missouri and to ensure that the State of Missouri is indemnified, saved, and held harmless from and against any and all claims of damage, loss, and cost (including attorney fees) of any kind related to a subcontract in those matters described in the contract between the State of Missouri and the contractor.

a. The contractor shall expressly understand and agree that he/she shall assume and be solely responsible for all legal and financial responsibilities related to the execution of a subcontract.

b. The contractor shall agree and understand that utilization of a subcontractor to provide any of the products/services in the contract shall in no way relieve the contractor of the responsibility for providing the products/services as described and set forth herein.

c. The contractor must obtain the approval of the State of Missouri prior to establishing any new subcontracting arrangements and before changing any subcontractors. The approval shall not be arbitrarily withheld.

d. Pursuant to subsection 1 of section 285.530, RSMo, no contractor or subcontractor shall knowingly employ, hire for employment, or continue to employ an unauthorized alien to perform work within the state of Missouri. In accordance with sections 285.525 to 285.550, RSMo, a general contractor or subcontractor of any tier shall not be liable when such contractor or subcontractor contracts with its direct subcontractor who violates subsection 1 of section 285.530, RSMo, if the contract binding the contractor and subcontractor affirmatively states that:

1) The direct subcontractor is not knowingly in violation of subsection 1 of section 285.530, RSMo, and shall not henceforth be in such violation.
2) The contractor or subcontractor receives a sworn affidavit under the penalty of perjury attesting to the fact that the direct subcontractor's employees are lawfully present in the United States.

2.11.8 Participation by Other Organizations - The contractor must comply with any Organization for the Blind/Sheltered Workshop, Service-Disabled Veteran Business Enterprise (SDVE), and/or Minority Business Enterprise/Women Business Enterprise (MBE/WBE) participation levels committed to in the contractor's awarded proposal.

a. The contractor shall prepare and submit to the Division of Purchasing a report detailing all payments made by the contractor to Organizations for the Blind/Sheltered Workshops, SDVEs, and/or MBE/WBEs participating in the contract for the reporting period. The contractor must submit the report on a monthly basis, unless otherwise determined by the Division of Purchasing.

b. The Division of Purchasing will monitor the contractor's compliance in meeting the Organizations for the Blind/Sheltered Workshop and SDVE participation levels committed to in the contractor's awarded proposal. The Division of Purchasing in conjunction with the Office of Equal Opportunity (OEO) will monitor the contractor's compliance in meeting the MBE/WBE participation levels committed to in the contractor's awarded proposal. If the contractor's payments to the participating entities are less than the amount committed, the state may cancel the contract and/or suspend or debar the contractor from participating in future state procurements, or retain payments to the contractor in an amount equal to the value of the participation commitment less actual payments made by the contractor to the participating entity. If the Division of Purchasing determines that the contractor becomes compliant with the commitment, any funds retained as stated above, will be released.

c. If a participating entity fails to retain the required certification or is unable to satisfactorily perform, the contractor must obtain other certified MBE/WBEs or other organizations for the blind/sheltered workshops or other SDVEs to fulfill the participation requirements committed to in the contractor's awarded proposal.

1) The contractor must obtain the written approval of the Division of Purchasing for any new entities. This approval shall not be arbitrarily withheld.

2) If the contractor cannot obtain a replacement entity, the contractor must submit documentation to the Division of Purchasing detailing all efforts made to secure a replacement. The Division of Purchasing shall have sole discretion in determining if the actions taken by the contractor constitute a good faith effort to secure the required participation and whether the contract will be amended to change the contractor's participation commitment.

d. No later than 30 days after the effective date of the first renewal period, the contractor must submit an affidavit to the Division of Purchasing. The affidavit must be signed by the director or manager of the participating Organizations for the Blind/Sheltered Workshop verifying provision of products

and/or services and compliance of all contractor payments made to the Organizations for the Blind/Sheltered Workshops. The contractor may use the affidavit available on the Division of Purchasing's website at http://oa.mo.gov/sites/default/files/bswaffidavit.doc or another affidavit providing the same information.

2.11.9 Substitution of Personnel - The contractor agrees and understands that the State of Missouri's agreement to the contract is predicated in part on the utilization of the specific key individual(s) and/or personnel qualifications identified in the proposal. Therefore, the contractor agrees that no substitution of such specific key individual(s) and/or personnel qualifications shall be made without the prior written approval of the state agency. The contractor further agrees that any substitution made pursuant to this paragraph must be equal or better than originally proposed and that the state agency's approval of a substitution shall not be construed as an acceptance of the substitution's performance potential. The State of Missouri agrees that an approval of a substitution will not be unreasonably withheld.

2.11.10 Authorized Personnel:

a. The contractor shall only employ personnel authorized to work in the United States in accordance with applicable federal and state laws. This includes but is not limited to the Illegal Immigration Reform and Immigrant Responsibility Act (IIRIRA) and INA Section 274A.

b. If the contractor is found to be in violation of this requirement or the applicable state, federal and local laws and regulations, and if the State of Missouri has reasonable cause to believe that the contractor has knowingly employed individuals who are not eligible to work in the United States, the state shall have the right to cancel the contract immediately without penalty or recourse and suspend or debar the contractor from doing business with the state. The state may also withhold up to twenty-five percent of the total amount due to the contractor.

c. The contractor shall agree to fully cooperate with any audit or investigation from federal, state, or local law enforcement agencies.

d. If the contractor meets the definition of a business entity as defined in section 285.525, RSMo, pertaining to section 285.530, RSMo, the contractor shall maintain enrollment and participation in the E-Verify federal work authorization program with respect to the employees hired after enrollment in the program who are proposed to work in connection with the contracted services included herein. If the contractor's business status changes during the life of the contract to become a business entity as defined in section 285.525, RSMo, pertaining to section 285.530, RSMo, then the contractor shall, prior to the performance of any services as a business entity under the contract:

1) Enroll and participate in the E-Verify federal work authorization program with respect to the employees hired after enrollment in the program who are proposed to work in connection with the services required herein; AND
2) Provide to the Division of Purchasing the documentation required in the exhibit titled, Business Entity Certification, Enrollment Documentation, and Affidavit of Work Authorization affirming said company's/individual's enrollment and participation in the E-Verify federal work authorization program; AND
3) Submit to the Division of Purchasing a completed, notarized Affidavit of Work Authorization provided in the exhibit titled, Business Entity Certification, Enrollment Documentation, and Affidavit of Work Authorization.

e. In accordance with subsection 2 of section 285.530, RSMo, the contractor should renew their Affidavit of Work Authorization annually. A valid Affidavit of Work Authorization is necessary to award any new contracts.

2.11.11 Contractor Status - The contractor is an independent contractor and shall not represent the contractor or the contractor's employees to be employees of the State of Missouri or an agency of the State of

Missouri. The contractor shall assume all legal and financial responsibility for salaries, taxes, FICA, employee fringe benefits, workers compensation, employee insurance, minimum wage requirements, overtime, etc., and agrees to indemnify, save, and hold the State of Missouri, its officers, agents, and employees, harmless from and against, any and all loss; cost (including attorney fees); and damage of any kind related to such matters.

2.11.12 Coordination - The contractor shall fully coordinate all contract activities with those activities of the state agency. As the work of the contractor progresses, advice and information on matters covered by the contract shall be made available by the contractor to the state agency or the Division of Purchasing throughout the effective period of the contract.

2.11.13 Property of State – The contractor shall agree and understand that all documents, data, reports, supplies, equipment, and accomplishments prepared, furnished, or completed by the contractor pursuant to the terms of the contract shall become the property of the State of Missouri. Upon expiration, termination, or cancellation of the contract, said items shall become the property of the State of Missouri, which shall include all rights and interests for present and future use or sale as deemed appropriate by the state agency.

a. The State of Missouri understands and agrees that any ancillary software tools or pre-printed materials (e.g., project management software tools or training software tools, etc.) developed or acquired by the contractor that may be necessary to perform a particular service required hereunder but not required as a specific deliverable of the contract, shall remain the property of the contractor; however, the contractor shall be responsible for ensuring such tools and materials are being used in accordance with applicable intellectual property rights and copyrights.

2.11.14 Confidentiality:

a. The contractor shall agree and understand that all discussions with the contractor and all information gained by the contractor as a result of the contractor's performance under the contract shall be confidential and that no reports, documentation, or material prepared as required by the contract shall be released to the public without the prior written consent of the state agency.

b. If required by the state agency, the contractor and any required contractor personnel must sign specific documents regarding confidentiality, security, or other similar documents upon request. Failure of the contractor and any required personnel to sign such documents shall be considered a breach of contract and subject to the cancellation provisions of this document.

2.11.15 Contractor Equipment Use:

a. Title to any equipment required by the contract shall be held by and vested in the contractor. The State of Missouri shall not be liable in the event of loss, incident, destruction, theft, damage, etc., for the equipment including, but not limited to, devices, wires, software, technical literature, etc. It shall be the contractor's sole responsibility to obtain insurance coverage for such loss in an amount that the contractor deems appropriate.

2.11.16 Force Majeure - The contractor shall not be liable for any excess costs for delayed delivery of goods or services to the State of Missouri, if the failure to perform the contract arises out of causes beyond the control of, and without the fault or negligence of the contractor. Such causes may include, however are not restricted to: acts of God, fires, floods, epidemics, quarantine restrictions, strikes, and freight embargoes. In all cases, the failure to perform must be beyond the control of, and without the fault or negligence of, either the contractor or any subcontractor(s). The contractor shall take all possible steps to recover from any such occurrences.

2.12 Federal Funds Requirements - The contractor shall understand and agree that the contract may involve the use of federal funds. Therefore, for any federal funds used, the following paragraphs shall apply:

2.12.1 Applicable Laws and Regulations - In performing its responsibilities under the contract, the contractor shall fully comply with the following Office of Management and Budget (OMB) administrative requirements and cost principles, as applicable, including any subsequent amendments.

a. Uniform Administrative Requirements - OMB Circular A-102 – Grants and Cooperative Agreements with State and Local Governments; and 2 CFR 215 – Grants and Other Agreements with Institutions of Higher Learning, Hospitals and Other Non-Profit Organizations (OMB Circular A-110).

b. Cost Principles: 2 CFR 225 – State, Local and Indian Tribal Governments (OMB Circular A-87); 2 CFR 230 – Non-Profit Organizations (OMB Circular A-122); 2 CFR 220 Educational Institutions (OMB Circular A-21); 48 CFR 31.2 – For-Profit Organizations; and 45 CFR 74 Appendix E – Hospitals.

2.12.2 Steven's Amendment – In accordance with the Departments of Labor, Health and Human Services, and Education and Related Agencies Appropriations Act, Public Law 101-166, Section 511, "Steven's Amendment", the contractor shall not issue any statements, press releases, and other documents describing projects or programs funded in whole or in part with Federal funds unless the prior approval of the state agency is obtained and unless they clearly state the following as provided by the state agency:

a. The percentage of the total costs of the program or project which will be financed with Federal funds;
b. The dollar amount of Federal funds for the project or program; and
c. The percentage and dollar amount of the total costs of the project or program that will be financed by nongovernmental sources.

2.12.3 The contractor shall comply with 31 U.S.C. 1352 relating to limitations on use of appropriated funds to influence certain federal contracting and financial transactions. No funds under the contract shall be used to pay the salary or expenses of the contractor, or agent acting for the contractor, to engage in any activity designed to influence legislation or appropriations pending before the United States Congress or Missouri General Assembly. The contractor shall comply with all requirements of 31 U.S.C. 1352 which is incorporated herein as if fully set forth. The contractor shall submit to the state agency, when applicable, Disclosure of Lobbying Activities reporting forms.

2.12.4 The contractor shall comply with the requirements of the Single Audit Act Amendments of 1996 (P.L. 104-156) and OMB Circular A-133, including subsequent amendments or revisions, as applicable or 2 CFR 215.26 as it relates to for-profit hospitals and commercial organizations. A copy of any audit report shall be sent to the state agency each contract year if applicable. The contractor shall return to the state agency any funds disallowed in an audit of the contract.

2.12.5 The contractor shall comply with the Pro-Children Act of 1994 (20 U.S.C. 6081), which prohibits smoking within any portion of any indoor facility used for the provision of services for children as defined by the Act.

2.12.6 The contractor shall comply with 37 CFR part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations, as applicable.

2.12.7 The contractor shall comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401 et seq.) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251 et seq.).

2.12.8 If the contractor is a sub-recipient as defined in OMB Circular A-133, Section 210, the contractor shall comply with all applicable implementing regulations, and all other laws, regulations and policies authorizing or governing the use of any federal funds paid to the contractor through the contract.

2.12.9 The contractor shall comply with the public policy requirements as specified in the Department of Health and Human Services (HHS) Grants Policy Statement:
(http://www.hhs.gov/asfr/ogapa/aboutog/hhsgps107.pdf)

2.12.10 The contractor shall comply with Trafficking Victims Protection Act of 2000 (22 U.S.C. 7104), as amended.

2.12.11 The contractor shall provide a drug free workplace in accordance with the Drug Free Workplace Act of 1988 and all applicable regulations. The contractor shall report any conviction of the contractor's personnel under a criminal drug statute for violations occurring on the contractor's premises or off the contractor's premises while conducting official business. A report of a conviction shall be made to the state agency within five (5) working days after the conviction.

2.12.12 Non-Discrimination and ADA - The contractor shall comply with all federal and state statutes, regulations and executive orders relating to nondiscrimination and equal employment opportunity to the extent applicable to the contract. These include but are not limited to:

a. Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color, or national origin (this includes individuals with limited English proficiency) in programs and activities receiving federal financial assistance and Title VII of the Act which prohibits discrimination on the basis of race, color, national origin, sex, or religion in all employment activities;
b. Equal Pay Act of 1963 (P.L. 88 -38, as amended, 29 U.S.C. Section 206 (d));
c. Title IX of the Education Amendments of 1972, as amended (20 U.S.C 1681-1683 and 1685-1686) which prohibits discrimination on the basis of sex;
d. Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794) and the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) which prohibit discrimination on the basis of disabilities;
e. The Age Discrimination Act of 1975, as amended (42 U.S.C. 6101-6107) which prohibits discrimination on the basis of age;
f. Equal Employment Opportunity – E.O. 11246, "Equal Employment Opportunity", as amended by E.O. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity";
g. Missouri State Regulation, 19 CSR 10-2.010, Civil Rights Requirements;
h. Missouri Governor's E.O. #94-03 (excluding article II due to its repeal);
i. Missouri Governor's E.O. #05-30; and
j. The requirements of any other nondiscrimination federal and state statutes, regulations and executive orders which may apply to the services provided via the contract.

3. PROPOSAL SUBMISSION INFORMATION

3.1 Submission of Proposals:

3.1.1 On-line Proposal - If a registered vendor is responding electronically through the MissouriBUYS System website, in addition to completing the on-line pricing, the registered vendor should submit completed exhibits, forms, and other information concerning the proposal as an attachment to the electronic proposal. The registered vendor is instructed to review the RFP submission provisions carefully. Instructions on how a registered vendor responds to a bid on-line are available on the MissouriBUYS System website at: https://missouribuys.mo.gov/bidboard.html.

a. The exhibits and forms provided herein can be saved into a word processing document, completed by a registered vendor, and then sent as an attachment to the electronic submission. Other information requested or required may be sent as an attachment. Additional instructions for submitting electronic attachments are on the MissouriBUYS System website. Be sure to include the solicitation/opportunity (OPP) number, company name, and a contact name on any electronic attachments.

b. In addition, a registered vendor may submit the exhibits, forms, Pricing Page(s), etc., through mail or courier service. However, any such submission must be received prior to the specified end date and time.

c. If a registered vendor submits an electronic and hard copy proposal response and if such responses are not identical, the vendor should explain which response is valid. In the absence of an explanation, the State of Missouri shall consider the response which serves its best interest.

3.1.2 Hard Copy Proposal - If the vendor is submitting a proposal via the mail or a courier service or is hand delivering the proposal, the vendor should include completed exhibits, forms, and other information concerning the proposal. The vendor is instructed to review the RFP submission provisions carefully to ensure they are providing all required pricing, including applicable renewal pricing.

a. Recycled Products - The State of Missouri recognizes the limited nature of our resources and the leadership role of government agencies in regard to the environment. Accordingly, the vendor is requested to print the proposal double-sided using recycled paper, if possible, and minimize or eliminate the use of non-recyclable materials such as plastic report covers, plastic dividers, vinyl sleeves, and binding. Lengthy proposals may be submitted in a notebook or binder.

3.1.3 Confidential Materials: Pursuant to section 610.021, RSMo, the vendor's proposal and related documents shall not be available for public review until a contract has been awarded or all proposals are rejected.

a. The Division of Purchasing is a governmental body under Missouri Sunshine Law (chapter 610, RSMo). Section 610.011, RSMo, requires that all provisions be "*liberally construed and their exceptions strictly construed*" to promote the public policy that records are open unless otherwise provided by law.

b. Regardless of any claim by a vendor as to material being confidential and not subject to copying or distribution, or how a vendor characterizes any information provided in its proposal, all material submitted by the vendor in conjunction with the RFP is subject to release after the award of a contract in relation to a request for public records under the Missouri Sunshine Law (see chapter 610, RSMo). Only information expressly permitted to be closed pursuant to the strictly construed provisions of Missouri's Sunshine Law will be treated as a closed record by the Division of Purchasing and withheld from any public request submitted to Division of Purchasing after award. The vendor should presume information provided to Division of Purchasing in a proposal will be public following the award of the contract or after rejection of all proposals and made available upon

request in accordance with the provisions of state law. The vendor's sole remedy for the state's denial of any confidentiality request shall be limited to withdrawal of their proposal in its entirety.

c. In no event will the following be considered confidential or exempt from the Missouri Sunshine Law:

1) Vendor's entire proposal;

2) Vendor's pricing;

3) Vendor's proposed method of performance including schedule of events and/or deliverables;

4) Vendor's experience information including customer lists or references; and

5) Vendor's product specifications unless specifications disclose scientific and technological innovations in which the owner has a proprietary interest (see subsection 15 of section 610.021, RSMo).

d. On-line Proposal - If a registered vendor is responding electronically through the MissouriBUYS System website and attaches information with their proposal that is allowed by the Missouri Sunshine Law to be exempt from public disclosure, such specific material of their proposal must be attached as a separate document and must have the box "Confidential" selected when attaching the document. If the "Confidential" box is not selected when attaching the document, the document must be clearly marked as confidential along with an explanation of what qualifies the specific material to be held as confidential pursuant to the provisions of section 610.021, RSMo. The vendor's failure to follow these instructions shall relieve the state of any obligation to preserve the confidentiality of the documents.

e. Hard Copy Proposal - If the vendor is submitting a proposal via the mail or a courier service or is hand delivering the proposal and submits information with their proposal that is allowed by the Missouri Sunshine Law to be exempt from public disclosure, such specific material of their proposal must be separated, sealed, and clearly marked as confidential along with an explanation of what qualifies the specific material to be held as confidential pursuant to the provisions of section 610.021, RSMo. The vendor's failure to follow this instruction shall relieve the state of any obligation to preserve the confidentiality of the documents.

f. Imaging Ready - Except for any portion of a proposal qualifying as confidential as determined by the Division of Purchasing as specified above, after a contract is executed or all proposals are rejected, all proposals are scanned into the Division of Purchasing imaging system.

1) The scanned information will be available for viewing through the Internet from the Division of Purchasing Awarded Bid and Contract Document Search system. Therefore, the vendor is advised not to include any information in the proposal that the vendor does not want to be viewed by the public, including personal identifying information such as social security numbers.

2) Also, in preparing a proposal, the vendor should be mindful of document preparation efforts for imaging purposes and storage capacity that will be required to image the proposal and should limit proposal content to items that provide substance, quality of content, and clarity of information.

3.1.4 To facilitate the evaluation process, the vendor is encouraged to organize their proposal into sections that correspond with the individual evaluation categories described herein. The vendor is cautioned that it is the vendor's sole responsibility to submit information related to the evaluation categories and that the State of Missouri is under no obligation to solicit such information if it is not included with the proposal.

The vendor's failure to submit such information may cause an adverse impact on the evaluation of the proposal.

a. The proposal should be page numbered.

b. The signed page one from the original RFP and all signed addendums should be placed at the beginning of the proposal.

c. Each section should be titled with each individual evaluation category and all material related to that category should be included therein.

3.1.5 Questions Regarding the RFP – Except as may be otherwise stated herein, the vendor and the vendor's agents (including subcontractors, employees, consultants, or anyone else acting on their behalf) must direct all of their questions or comments regarding the RFP, the solicitation process, the evaluation, etc., to the buyer of record indicated on the first page of this RFP. Inappropriate contacts to other personnel are grounds for suspension and/or exclusion from specific procurements. Vendors and their agents who have questions regarding this matter should contact the buyer.

a. The buyer may be contacted via e-mail or phone as shown on the first page, or via facsimile to 573-526-9816.

b. Only those questions which necessitate a change to the RFP will be addressed via an addendum to the RFP. Written records of the questions and answers will not be maintained. Vendors are advised that any questions received less than ten (10) calendar days prior to the RFP opening date may not be addressed.

c. The vendor may contact the Office of Equal Opportunity (OEO) regarding MBE/WBE certification or subcontracting with MBE/WBE companies.

3.2 Competitive Negotiation of Proposals - The vendor is advised that under the provisions of this Request for Proposal, the Division of Purchasing reserves the right to conduct negotiations of the proposals received or to award a contract without negotiations. If such negotiations are conducted, the following conditions shall apply:

3.2.1 Negotiations may be conducted in person, in writing, or by telephone.

3.2.2 Negotiations will only be conducted with potentially acceptable proposals. The Division of Purchasing reserves the right to limit negotiations to those proposals which received the highest rankings during the initial evaluation phase. All vendors involved in the negotiation process will be invited to submit a best and final offer.

3.2.3 Terms, conditions, prices, methodology, or other features of the vendor's proposal may be subject to negotiation and subsequent revision. As part of the negotiations, the vendor may be required to submit supporting financial, pricing and other data in order to allow a detailed evaluation of the feasibility, reasonableness, and acceptability of the proposal.

3.2.4 The mandatory requirements of the Request for Proposal shall not be negotiable and shall remain unchanged unless the Division of Purchasing determines that a change in such requirements is in the best interest of the State of Missouri.

3.3 Evaluation and Award Process:

3.3.1 After determining that a proposal satisfies the mandatory requirements stated in the Request for Proposal, the evaluator(s) shall use both objective analysis and subjective judgment in conducting a comparative assessment of the proposal in accordance with the evaluation criteria stated below. The contracts shall be awarded to the lowest and best proposals.

Vendor's Experience, Reliability, and Expertise	90 points
Vendor's Method of Performance	100 points
MBE/WBE Participation	10 points
TOTAL	**200 points**

3.3.2 After an initial screening process, a question and answer conference or interview may be conducted with the vendor, if deemed necessary by the Division of Purchasing. In addition, the vendor may be asked to make an oral presentation of their proposal during the conference. Attendance cost at the conference shall be at the vendor's expense. All arrangements and scheduling shall be coordinated by the Division of Purchasing.

3.3.3 Due to pricing for photogrammetric mapping products and services being volatile for the variety of products/services available and market conditions at the time products and services may be required; the State of Missouri anticipates awarding up to four (4) contract awards.

3.4 Evaluation of Vendor's Experience, Reliability and Expertise:

3.4.1 Experience and reliability of the vendor and expertise of the vendor's personnel will be considered subjectively in the evaluation process. Therefore, the vendor is advised to submit information concerning the vendor's organization, information documenting the vendor's experience in past performances related to the requirements of this RFP, and information documenting the qualifications of the personnel proposed by the vendor to perform the requirements of this RFP. If the vendor is proposing an entity other than the vendor to perform the required services, the vendor should also submit the information requested for such proposed subcontractor.

a. Vendor Information - The vendor should provide information about the vendor's organization on Exhibit A.

b. Experience - The vendor should provide information related to previous and current services/contracts of the vendor or any proposed subcontractor where performance was similar to the required services of this RFP. The information may be shown on Exhibit B or in a similar manner.

1) As part of the evaluation process, the State of Missouri may contact the vendor's references, including references not listed or identified within the vendor's proposal but who have current or previous experiences with the vendor.

2) The vendor shall agree and understand that the State of Missouri is not obligated to contact the vendor's references.

c. Personnel Expertise - The vendor should provide the information requested on Exhibit C for each key person proposed to provide the services required herein. The vendor may also submit resumes for such key personnel.

1) The information should identify any relevant qualifications and experience of the person in performing services similar to the services required herein.

d. Personnel Qualifications - If personnel are not yet hired, the vendor should provide detailed descriptions of the required employment qualifications; and detailed job descriptions of the position to be filled, including the type of person proposed to be hired.

3.5 Evaluation of the Vendor's Method of Performance:

3.5.1 Proposals will be subjectively evaluated based on the vendor's plan for performing the requirements of the RFP. Exhibit D is provided for the vendor's use in providing information about the proposed method of performance.

3.6 Evaluation of Vendor's Minority Business Enterprise (MBE)/ Women Business Enterprise (WBE) Participation:

3.6.1 In order for the Division of Purchasing (Purchasing) to meet the provisions of Executive Order 05-30, the vendor should secure participation of certified MBEs and WBEs in providing the products/services required in this RFP. The targets of participation recommended by the State of Missouri are 10% MBE and 5% WBE of the total dollar value of the contract.

a. These targets can be met by a qualified MBE/WBE vendor themselves and/or through the use of qualified subcontractors, suppliers, joint ventures, or other arrangements that afford meaningful opportunities for MBE/WBE participation.

b. The services performed or the products provided by MBE/WBEs must provide a commercially useful function related to the delivery of the contractually-required service/product in a manner that will constitute an added value to the contract and shall be performed/provided exclusive to the performance of the contract. Therefore, if the services performed or the products provided by MBE/WBEs is utilized, to any extent, in the vendor's obligations outside of the contract, it shall not be considered a valid added value to the contract and shall not qualify as participation in accordance with this clause.

c. In order to be considered as meeting these targets, the MBE/WBEs must be "qualified" by the proposal opening date (date the proposal is due). (See below for a definition of a qualified MBE/WBE.)

3.6.2 The vendor's proposed participation of MBE/WBE firms in meeting the targets of the RFP will be considered in the evaluation process as specified below:

a. <u>If Participation Meets Target:</u> Vendors proposing MBE and WBE participation percentages that meet the State of Missouri's target participation percentage of 10% for MBE and 5% for WBE shall be assigned the maximum stated MBE/WBE Participation evaluation points.

b. <u>If Participation Exceeds Target:</u> Vendors proposing MBE and WBE participation percentages that exceed the State of Missouri's target participation shall be assigned the same MBE/WBE Participation evaluation points as those meeting the State of Missouri's target participation percentages stated above.

c. <u>If Participation Below Target:</u> Vendors proposing MBE and WBE participation percentages that are lower than the State of Missouri's target participation percentages of 10% for MBE and 5% for WBE shall be assigned a proportionately lower number of the MBE/WBE Participation evaluation points than the maximum MBE/WBE Participation evaluation points.

d. <u>If No Participation:</u> Vendors failing to propose any commercially useful MBE/WBE participation shall be assigned a score of 0 in this evaluation category.

3.6.3 MBE/WBE Participation evaluation points shall be assigned using the following formula:

$$\frac{\text{Vendor's Proposed MBE \%} \leq 10\% + \text{WBE \%} \leq 5\%}{\text{State's Target MBE \% (10)} + \text{WBE \% (5)}} \times \begin{array}{c}\text{Maximum}\\ \text{MBE/WBE}\\ \text{Participation}\\ \text{Evaluation}\\ \text{points (10)}\end{array} = \begin{array}{c}\text{Assigned}\\ \text{MBE/WBE}\\ \text{Participation}\\ \text{points}\end{array}$$

3.6.4 If the vendor is proposing MBE/WBE participation, in order to receive evaluation consideration for MBE/WBE participation, the vendor must provide the following information with the proposal.

a. Participation Commitment - If the vendor is proposing MBE/WBE participation, the vendor must complete Exhibit E, Participation Commitment, by listing each proposed MBE and WBE, the committed percentage of participation for each MBE and WBE, and the commercially useful products/services to be provided by the listed MBE and WBE. If the vendor submitting the proposal is a qualified MBE and/or WBE, the vendor must include the vendor in the appropriate table on the Participation Commitment Form.

b. Documentation of Intent to Participate – The vendor must either provide a properly completed Exhibit F, Documentation of Intent to Participate Form, signed and dated no earlier than the RFP issuance date by each MBE and WBE proposed or must provide a letter of intent signed and dated no earlier than the RFP issuance date by each MBE and WBE proposed which: (1) must describe the products/services the MBE/WBE will provide and (2) should include evidence that the MBE/WBE is qualified, as defined herein (i.e., the MBE/WBE Certification Number or a copy of MBE/WBE certificate issued by the Missouri OEO). If the vendor submitting the proposal is a qualified MBE and/or WBE, the vendor is not required to complete Exhibit F, Documentation of Intent to Participate Form or provide a recently dated letter of intent.

3.6.5 Commitment – If the vendor's proposal is awarded, the percentage level of MBE/WBE participation committed to by the vendor on Exhibit E, Participation Commitment, shall be interpreted as a contractual requirement.

3.6.6 Definition – Qualified MBE/WBE:

a. In order to be considered a qualified MBE or WBE for purposes of this RFP, the MBE/WBE must be certified by the State of Missouri, Office of Administration, Office of Equal Opportunity (OEO) by the proposal opening date.

b. MBE or WBE means a business that is a sole proprietorship, partnership, joint venture, or corporation in which at least fifty-one percent (51%) of the ownership interest is held by minorities or women and the management and daily business operations of which are controlled by one or more minorities or women who own it.

c. Minority is defined as belonging to one of the following racial minority groups: African Americans, Native Americans, Hispanic Americans, Asian Americans, American Indians, Eskimos, Aleuts, and other groups that may be recognized by the Office of Advocacy, United States Small Business Administration, Washington, D.C.

3.6.7 Resources - A listing of several resources that are available to assist vendors in their efforts to identify and secure the participation of qualified MBEs and WBEs is available at the website shown below or by contacting the Office of Equal Opportunity (OEO) at:

Office of Administration, Office of Equal Opportunity (OEO)
Harry S Truman Bldg., Room 630, P.O. Box 809, Jefferson City, MO 65102-0809
Phone: (877) 259-2963 or (573) 751-8130
Fax: (573) 522-8078
Web site: http://oeo.mo.gov

3.7 Miscellaneous Submittal Information:

3.7.1 Organizations for the Blind and Sheltered Workshop Preference - Pursuant to section 34.165, RSMo, and 1 CSR 40-1.050, a ten (10) bonus point preference shall be granted to vendors including products and/or services manufactured, produced or assembled by a qualified nonprofit organization for the blind established pursuant to 41 U.S.C. sections 46 to 48c or a sheltered workshop holding a certificate of approval from the Department of Elementary and Secondary Education pursuant to section 178.920, RSMo.

a. In order to qualify for the ten bonus points, the following conditions must be met and the following evidence must be provided:

1) The vendor must either be an organization for the blind or sheltered workshop or must be proposing to utilize an organization for the blind/sheltered workshop as a subcontractor and/or supplier in an amount that must equal the greater of $5,000 or 2% of the total dollar value of the contract for purchases not exceeding $10 million.

2) The services performed or the products provided by the organization for the blind or sheltered workshop must provide a commercially useful function related to the delivery of the contractually-required service/product in a manner that will constitute an added value to the contract and shall be performed/provided exclusive to the performance of the contract. Therefore, if the services performed or the products provided by the organization for the blind or sheltered workshop is utilized, to any extent, in the vendor's obligations outside of the contract, it shall not be considered a valid added value to the contract and shall not qualify as participation in accordance with this clause.

3) If the vendor is proposing participation by an organization for the blind or sheltered workshop, in order to receive evaluation consideration for participation by the organization for the blind or sheltered workshop, the vendor must provide the following information with the proposal:

- Participation Commitment - The vendor must complete Exhibit E, Participation Commitment, by identifying the organization for the blind or sheltered workshop and the commercially useful products/services to be provided by the listed organization for the blind or sheltered workshop. If the vendor submitting the proposal is an organization for the blind or sheltered workshop, the vendor must be listed in the appropriate table on the Participation Commitment Form.

- Documentation of Intent to Participate – The vendor must either provide a properly completed Exhibit F, Documentation of Intent to Participate Form, signed and dated no earlier than the RFP issuance date by the organization for the blind or sheltered workshop proposed or must provide a recently dated letter of intent signed and dated no earlier than the RFP issuance date by the organization for the blind or sheltered workshop which: (1) must describe the products/services the organization for the blind/sheltered workshop will provide and (2) should include evidence of the organization for the blind/sheltered

workshop qualifications (e.g. copy of certificate or Certificate Number for Missouri Sheltered Workshop).

NOTE: If the vendor submitting the proposal is an organization for the blind or sheltered workshop, the vendor is not required to complete Exhibit F, Documentation of Intent to Participate Form or provide a recently dated letter of intent.

b. A list of Missouri sheltered workshops can be found at the following internet address:
http://dese.mo.gov/special-education/sheltered-workshops/directories

c. The websites for the Missouri Lighthouse for the Blind and the Alphapointe Association for the Blind can be found at the following internet addresses:
http://www.lhbindustries.com
http://www.alphapointe.org

d. Commitment – If the vendor's proposal is awarded, the organization for the blind or sheltered workshop participation committed to by the vendor on Exhibit E, Participation Commitment, shall be interpreted as a contractual requirement.

3.7.2 Service-Disabled Veteran Business Enterprises (SDVEs) - Pursuant to section 34.074, RSMo, and 1 CSR 40-1.050, the Division of Purchasing (Purchasing) has a goal of awarding three (3) percent of all contracts for the performance of any job or service to qualified service-disabled veteran business enterprises (SDVEs). A three (3) point bonus preference shall be granted to vendors including products and/or services manufactured, produced or assembled by a qualified SDVE.

a. In order to qualify for the three bonus points, the following conditions must be met and the following evidence must be provided:

1) The vendor must either be an SDVE or must be proposing to utilize as SDVE as a subcontractor and/or supplier that provides at least three percent (3%) of the total contract value.

2) The services performed or the products provided by the SDVE must provide a commercially useful function related to the delivery of the contractually-required service/product in a manner that will constitute an added value to the contract and shall be performed/provided exclusive to the performance of the contract. Therefore, if the services performed or the products provided by the SDVE are utilized, to any extent, in the vendor's obligations outside of the contract, it shall not be considered a valid added value to the contract and shall not qualify as participation in accordance with this clause.

3) In order to receive evaluation consideration for participation by an SDVE, the vendor must provide the following information with the proposal:

- Participation Commitment - The vendor must complete Exhibit E, Participation Commitment, by identifying each proposed SDVE, the committed percentage of participation for each SDVE, and the commercially useful products/services to be provided by the listed SDVE. If the vendor submitting the proposal is a qualified SDVE, the vendor must be listed in the appropriate table on the Participation Commitment Form.

- Documentation of Intent to Participate – The vendor must either provide a properly completed Exhibit F, Documentation of Intent to Participate Form, signed and dated no earlier than the RFP issuance date by the SDVE or a recently dated letter of intent signed and dated no earlier than the RFP issuance date by the SDVE which: (1) must describe the products/services the SDVE will provide and (2) must include the SDV Documents described below as evidence that the SDVE is qualified, as defined herein.

- Service-Disabled Veteran (SDV) Documents - If a participating organization is an SDVE, unless previously submitted within the past five (5) years to the Purchasing, the vendor **must** provide the following Service-Disabled Veteran (SDV) documents:

  ✓ a copy of the SDV's award letter from the Department of Veterans Affairs or a copy of the SDV's discharge paper (DD Form 214, Certificate of Release or Discharge from Active Duty); and
  ✓ a copy of the SDV's documentation certifying disability by the appropriate federal agency responsible for the administration of veterans' affairs.

  NOTE:
  a) If the vendor submitting the proposal is a qualified SDVE, the vendor must include the SDV Documents as evidence that the vendor qualifies as an SDVE. However, the vendor is not required to complete Exhibit F, Documentation of Intent to Participate Form or provide a recently dated letter of intent.
  b) If the SDVE and SDV are listed on the following internet address, the vendor is not required to provide the SDV Documents listed above.
  http://oa.mo.gov/sites/default/files/sdvelisting.pdf

b. Commitment – If awarded a contract, the SDVE participation committed to by the vendor on Exhibit E, Participation Commitment, shall be interpreted as a contractual requirement.

c. Definition - Qualified SDVE:

1) SDVE is doing business as a Missouri firm, corporation, or individual or maintaining a Missouri office or place of business, not including an office of a registered agent;

2) SDVE has not less than fifty-one percent (51%) of the business owned by one (1) or more service-disabled veterans (SDVs) or, in the case of any publicly-owned business, not less than fifty-one percent (51%) of the stock of which is owned by one (1) or more SDVs;

3) SDVE has the management and daily business operations controlled by one (1) or more SDVs;

4) SDVE has a copy of the SDV's award letter from the Department of Veterans Affairs or a copy of the SDV's discharge paper (DD Form 214, Certificate of Release or Discharge from Active Duty), and a copy of the SDV's documentation certifying disability by the appropriate federal agency responsible for the administration of veterans' affairs; and

5) SDVE possesses the power to make day-to-day as well as major decisions on matters of management, policy, and operation.

3.7.3 Affidavit of Work Authorization and Documentation - Pursuant to section 285.530, RSMo, if the vendor meets the section 285.525, RSMo, definition of a "business entity" (http://www.moga.mo.gov/statutes/C200-299/2850000525.HTM), the vendor must affirm the vendor's enrollment and participation in the E-Verify federal work authorization program with respect to the employees hired after enrollment in the program who are proposed to work in connection with the services requested herein. The vendor should complete applicable portions of Exhibit G, Business Entity Certification, Enrollment Documentation, and Affidavit of Work Authorization. The applicable portions of Exhibit G must be submitted prior to an award of a contract.

3.7.4 Debarment Certification – The vendor certifies by signing the signature page of this original document and any addendum signature page(s) that the vendor is not presently debarred, suspended, proposed for debarment, declared ineligible, voluntarily excluded from participation, or otherwise excluded from or ineligible for participation under federal assistance programs. The vendor should complete and return the

attached certification regarding debarment, etc., Exhibit H with the proposal. This document must be satisfactorily completed prior to award of the contract.

3.7.5 The vendor should complete and submit Exhibit I, Miscellaneous Information.

3.7.6 Business Compliance - The vendor must be in compliance with the laws regarding conducting business in the State of Missouri. The vendor certifies by signing the signature page of this original document and any addendum signature page(s) that the vendor and any proposed subcontractors either are presently in compliance with such laws or shall be in compliance with such laws prior to any resulting contract award. The vendor shall provide documentation of compliance upon request by the Division of Purchasing. The compliance to conduct business in the state shall include, but not necessarily be limited to:

a. Registration of business name (if applicable) with the Secretary of State at http://sos.mo.gov/business/startBusiness.asp
b. Certificate of authority to transact business/certificate of good standing (if applicable)
c. Taxes (e.g., city/county/state/federal)
d. State and local certifications (e.g., professions/occupations/activities)
e. Licenses and permits (e.g., city/county license, sales permits)
f. Insurance (e.g., worker's compensation/unemployment compensation)

The vendor should refer to the Missouri Business Portal at http://business.mo.gov for additional information.

EXHIBIT A

VENDOR INFORMATION

The vendor should provide the following information about the vendor's organization:

a. Provide a brief company history, including the founding date and number of years in business as currently constituted.

b. Describe the nature of the vendor's business, type of services performed, etc. Identify the vendor's website address, if any.

c. Describe any previous project experiences of a similar nature and complexity in scope, responsibility and technologies involved.

d. Provide information regarding previous experience working with federal agencies, state, county, and city governments.

e. Indicate the number of years the vendor's business has been providing services of the nature of those described in the RFP for government entities.

f. Provide the vendor's experience developing multi-resolution orthoimagery mapping products.

g. Provide the vendor's experience developing multi-resolution orthoimagery using airborne GPS.

h. Submit a sample(s) of digital orthoimagery and other photogrammetric products produced for a previous or current client that are representative of the product required herein. However, if the vendor is proposing another entity to provide the services, the vendor should submit samples of some of the proposed entity's previous digital orthoimagery and other photogrammetric products produced.

EXHIBIT B

CURRENT/PRIOR EXPERIENCE

The vendor should copy and complete this form documenting the vendor and any subcontractor's current/prior experience considered relevant to the services required herein. In addition, the vendor is advised that if the contact person listed for verification of services is unable to be reached during the evaluation, the listed experience may not be considered.

Vendor Name or Subcontractor Name: _____	
Reference Information (Current/Prior Services Performed For:)	
Name of Reference Company:	
Address of Reference Company ✓ Street Address ✓ City, State, Zip	
Reference Contact Person Information: ✓ Name ✓ Phone Number ✓ E-mail Address	
Dates of Services:	
If service/contract has terminated, specify reason:	
Dollar Value of Services	
Description of Services Performed including the Following:	
✓ Acquisition of Digital Orthoimagery	
✓ Acquisition of LiDAR Elevation Data	
✓ Creation of Digital Terrain Model from LiDAR	
✓ Creation of Digital Elevation Model from LiDAR	
✓ Creation of Contours Lines	
✓ Planimetric Mapping	

EXHIBIT C

EXPERTISE OF KEY PERSONNEL

(Copy and complete this table for each key person proposed)

Title of Position:	
Name of Person:	
Educational Degree (s): include college or university, major, and dates	
License(s)/Certification(s), number(s), expiration date(s), if applicable:	
Specialized Training Completed.	
Number of years' experience in area of service proposed to provide:	
Describe person's relationship to vendor. If employee, number of years. If subcontractor, describe other/past working relationships	
Describe this person's responsibilities over the past 12 months.	
Previous employer(s), positions, and Dates	
Identify specific information about experience in:	Clearly identify the experience, provide dates, describe the person's role and extent of involvement in the experience
✓ All types of Photogrammetry projects	
✓ Modifying existing Digital Terrain Model(DTM) to produce quality orthoimagery	
✓ Acquisition of Digital Orthoimagery	
✓ Acquisition of LiDAR Elevation Data	
✓ Creation of Digital Terrain Model from LiDAR	
✓ Creation of Digital Elevation Model from LiDAR	
✓ Creation of Contours Lines	
✓ Planimetric Mapping	

EXHIBIT D

METHOD OF PERFORMANCE

The vendor should use this Exhibit, or any format desired, to present a written plan for performing the requirements specified in this Request for Proposal.

1. The vendor should indicate in the table below which products/services they are able to provide. Additionally, the vendor should identify any additional photogrammetric mapping products and services that the vendor is able to provide.

PRODUCT/SERVICE DESCRIPTION	CHECK BOX BELOW IF THE VENDOR PROVIDES SPECIFIED PRODUCT/SERVICE	CHECK BOX BELOW IF A SUBCONTRACTOR IS PROPOSED TO PROVIDE THE PRODUCT/SERVICE
Acquisition of Digital Orthoimagery		
Acquisition of LiDAR Elevation Data		
Creation of Digital Terrain Model from LiDAR		
Creation of Digital Elevation Model from LiDAR		
Creation of Contours Lines		
Planimetric Mapping		

2. The vendor should provide a description of their proposed project approach for categories of products/services the vendor proposes to provide.

   - The vendor should provide any details of their proposed services supporting innovative approaches that will meet the requirements of the RFP and minimize costs.
   - The vendor should highlight any portion of their approach that would expedite completion of projects.
   - The vendor should provide a description of their plan to keep state agency personnel involved and informed of project progress and decision points.
   - The vendor should include their proposed Quality Assurance Plan and Quality Control process(es). The vendor should include a flowchart illustrating the process(es).

3. The vendor should state whether a digital sensor camera or an analog (film) camera will be utilized in performance of the contract requirements.

- The vendor shall provide details regarding equipment, software, etc. proposed for use in performance of requirements of the RFP. The vendor should highlight the benefit or requirement for using the proposed equipment, software, etc.

4. The vendor should provide information related to the availability of equipment and personnel to provide services for the categories of services the vendor proposes to provide.

   - The vendor should provide details regarding their ability to deploy surveying personnel to complete projects in a timely manner.

   - The vendor should provide details regarding their ability to deploy equipment and personnel to provide the photogrammetric mapping products and services in a timely manner.

   - The vendor should provide information regarding their ability to keep the same personnel and equipment available on each phase of an individual project.

5. Economic Impact to Missouri - the vendor should describe the economic advantages that will be realized as a result of the vendor performing the required services. The vendor should respond to the following:

   - Provide a description of the proposed services that will be performed and/or the proposed products that will be provided by Missourians and/or Missouri products.

   - Provide a description of the economic impact returned to the State of Missouri through tax revenue obligations.

   - Provide a description of the company's economic presence within the State of Missouri (e.g., type of facilities: sales offices; sales outlets; divisions; manufacturing; warehouse; other), including Missouri employee statistics.

EXHIBIT D.6 ADDED PER BAFO #001

6. The vendor should provide the information included in the table below, if necessary the vendor may add additional pages:

Description of Aircraft	Is the Aircraft Owned, Leased, or Subcontracted? If Leased or Subcontracted, Who is Providing the Equipment?	Where is the Aircraft Based?

EXHIBIT E

PARTICIPATION COMMITMENT

Minority Business Enterprise/Women Business Enterprise (MBE/WBE) and/or Organization for the Blind/Sheltered Workshop and/or Service-Disabled Veteran Business Enterprise (SDVE) Participation Commitment – If the vendor is committing to participation by or if the vendor is a qualified MBE/WBE and/or organization for the blind/sheltered workshop and/or a qualified SDVE, the vendor must provide the required information in the appropriate table(s) below for the organization proposed and must submit the completed exhibit with the vendor's proposal.

For Minority Business Enterprise (MBE) and/or Woman Business Enterprise (WBE) Participation, if proposing an entity certified as both MBE and WBE, the vendor must either (1) enter the participation percentage under MBE or WBE, or must (2) divide the participation between both MBE and WBE. If dividing the participation, do not state the total participation on both the MBE and WBE Participation Commitment tables below. Instead, divide the total participation as proportionately appropriate between the tables below.

MBE Participation Commitment Table		
(The services performed or the products provided by the listed MBE must provide a commercially useful function related to the delivery of the contractually-required service/product in a manner that will constitute an added value to the contract and shall be performed/provided exclusive to the performance of the contract.)		
Name of Each Qualified Minority Business Enterprise (MBE) Proposed	**Committed Percentage of Participation for Each MBE** (% of the Actual Total Contract Value)	**Description of Products/Services to be Provided by Listed MBE** *The vendor should also include the paragraph number(s) from the RFP which requires the product/service the MBE is proposed to perform and describe how the proposed product/service constitutes added value and will be exclusive to the contract.*
1.	%	Product/Service(s) proposed: RFP Paragraph References:
2.	%	Product/Service(s) proposed: RFP Paragraph References:
3.	%	Product/Service(s) proposed: RFP Paragraph References:
4.	%	Product/Service(s) proposed: RFP Paragraph References:
Total MBE Percentage:	%	

WBE Participation Commitment Table		
(The services performed or the products provided by the listed WBE must provide a commercially useful function related to the delivery of the contractually-required service/product in a manner that will constitute an added value to the contract and shall be performed/provided exclusive to the performance of the contract.)		
Name of Each Qualified Women Business Enterprise (WBE) proposed	**Committed Percentage of Participation for Each WBE** (% of the Actual Total Contract Value)	**Description of Products/Services to be Provided by Listed WBE** *The vendor should also include the paragraph number(s) from the RFP which requires the product/service the WBE is proposed to perform and describe how the proposed product/service constitutes added value and will be exclusive to the contract.*
1.	%	Product/Service(s) proposed: RFP Paragraph References:
2.	%	Product/Service(s) proposed: RFP Paragraph References:
3.	%	Product/Service(s) proposed: RFP Paragraph References:
4.	%	Product/Service(s) proposed: RFP Paragraph References:
Total WBE Percentage:	%	

Organization for the Blind/Sheltered Workshop Commitment Table By completing this table, the vendor commits to the use of the organization at the greater of $5,000 or 2% of the actual total dollar value of contract.	
(The services performed or the products provided by the listed Organization for the Blind/Sheltered Workshop must provide a commercially useful function related to the delivery of the contractually-required service/product in a manner that will constitute an added value to the contract and shall be performed/provided exclusive to the performance of the contract.)	
Name of Organization for the Blind or Sheltered Workshop Proposed	**Description of Products/Services to be Provided by Listed Organization for the Blind/Sheltered Workshop** *The vendor should also include the paragraph number(s) from the RFP which requires the product/service the organization for the blind/sheltered workshop is proposed to perform and describe how the proposed product/service constitutes added value and will be exclusive to the contract.*
1.	Product/Service(s) proposed: RFP Paragraph References:
2.	Product/Service(s) proposed: RFP Paragraph References:

SDVE Participation Commitment Table		
(The services performed or the products provided by the listed SDVE must provide a commercially useful function related to the delivery of the contractually-required service/product in a manner that will constitute an added value to the contract and shall be performed/provided exclusive to the performance of the contract.)		
Name of Each Qualified Service-Disabled Veteran Business Enterprise (SDVE) Proposed	**Committed Percentage of Participation for Each SDVE** (% of the Actual Total Contract Value)	**Description of Products/Services to be Provided by Listed SDVE** *The vendor should also include the paragraph number(s) from the RFP which requires the product/service the SDVE is proposed to perform and describe how the proposed product/service constitutes added value and will be exclusive to the contract.*
1.	%	Product/Service(s) proposed: RFP Paragraph References:
2.	%	Product/Service(s) proposed: RFP Paragraph References:
Total SDVE Percentage:	%	

EXHIBIT F

DOCUMENTATION OF INTENT TO PARTICIPATE

If the vendor is proposing to include the participation of a Minority Business Enterprise/Women Business Enterprise (MBE/WBE) and/or Organization for the Blind/Sheltered Workshop and/or qualified Service-Disabled Veteran Business Enterprise (SDVE) in the provision of the products/services required in the RFP, the vendor must either provide a recently dated letter of intent, signed and dated no earlier than the RFP issuance date, from each organization documenting the following information, or complete and provide this Exhibit with the vendor's proposal.

~ Copy This Form For Each Organization Proposed ~

Vendor Name: _____

This Section To Be Completed by Participating Organization:

By completing and signing this form, the undersigned hereby confirms the intent of the named participating organization to provide the products/services identified herein for the vendor identified above.

Indicate appropriate business classification(s):

___ MBE ___ WBE ___ Organization for the Blind ___ Sheltered Workshop ___ SDVE

Name of Organization: _____
(Name of MBE, WBE, Organization for the Blind, Sheltered Workshop, or SDVE)

Contact Name:		Email:	
Address (If SDVE, provide MO Address):		Phone #:	
City:		Fax #:	
State/Zip:		Certification #	(or attach copy of certification)
SDVE's Website Address:		Certification Expiration Date:	
Service-Disabled Veteran's (SDV) Name: (Please Print)		SDV's Signature:	

PRODUCTS/SERVICES PARTICIPATING ORGANIZATION AGREED TO PROVIDE

Describe the products/services you *(as the participating organization)* have agreed to provide:

_____
_____
_____
_____

Authorized Signature:

_____ _____
Authorized Signature of Participating Organization (MBE, WBE, Organization for the Blind, Sheltered Workshop, or SDVE) *Date (Dated no earlier than the RFP issuance date)*

EXHIBIT F, continued

DOCUMENTATION OF INTENT TO PARTICIPATE

SERVICE-DISABLED VETERAN BUSINESS ENTERPRISE (SDVE)

If a participating organization is an SDVE, unless the Service-Disabled Veteran (SDV) documents were previously submitted within the past five (5) years to the Division of Purchasing (Purchasing), the vendor **must** provide the following SDV documents:

- a copy of the SDV's award letter from the Department of Veterans Affairs or a copy of the SDV's discharge paper (DD Form 214, Certificate of Release or Discharge from Active Duty), AND
- a copy of the SDV's documentation certifying disability by the appropriate federal agency responsible for the administration of veterans' affairs.

(NOTE: The SDV's award letter, the SDV's discharge paper, and the SDV's documentation certifying disability shall be considered confidential pursuant to subsection 14 of section 610.021, RSMo.)

The vendor should check the appropriate statement below and, if applicable, provide the requested information.

☐ No, I have not previously submitted the SDV documents specified above to the Purchasing and therefore have enclosed the SDV documents.

☐ Yes, I previously submitted the SDV documents specified above within the past five (5) years to the Purchasing.

Date SDV Documents were Submitted: _____

Previous **Proposal/Contract Number** for Which the SDV Documents were Submitted: _____
(if applicable and known)

(NOTE: If the proposed SDVE and SDV are listed on the Purchasing SDVE database located at http://oa.mo.gov/sites/default/files/sdvelisting.pdf, then the SDV documents have been submitted to the Purchasing within the past five [5] years. However, if it has been determined that an SDVE at any time no longer meets the requirements stated above, the Purchasing will remove the SDVE and associated SDV from the database.)

FOR STATE USE ONLY

SDV Documents - Verification Completed By:

_____ _____
Buyer Date

EXHIBIT G
BUSINESS ENTITY CERTIFICATION, ENROLLMENT DOCUMENTATION, AND AFFIDAVIT OF WORK AUTHORIZATION

BUSINESS ENTITY CERTIFICATION:

The vendor must certify their current business status by completing either Box A or Box B or Box C on this Exhibit.

BOX A:	To be completed by a non-business entity as defined below.
BOX B:	To be completed by a business entity who has not yet completed and submitted documentation pertaining to the federal work authorization program as described at http://www.uscis.gov/e-verify.
BOX C:	To be completed by a business entity who has current work authorization documentation on file with a Missouri state agency including Division of Purchasing.

Business entity, as defined in section 285.525, RSMo, pertaining to section 285.530, RSMo, is any person or group of persons performing or engaging in any activity, enterprise, profession, or occupation for gain, benefit, advantage, or livelihood. The term "**business entity**" shall include but not be limited to self-employed individuals, partnerships, corporations, contractors, and subcontractors. The term "**business entity**" shall include any business entity that possesses a business permit, license, or tax certificate issued by the state, any business entity that is exempt by law from obtaining such a business permit, and any business entity that is operating unlawfully without such a business permit. The term "**business entity**" shall not include a self-employed individual with no employees or entities utilizing the services of direct sellers as defined in subdivision (17) of subsection 12 of section 288.034, RSMo.

Note: Regarding governmental entities, business entity includes Missouri schools, Missouri universities (other than stated in Box C), out of state agencies, out of state schools, out of state universities, and political subdivisions. A business entity does not include Missouri state agencies and federal government entities.

BOX A – CURRENTLY NOT A BUSINESS ENTITY

I certify that _____ (Company/Individual Name) **DOES NOT CURRENTLY MEET** the definition of a business entity, as defined in section 285.525, RSMo pertaining to section 285.530, RSMo as stated above, because: (check the applicable business status that applies below)

☐ - I am a self-employed individual with no employees; **OR**

☐ - The company that I represent employs the services of direct sellers as defined in subdivision (17) of subsection 12 of section 288.034, RSMo.

I certify that I am not an alien unlawfully present in the United States and if _____ (Company/Individual Name) is awarded a contract for the services requested herein under _____ (RFP Number) and if the business status changes during the life of the contract to become a business entity as defined in section 285.525, RSMo pertaining to section 285.530, RSMo then, prior to the performance of any services as a business entity, _____ (Company/Individual Name) agrees to complete Box B, comply with the requirements stated in Box B and provide the Division of Purchasing with all documentation required in Box B of this exhibit.

_____ _____

Authorized Representative's Name (Please Print) *Authorized Representative's Signature*

_____ _____

Company Name (if applicable) Date

EXHIBIT G, continued

(Complete the following if you DO NOT have the E-Verify documentation and a current Affidavit of Work Authorization already on file with the State of Missouri. If completing Box B, do not complete Box C)

BOX B – CURRENT BUSINESS ENTITY STATUS

I certify that _____ (Business Entity Name) **MEETS** the definition of a business entity as defined in section 285.525, RSMo pertaining to section 285.530.

Authorized Business Entity Representative's Name (Please Print)	*Authorized Business Entity Representative's Signature*
Business Entity Name	Date
E-Mail Address	

As a business entity, the vendor must perform/provide each of the following. The vendor should check each to verify completion/submission of all of the following:

☐- Enroll and participate in the E-Verify federal work authorization program (Website: http://www.uscis.gov/e-verify; Phone: 888-464-4218; Email: e-verify@dhs.gov) with respect to the employees hired after enrollment in the program who are proposed to work in connection with the services required herein;

AND

☐- Provide documentation affirming said company's/individual's enrollment and participation in the E-Verify federal work authorization program. Documentation shall include EITHER the E-Verify Employment Eligibility Verification page listing the vendor's name and company ID OR a page from the E-Verify Memorandum of Understanding (MOU) listing the vendor's name and the MOU signature page completed and signed, at minimum, by the vendor and the Department of Homeland Security – Verification Division. If the signature page of the MOU lists the vendor's name and company ID, then no additional pages of the MOU must be submitted;

AND

☐- Submit a completed, notarized Affidavit of Work Authorization provided on the next page of this Exhibit.

EXHIBIT G, continued

AFFIDAVIT OF WORK AUTHORIZATION:

The vendor who meets the section 285.525, RSMo, definition of a business entity must complete and return the following Affidavit of Work Authorization.

Comes now _____ (Name of Business Entity Authorized Representative) as _____ (Position/Title) first being duly sworn on my oath, affirm _____ (Business Entity Name) is enrolled and will continue to participate in the E-Verify federal work authorization program with respect to employees hired after enrollment in the program who are proposed to work in connection with the services related to contract(s) with the State of Missouri for the duration of the contract(s), if awarded in accordance with subsection 2 of section 285.530, RSMo. I also affirm that _____ (Business Entity Name) does not and will not knowingly employ a person who is an unauthorized alien in connection with the contracted services provided under the contract(s) for the duration of the contract(s), if awarded.

In Affirmation thereof, the facts stated above are true and correct. (The undersigned understands that false statements made in this filing are subject to the penalties provided under section 575.040, RSMo.)

Authorized Representative's Signature	Printed Name
Title	Date
E-Mail Address	E-Verify Company ID Number

Subscribed and sworn to before me this _____ (DAY) of _____ (MONTH, YEAR). I am commissioned as a notary public within the County of _____ (NAME OF COUNTY), State of _____ (NAME OF STATE), and my commission expires on _____ (DATE).

Signature of Notary	*Date*

EXHIBIT G, continued

(Complete the following if you have the E-Verify documentation and a current Affidavit of Work Authorization already on file with the State of Missouri. If completing Box C, do not complete Box B.)

BOX C – AFFIDAVIT ON FILE - CURRENT BUSINESS ENTITY STATUS

I certify that _____ (Business Entity Name) **MEETS** the definition of a business entity as defined in section 285.525, RSMo pertaining to section 285.530, RSMo and have enrolled and currently participates in the E-Verify federal work authorization program with respect to the employees hired after enrollment in the program who are proposed to work in connection with the services related to contract(s) with the State of Missouri. We have previously provided documentation to a Missouri state agency or public university that affirms enrollment and participation in the E-Verify federal work authorization program. The documentation that was previously provided included the following.

- ✓ The E-Verify Employment Eligibility Verification page OR a page from the E-Verify Memorandum of Understanding (MOU) listing the vendor's name and the MOU signature page completed and signed by the vendor and the Department of Homeland Security – Verification Division
- ✓ A current, notarized Affidavit of Work Authorization (must be completed, signed, and notarized within the past twelve months).

Name of **Missouri State Agency** or **Public University*** to Which Previous E-Verify Documentation Submitted: _____

(*Public University includes the following five schools under chapter 34, RSMo: Harris-Stowe State University – St. Louis; Missouri Southern State University – Joplin; Missouri Western State University – St. Joseph; Northwest Missouri State University – Maryville; Southeast Missouri State University – Cape Girardeau.)

Date of Previous E-Verify Documentation Submission: _____

Previous **Bid/Contract Number** for Which Previous E-Verify Documentation Submitted: _____ (if known)

Authorized Business Entity Representative's Name (Please Print)	*Authorized Business Entity Representative's Signature*
Business Entity Name	Date
E-Mail Address	E-Verify MOU Company ID Number

FOR STATE OF MISSOURI USE ONLY

Documentation Verification Completed By:

Buyer	Date

EXHIBIT H

Certification Regarding
Debarment, Suspension, Ineligibility and Voluntary Exclusion
Lower Tier Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 29 CFR Part 98 Section 98.510, Participants' responsibilities. The regulations were published as Part VII of the May 26, 1988, Federal Register (pages 19160-19211).

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS FOR CERTIFICATION)

(1) The prospective recipient of Federal assistance funds certifies, by submission of this proposal, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective recipient of Federal assistance funds is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Company Name	DUNS # (if known)
Authorized Representative's Printed Name	Authorized Representative's Title
Authorized Representative's Signature	Date

Instructions for Certification

1. By signing and submitting this proposal, the prospective recipient of Federal assistance funds is providing the certification as set out below.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective recipient of Federal assistance funds knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the Department of Labor (DOL) may pursue available remedies, including suspension and/or debarment.
3. The prospective recipient of Federal assistance funds shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective recipient of Federal assistance funds learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective recipient of Federal assistance funds agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the DOL.
6. The prospective recipient of Federal assistance funds further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may but is not required to check the List of Parties Excluded from Procurement or Nonprocurement Programs.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntary excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the DOL may pursue available remedies, including suspension and/or debarment.

EXHIBIT I

MISCELLANEOUS INFORMATION

Outside United States: If any products and/or services offered under this RFP are being manufactured or performed at sites outside the United States, the vendor MUST disclose such fact and provide details in the space below or on an attached page.

Are any of the vendor's proposed products and/or services being manufactured or performed at sites outside the United States?	Yes ____	No ____
If YES, do the proposed products/services satisfy the conditions described in section 4, subparagraphs 1, 2, 3, and 4 of Executive Order 04-09? (see the following web link: http://s1.sos.mo.gov/CMSImages/Library/Reference/Orders/2004/eo04_009.pdf)	Yes ____	No ____

If YES, mark the appropriate exemption below, and provide the requested details:

1.____ Unique good or service.
- EXPLAIN:_____

2.____ Foreign firm hired to market Missouri services/products to a foreign country.
- Identify foreign country: _____

3.____ Economic cost factor exists
- EXPLAIN:_____

4.____ Vendor/subcontractor maintains significant business presence in the United States and only performs trivial portion of contract work outside US.
- Identify maximum percentage of the overall value of the contract, for any contract period, attributed to the value of the products and/or services being manufactured or performed at sites outside the United States: ___%
- Specify what contract work would be performed outside the United States:

_____

Employee/Conflict of Interest:

Vendors who are elected or appointed officials or employees of the State of Missouri or any political subdivision thereof, serving in an executive or administrative capacity, must comply with sections 105.450 to 105.458, RSMo, regarding conflict of interest. If the vendor or any owner of the vendor's organization is currently an elected or appointed official or an employee of the State of Missouri or any political subdivision thereof, please provide the following information:

Name and title of elected or appointed official or employee of the State of Missouri or any political subdivision thereof:	
If employee of the State of Missouri or political subdivision thereof, provide name of state agency or political subdivision where employed:	
Percentage of ownership interest in vendor's organization held by elected or appointed official or employee of the State of Missouri or political subdivision thereof:	_____%

Registration of Business Name (if applicable) with the Missouri Secretary of State: The vendor should indicate the vendor's charter number and company name with the Missouri Secretary of State. Additionally, the vendor should provide proof of the vendor's good standing status with the Missouri Secretary of State. If the vendor is exempt from registering with the Missouri Secretary of State pursuant to section 351.572, RSMo., identify the specific section of 351.572 RSMo., which supports the exemption.

Charter Number (if applicable)	*Company Name*
If exempt from registering with the Missouri Secretary of State pursuant to section 351.572 RSMo., identify the section of 351.572 to support the exemption:	

Proposed Subcontractors - The vendor should identify any subcontractor(s) proposed to provide any of the services required herein.

Proposed Subcontractor Name and Address	Service Proposed to be Provided by the Proposed Subcontractor

Attachment 1

Band shall mean a range of wavelengths of electromagnetic radiation. Also, image data gathered at this wavelength range.

Brightness Number shall mean a number (normally 0-255) representing relative reflectance or emittance of an object in a digital image.

Buy-ups shall be defined as improvements over the standard base product (2-ft leaf-off True Color /CIR) that may be purchased by a state agency or other authorized user of the contract.

CIR shall mean color infrared images

Deliverable shall mean the photogrammetric product delivered by the contractor to the ordering entity

DEM refers to Digitial Elevation Model

Digital Orthoimage shall mean a georeferenced image prepared from a perspective photograph or other remotely-sensed data in which displacement of objects due to sensor orientation and terrain relief have been removed. It has the geometric characteristics of a map and the image qualities of a photograph.

FGDC refers to the Federal Geographic Data Committee.

Field refers only to the entire field, including the value, of the geokey (as defined in the TIFF Specification).

Geokey shall mean GeoTIFF information stored one level of abstraction lower than GeoTIFF tags. Similar to a tag, but not as limited in number.

Ground Sample Distance (GSD) shall mean the area of ground represented in each pixel in x and y components.

Image File Directory contains information about an image. There must be at least one IFD in a TIFF file and each IFD must have at least one entry.

LiDAR shall mean Light Detection and Ranging.

NAD83 shall mean North American Datum of 1983.

NAVD88 shall mean North American Vertical Datum of 1988.

Private tags shall mean TIFF tags numbered 32768 or higher. Private tags are not defined in the TIFF Specification.

Public tags shall mean TIFF tags that are defined by the TIFF Specification.

Resample shall mean interpolation of pixel values based upon neighboring pixel values.

SPC shall mean State Plane Coordinate.

Tag refers only to the identifying number portion of the geokey (as defined in the TIFF Specification).

TIFF™ shall mean tagged image file format.

UTM shall mean Universal Transverse Mercator.

Attachment 2

List of Missouri Counties

County	Square Miles (est.)
Adair	569
Andrew	436
Atchison	550
Audrain	696
Barry	790
Barton	596
Bates	851
Benton	752
Bollinger	622
Boone	690
Buchanan	415
Butler	700
Caldwell	429
Callaway	847
Camden	708
Cape Girardeau	587
Carroll	701
Carter	509
Cass	702
Cedar	498
Chariton	766
Christian	563
Clark	512
Clay	409
Clinton	423
Cole	399
Cooper	569
Crawford	743
Dade	506
Dallas	543
Daviess	569
Dekalb	426
Dent	754
Douglas	814
Dunklin	548
Franklin	929
Gasconade	526
Gentry	492
Greene	677

Attachment 2 (continued)

List of Missouri Counties

Grundy	438
Harrison	726
Henry	732
Hickory	411
Holt	471
Howard	471
Howell	928
Iron	552
Jackson	616
Jasper	641
Jefferson	664
Johnson	833
Knox	506
Laclede	767
Lafayette	638
Lawrence	613
Lewis	511
Lincoln	641
Linn	621
Livingston	538
Macon	812
Madison	498
Maries	530
Marion	444
McDonald	539
Mercer	455
Miller	600
Mississippi	430
Moniteau	418
Monroe	670
Montgomery	541
Morgan	613
New Madrid	698
Newton	626
Nodaway	878
Oregon	791
Osage	612
Ozark	755
Pemiscot	510
Perry	485
Pettis	686
Phelps	674

Attachment 2 (continued)

List of Missouri Counties

Pike	687
Platte	427
Polk	642
Pulaski	552
Putnam	519
Ralls	483
Randolph	487
Ray	574
Reynolds	814
Ripley	632
Saline	766
Schuyler	308
Scotland	439
Scott	426
Shannon	1,004
Shelby	502
St Charles	593
St Clair	702
St Francois	454
St Louis	523
St Louis City	66
Ste Genevieve	507
Stoddard	830
Stone	510
Sullivan	651
Taney	651
Texas	1,178
Vernon	836
Warren	438
Washington	763
Wayne	774
Webster	593
Worth	267
Wright	683
Total square miles(est.)	69,680

Attachment 3

TAG LISTINGS AND TIFFINFO/LISTGEO SAMPLE OUTPUTS

Tag Listings

The following table summarizes the TIFF 6.0, GeoTIFF 1.0, and GeoKey requirements. The values in the table are consistent with the TIFF 6.0 and GeoTIFF 1.0 standards, but there are fewer options than are allowed by TIFF. Additional guidelines and requirements for the values of tags and keys are detailed in the Annex A. Additional tags and keys may be used at the data producer's option, providing they do not conflict with the required tags.

TIFF tags required by baseline color TIFF:

TagName	Decimal	Hex	Type	Value
ImageWidth	256	100	SHORT or LONG	
ImageLength	257	101	SHORT or LONG	
BitsPerSample	258	102	SHORT	8,8,8
Compression	259	103	SHORT	1
PhotometricInterpretation	262	106	SHORT	2
Orientation	274	112	SHORT	1
StripOffsets	273	111	SHORT or LONG	
SamplesPerPixel	277	115	SHORT or LONG	3
RowsPerStrip	278	116	SHORT or LONG	1
StripByteCounts	279	117	LONG or SHORT	

TIFF tags defined by GeoTIFF:

TagName	Decimal	Hex	Type	Value
ModelPixelScaleTag	33550	830E	DOUBLE	
ModelTiepointTag	33922	8482	DOUBLE	
GeoAsciiParamsTag	34737	87B1	ASCII	
GeoKeyDirectoryTag	34735	87AF	SHORT	

GeoKeys defined by GeoTIFF:

TagName	Decimal	Hex	Type	Value
GTModelTypeGeoKey	1024	400	6.3.1.1 code	1
GTRasterTypeGeoKey	1025	401	6.3.1.2 code	1
GTCitationGeoKey		1026	402	ASCII
ProjectedCSTypeGeoKey	3072	C00	6.3.3.1 code	
PCSCitationGeoKey	3073	C01	ASCII	
ProjLinearUnitsGeoKey	3076	C04	SHORT	

Utility *tiffinfo* sample output

This listing is an output of the libtiff utility program "*tiffinfo*".

TIFF Directory at offset 0x2370bc4
Image Width: 3247 Image Length: 3815
Resolution: 200, 200 (unitless)
Bits/Sample: 8
Compression Scheme: none
Photometric Interpretation: RGB color
Samples/Pixel: 3
Rows/Strip: 1
Planar Configuration: single image plane

Utility *listgeo* sample output

The following is an example of a GeoTIFF tag and GeoKey listing from a USGS image. This listing is the output of the libgeotiff utility program "*listgeo*". The projection information below the line "End_Of_Geotiff" is implied by the standard projection and is not stored explicitly in the data file. The descriptions are retrieved from libgeotiff lookup tables in the listgeo application.

```
Geotiff_Information:
  Version: 1
  Key_Revision: 1.0
  Tagged_Information:
    ModelTiepointTag (2,3):
      0          0          0
      337962     3763838    0
    ModelPixelScaleTag (1,3):
      2          2          1
    End_Of_Tags.
  Keyed_Information:
    GTModelTypeGeoKey (Short,1): ModelTypeProjected
    GTRasterTypeGeoKey (Short,1): RasterPixelIsArea
    GTCitationGeoKey (Ascii,45): "USGS n3309403nw_2_20050714"
    ProjectedCSTypeGeoKey (Short,1): PCS_NAD83_UTM_zone_15N
    PCSCitationGeoKey (Ascii,21): "NAD83 / UTM zone 15N"
    ProjLinearUnitsGeoKey (Short,1): Linear_Meter
    End_Of_Keys.
  End_Of_Geotiff.

PCS = 26915 (name unknown)
Projection = 16015 ()
Projection Method: CT_TransverseMercator
  ProjNatOriginLatGeoKey: 0.000000 (  0d 0' 0.00"N)
  ProjNatOriginLongGeoKey: -93.000000 ( 93d 0' 0.00"W)
  ProjScaleAtNatOriginGeoKey: 0.999600
  ProjFalseEastingGeoKey: 500000.000000
  ProjFalseNorthingGeoKey: 0.000000
GCS: 4269/NAD83
Datum: 6269/North American Datum 1983
Ellipsoid: 7019/GRS 1980 (6378137.00,6356752.31)
Prime Meridian: 8901/Greenwich (0.000000/  0d 0' 0.00"E)
Projection Linear Units: 9001/metre (1.000000m)

Corner Coordinates:
Upper Left   ( 337962.000,3763838.000) ( 94d45'16.56"W, 34d 0' 9.55"N)
Lower Left   ( 337962.000,3756208.000) ( 94d45'11.47"W, 33d56' 1.94"N)
Upper Right  ( 344456.000,3763838.000) ( 94d41' 3.51"W, 34d 0'13.09"N)
Lower Right  ( 344456.000,3756208.000) ( 94d40'58.63"W, 33d56' 5.47"N)

Center       ( 341209.000,3760023.000) ( 94d43' 7.54"W, 33d58' 7.53"N)
```

Attachment 4

Feature			
Buildings Features			
Buildings General	BLDG_GEN	Polygon	All residential, commercial, industrial and institutional
Out Buildings	BLDG_OUT	Polygon	Out buildings such as sheds, detached garages, carports, etc.
Mobile Homes	BLDG_MH	Polygon	All visible mobile homes
Swimming Pools	BLDG_POOL	Polygon	All visible pools; Must contain field to discern above ground vs. in-ground
Docks and Piers	DOCKS	Polygon	All visible docks/piers
Foundations	BLDG_FDN	Polygon	All visible foundations and ruins
Decks and Porches	BLDG_DECK BLDG_PORCH	Polygon	All visible decks/porches
Canopies	BLDG_CANOPY	Polygon	All visible canopies
Tanks	BLDG_TANK	Polygon	All water, gas, and other tanks
Hydrographic Features			
Rivers	HYDRO_RIVER	Line/Polygon	Collect all rivers
Streams and Brooks	HYDRO_STREAM	Line/Polygon	All visible streams and brooks
Ponds and Lakes	HYDRO_LAKE	Polygon	Closed, permanent bodies of water
Intermittent Streams	HYDRO_STREAM_INT	Line	Visible intermittent streams
Transportation Features			
Street and Pavement Edge	RD_EDGE_PAVED RD_EDGE-UNPAVED RD_PAVED RD_UNPAVED	Line Line Polygon Polygon	All paved and unpaved edges of street pavement including alleys. Pavement edges must be continuous and should not break at driveways, parking lots, or other features.
Curb Lines	RD_CURB	Line	All curb lines. Lines must be continuous and should not break at driveways, etc.
Sidewalk-Public	RD_SDWLK	Polygon	Front and Back of sidewalk. If front of sidewalk is coincident with curb or road features, road features take a precedent.
Parking Areas	PARKING_PAVED PARKING _UNPAVED	Polygon	Identify all areas having more than 5 parking spaces. Attribute table must have a field to discern Paved vs. Unpaved.
Driveways	BRIVE_PAVED DRIVE_UNPAVED	Polygon	Identify all public and private driveways. Attribute table must have a field to discern paved vs. unpaved.
Airport	AIRPORT	Polygon	Concord Airport paved area.

Attachments

Attachments 5, 6, and 7 are separate links that must be downloaded separately from the MissouriBUYS Statewide eProcurement System at: https://missouribuys.mo.gov/bidboard.html.

STATE OF MISSOURI
DIVISION OF PURCHASING

TERMS AND CONDITIONS -- REQUEST FOR PROPOSAL

1. TERMINOLOGY/DEFINITIONS

Whenever the following words and expressions appear in a Request for Proposal (RFP) document or any addendum thereto, the definition or meaning described below shall apply.

a. **Agency and/or State Agency** means the statutory unit of state government in the State of Missouri for which the equipment, supplies, and/or services are being purchased by the **Division of Purchasing (Purchasing)**. The agency is also responsible for payment.
b. **Addendum** means a written, official modification to an RFP.
c. **Amendment** means a written, official modification to a contract.
d. **Attachment** applies to all forms which are included with an RFP to incorporate any informational data or requirements related to the performance requirements and/or specifications.
e. **Proposal End Date and Time** and similar expressions mean the exact deadline required by the RFP for the receipt of sealed proposals.
f. **Vendor** means the supplier, vendor, person, or organization that responds to an RFP by submitting a proposal with prices to provide the equipment, supplies, and/or services as required in the RFP document.
g. **Buyer** means the procurement staff member of Purchasing. The **Contact Person** as referenced herein is usually the Buyer.
h. **Contract** means a legal and binding agreement between two or more competent parties, for a consideration for the procurement of equipment, supplies, and/or services.
i. **Contractor** means a supplier, vendor, person, or organization who is a successful vendor as a result of an RFP and who enters into a contract.
j. **Exhibit** applies to forms which are included with an RFP for the vendor to complete and submit with the sealed proposal prior to the specified end date and time.
k. **Request for Proposal (RFP)** means the solicitation document issued by Purchasing to potential vendors for the purchase of equipment, supplies, and/or services as described in the document. The definition includes these Terms and Conditions as well as all Pricing Pages, Exhibits, Attachments, and Addendums thereto.
l. **May** means that a certain feature, component, or action is permissible, but not required.
m. **Must** means that a certain feature, component, or action is a mandatory condition.
n. **Pricing Page(s)** applies to the form(s) on which the vendor must state the price(s) applicable for the equipment, supplies, and/or services required in the RFP. The pricing pages must be completed and submitted by the vendor with the sealed proposal prior to the specified proposal end date and time.
o. **RSMo (Revised Statutes of Missouri)** refers to the body of laws enacted by the Legislature which govern the operations of all agencies of the State of Missouri. Chapter 34 of the statutes is the primary chapter governing the operations of Purchasing.
p. **Shall** has the same meaning as the word must.
q. **Should** means that a certain feature, component and/or action is desirable but not mandatory.

2. APPLICABLE LAWS AND REGULATIONS

a. The contract shall be construed according to the laws of the State of Missouri. The contractor shall comply with all local, state, and federal laws and regulations related to the performance of the contract to the extent that the same may be applicable.
b. To the extent that a provision of the contract is contrary to the Constitution or laws of the State of Missouri or of the United States, the provisions shall be void and unenforceable. However, the balance of the contract shall remain in force between the parties unless terminated by consent of both the contractor and Purchasing.
c. The contractor must be registered and maintain good standing with the Secretary of State of the State of Missouri and other regulatory agencies, as may be required by law or regulations.
d. The contractor must timely file and pay all Missouri sales, withholding, corporate and any other required Missouri tax returns and taxes, including interest and additions to tax.
e. The exclusive venue for any legal proceeding relating to or arising out of the RFP or resulting contract shall be in the Circuit Court of Cole County, Missouri.
f. The contractor shall only employ personnel authorized to work in the United States in accordance with applicable federal and state laws and Executive Order 07-13 for work performed in the United States.

3. OPEN COMPETITION/REQUEST FOR PROPOSAL DOCUMENT

a. It shall be the vendor's responsibility to ask questions, request changes or clarification, or otherwise advise Purchasing if any language, specifications or requirements of an RFP appear to be ambiguous, contradictory, and/or arbitrary, or appear to inadvertently restrict or limit the requirements stated in the RFP to a single source. Any and all communication from vendors regarding specifications, requirements, competitive proposal process, etc., must be directed to the buyer from Purchasing, unless the RFP specifically refers the vendor to another contact. Such e-mail, fax, or phone communication should be received at least ten calendar days prior to the official proposal end date.
b. Every attempt shall be made to ensure that the vendor receives an adequate and prompt response. However, in order to maintain a fair and equitable procurement process, all vendors will be advised, via the issuance of an addendum to the RFP, of any relevant or pertinent information related to the procurement. Therefore, vendors are advised that unless specified elsewhere in the RFP, any questions received less than ten calendar days prior to the RFP end date may not be answered.
c. Vendors are cautioned that the only official position of the State of Missouri is that which is issued by Purchasing in the RFP or an addendum thereto. No other means of communication, whether oral or written, shall be construed as a formal or official response or statement.
d. Purchasing monitors all procurement activities to detect any possibility of deliberate restraint of competition, collusion among vendors, price-fixing by vendors, or any other anticompetitive conduct by vendors which appears to violate state and federal antitrust laws. Any suspected violation shall be referred to the Missouri Attorney General's Office for appropriate action.
e. The RFP is available for viewing and downloading on the MissouriBUYS Statewide eProcurement System. Registered vendors are electronically notified of those proposal opportunities that match the commodity codes for which the vendor registered in MissouriBUYS. If a registered vendor's e-mail address is incorrect, the vendor must update the e-mail address themselves on the state's MissouriBUYS Statewide eProcurement System at https://missouribuys.mo.gov/ .
f. Purchasing reserves the right to officially amend or cancel an RFP after issuance. It shall be the sole responsibility of the vendor to monitor the MissouriBUYS Statewide eProcurement System to obtain a copy of the addendum(s). Registered vendors who received e-mail notification of the proposal opportunity when the RFP was established and registered vendors who have responded to the RFP on-line prior to an addendum being issued

should receive e-mail notification of the addendum(s). Registered vendors who received e-mail notification of the proposal opportunity when the RFP was established and registered vendors who have responded to the proposal on-line prior to a cancellation being issued should receive e-mail notification of a cancellation issued prior to the exact end date and time specified in the RFP.

4. PREPARATION OF PROPOSALS

a. Vendors must examine the entire RFP carefully. Failure to do so shall be at the vendor's risk.
b. Unless otherwise specifically stated in the RFP, all specifications and requirements constitute minimum requirements. All proposals must meet or exceed the stated specifications and requirements.
c. Unless otherwise specifically stated in the RFP, any manufacturer names, trade names, brand names, information and/or catalog numbers listed in a specification and/or requirement are for informational purposes only and are not intended to limit competition. The vendor may offer any brand which meets or exceeds the specification for any item, but must state the manufacturer's name and model number for any such brands in the proposal. In addition, the vendor shall explain, in detail, (1) the reasons why the proposed equivalent meets or exceeds the specifications and/or requirements and (2) why the proposed equivalent should not be considered an exception thereto. Proposals which do not comply with the requirements and specifications are subject to rejection without clarification.
d. Proposals lacking any indication of intent to offer an alternate brand or to take an exception shall be received and considered in complete compliance with the specifications and requirements as listed in the RFP.
e. In the event that the vendor is an agency of state government or other such political subdivision which is prohibited by law or court decision from complying with certain provisions of an RFP, such a vendor may submit a proposal which contains a list of statutory limitations and identification of those prohibitive clauses. The vendor should include a complete list of statutory references and citations for each provision of the RFP, which is affected by this paragraph. The statutory limitations and prohibitive clauses may (1) be requested to be clarified in writing by Purchasing or (2) be accepted without further clarification if the statutory limitations and prohibitive clauses are deemed acceptable by Purchasing. If Purchasing determines clarification of the statutory limitations and prohibitive clauses is necessary, the clarification will be conducted in order to agree to language that reflects the intent and compliance of such law and/or court order and the RFP.
f. All equipment and supplies offered in a proposal must be new, of current production, and available for marketing by the manufacturer unless the RFP clearly specifies that used, reconditioned, or remanufactured equipment and supplies may be offered.
g. Prices shall include all packing, handling and shipping charges FOB destination, freight prepaid and allowed unless otherwise specified in the RFP.
h. Proposals, including all prices therein, shall remain valid for 90 days from proposal opening or Best and Final Offer (BAFO) submission unless otherwise indicated. If the proposal is accepted, the entire proposal, including all prices, shall be firm for the specified contract period.
i. Any foreign vendor not having an Employer Identification Number assigned by the United States Internal Revenue Service (IRS) must submit a completed IRS Form W-8 prior to or with the submission of their proposal in order to be considered for award.

5. SUBMISSION OF PROPOSALS

a. Registered vendors may submit proposals electronically through the MissouriBUYS Statewide eProcurement System at https://missouribuys.mo.gov/ or by delivery of a hard copy to the Purchasing office. Vendors that have not registered on the MissouriBUYS Statewide eProcurement System may submit proposals hard copy delivered to the Purchasing office. Delivered proposals must be sealed in an envelope or container, and received in the Purchasing office located at 301 West High St, Rm 630 in Jefferson City, MO no later than the exact end date and time specified in the RFP. All proposals must (1) be submitted by a duly authorized representative of the vendor's organization, (2) contain all information required by the RFP, and (3) be priced as required. Hard copy proposals may be mailed to the Purchasing post office box address. However, it shall be the responsibility of the vendor to ensure their proposal is in the Purchasing office (address listed above) no later than the exact end date and time specified in the RFP.
b. The sealed envelope or container containing a proposal should be clearly marked on the outside with (1) the official RFP number and (2) the official end date and time. Different proposals should not be placed in the same envelope, although copies of the same proposal may be placed in the same envelope.
c. A proposal submitted electronically by a registered vendor may be modified on-line prior to the official end date and time. A proposal which has been delivered to the Purchasing office may be modified by signed, written notice which has been received by Purchasing prior to the official end date and time specified. A proposal may also be modified in person by the vendor or its authorized representative, provided proper identification is presented before the official end date and time. Telephone or telegraphic requests to modify a proposal shall not be honored.
d. A proposal submitted electronically by a registered vendor may be retracted on-line prior to the official end date and time. A proposal which has been delivered to the Purchasing may only be withdrawn by a signed, written document on company letterhead transmitted via mail, e-mail, or facsimile which has been received by Purchasing prior to the official end and time specified. A proposal may also be withdrawn in person by the vendor or its authorized representative, provided proper identification is presented before the official end date and time. Telephone or telegraphic requests to withdraw a proposal shall not be honored.
e. A proposal may also be withdrawn after the proposal opening through submission of a written request by an authorized representative of the vendor. Justification of withdrawal decision may include a significant error or exposure of proposal information that may cause irreparable harm to the vendor.
f. When submitting a proposal electronically, the registered vendor indicates acceptance of all RFP requirements, terms and conditions by clicking on the "Accept" button on the Overview tab. Vendors delivering a hard copy proposal to Purchasing must sign and return the RFP cover page or, if applicable, the cover page of the last addendum thereto in order to constitute acceptance by the vendor of all RFP requirements, terms and conditions. Failure to do so may result in rejection of the proposal unless the vendor's full compliance with those documents is indicated elsewhere within the vendor's response.
g. Faxed proposals shall not be accepted. However, faxed and e-mail no-bid notifications shall be accepted.

6. PROPOSAL OPENING

a. Proposal openings are public on the end date and at the opening time specified on the RFP document. Only the names of the respondents shall be read at the proposal opening. All vendors may view the same proposal response information on the MissouriBUYS Statewide eProcurement System. The contents of the responses shall not be disclosed at this time.
b. Proposals which are not received in the Purchasing office prior to the official end date and time shall be considered late, regardless of the degree of lateness, and normally will not be opened. Late proposals may only be opened under extraordinary circumstances in accordance with 1 CSR 40-1.050.

7. PREFERENCES

a. In the evaluation of proposals, preferences shall be applied in accordance with chapter 34, RSMo, other applicable Missouri statutes, and applicable Executive Orders. Contractors should apply the same preferences in selecting subcontractors.

b. By virtue of statutory authority, a preference will be given to materials, products, supplies, provisions and all other articles produced, manufactured, mined, processed or grown within the State of Missouri and to all firms, corporations or individuals doing business as Missouri firms, corporations or individuals. Such preference shall be given when quality is equal or better and delivered price is the same or less.
c. In accordance with Executive Order 05-30, contractors are encouraged to utilize certified minority and women-owned businesses in selecting subcontractors.

8. EVALUATION/AWARD

a. Any clerical error, apparent on its face, may be corrected by the buyer before contract award. Upon discovering an apparent clerical error, the buyer shall contact the vendor and request clarification of the intended proposal. The correction shall be incorporated in the notice of award. Examples of apparent clerical errors are: 1) misplacement of a decimal point; and 2) obvious mistake in designation of unit.
b. Any pricing information submitted by a vendor shall be subject to evaluation if deemed by Purchasing to be in the best interest of the State of Missouri.
c. The vendor is encouraged to propose price discounts for prompt payment or propose other price discounts that would benefit the State of Missouri. However, unless otherwise specified in the RFP, pricing shall be evaluated at the maximum potential financial liability to the State of Missouri.
d. Awards shall be made to the vendor whose proposal (1) complies with all mandatory specifications and requirements of the RFP and (2) is the lowest and best proposal, considering price, responsibility of the vendor, and all other evaluation criteria specified in the RFP and any subsequent negotiations and (3) complies with chapter 34, RSMo, other applicable Missouri statutes, and all applicable Executive Orders.
e. In the event all vendors fail to meet the same mandatory requirement in an RFP, Purchasing reserves the right, at its sole discretion, to waive that requirement for all vendors and to proceed with the evaluation. In addition, Purchasing reserves the right to waive any minor irregularity or technicality found in any individual proposal.
f. Purchasing reserves the right to reject any and all proposals.
g. When evaluating a proposal, the State of Missouri reserves the right to consider relevant information and fact, whether gained from a proposal, from a vendor, from vendor's references, or from any other source.
h. Any information submitted with the proposal, regardless of the format or placement of such information, may be considered in making decisions related to the responsiveness and merit of a proposal and the award of a contract.
i. Negotiations may be conducted with those vendors who submit potentially acceptable proposals. Proposal revisions may be permitted for the purpose of obtaining best and final offers. In conducting negotiations, there shall be no disclosure of any information submitted by competing vendors.
j. Any award of a contract shall be made by notification from Purchasing to the successful vendor. Purchasing reserves the right to make awards by item, group of items, or an all or none basis. The grouping of items awarded shall be determined by Purchasing based upon factors such as item similarity, location, administrative efficiency, or other considerations in the best interest of the State of Missouri.
k. Pursuant to section 610.021, RSMo, proposals and related documents shall not be available for public review until after a contract is executed or all proposals are rejected.
l. Purchasing posts all proposal results on the MissouriBUYS Statewide eProcurement System for all vendors to view for a reasonable period after proposal award and maintains images of all proposal file material for review. Vendors who include an e-mail address with their proposal will be notified of the award results via e-mail.
m. Purchasing reserves the right to request clarification of any portion of the vendor's response in order to verify the intent of the vendor. The vendor is cautioned, however, that its response may be subject to acceptance or rejection without further clarification.
n. Any proposal award protest must be received within ten (10) business days after the date of award in accordance with the requirements of 1 CSR 40-1.050 (9).
o. The final determination of contract(s) award shall be made by Purchasing.

9. CONTRACT/PURCHASE ORDER

a. By submitting a proposal, the vendor agrees to furnish any and all equipment, supplies and/or services specified in the RFP, at the prices quoted, pursuant to all requirements and specifications contained therein.
b. A binding contract shall consist of: (1) the RFP, addendums thereto, and any Best and Final Offer (BAFO) request(s) with RFP changes/additions, (2) the contractor's proposal including any contractor BAFO response(s), (3) clarification of the proposal, if any, and (4) Purchasing's acceptance of the proposal by "notice of award" or by "purchase order." All Exhibits and Attachments included in the RFP shall be incorporated into the contract by reference.
c. A notice of award issued by the State of Missouri does not constitute an authorization for shipment of equipment or supplies or a directive to proceed with services. Before providing equipment, supplies and/or services for the State of Missouri, the contractor must receive a properly authorized purchase order or other form of authorization given to the contractor at the discretion of the state agency.
d. The contract expresses the complete agreement of the parties and performance shall be governed solely by the specifications and requirements contained therein. Any change to the contract, whether by modification and/or supplementation, must be accomplished by a formal contract amendment signed and approved by and between the duly authorized representative of the contractor and Purchasing or by a modified purchase order prior to the effective date of such modification. The contractor expressly and explicitly understands and agrees that no other method and/or no other document, including correspondence, acts, and oral communications by or from any person, shall be used or construed as an amendment or modification to the contract.

10. INVOICING AND PAYMENT

a. The State of Missouri does not pay state or federal taxes unless otherwise required under law or regulation.
b. The statewide financial management system has been designed to capture certain receipt and payment information. For each purchase order received, an invoice must be submitted that references the purchase order number and must be itemized in accordance with items listed on the purchase order. Failure to comply with this requirement may delay processing of invoices for payment.
c. The contractor shall not transfer any interest in the contract, whether by assignment or otherwise, without the prior written consent of Purchasing.
d. Payment for all equipment, supplies, and/or services required herein shall be made in arrears unless otherwise indicated in the RFP.
e. The State of Missouri assumes no obligation for equipment, supplies, and/or services shipped or provided in excess of the quantity ordered. Any unauthorized quantity is subject to the state's rejection and shall be returned at the contractor's expense.
f. All invoices for equipment, supplies, and/or services purchased by the State of Missouri shall be subject to late payment charges as provided in section 34.055, RSMo.
g. The State of Missouri reserves the right to purchase goods and services using the state purchasing card.

11. DELIVERY

Time is of the essence. Deliveries of equipment, supplies, and/or services must be made no later than the time stated in the contract or within a reasonable period of time, if a specific time is not stated.

12. INSPECTION AND ACCEPTANCE

a. No equipment, supplies, and/or services received by an agency of the state pursuant to a contract shall be deemed accepted until the agency has had reasonable opportunity to inspect said equipment, supplies, and/or services.
b. All equipment, supplies, and/or services which do not comply with the specifications and/or requirements or which are otherwise unacceptable or defective may be rejected. In addition, all equipment, supplies, and/or services which are discovered to be defective or which do not conform to any warranty of the contractor upon inspection (or at any later time if the defects contained were not reasonably ascertainable upon the initial inspection) may be rejected.
c. The State of Missouri reserves the right to return any such rejected shipment at the contractor's expense for full credit or replacement and to specify a reasonable date by which replacements must be received.
d. The State of Missouri's right to reject any unacceptable equipment, supplies, and/or services shall not exclude any other legal, equitable or contractual remedies the state may have.

13. WARRANTY

a. The contractor expressly warrants that all equipment, supplies, and/or services provided shall: (1) conform to each and every specification, drawing, sample or other description which was furnished to or adopted by Purchasing, (2) be fit and sufficient for the purpose expressed in the RFP, (3) be merchantable, (4) be of good materials and workmanship, and (5) be free from defect.
b. Such warranty shall survive delivery and shall not be deemed waived either by reason of the state's acceptance of or payment for said equipment, supplies, and/or services.

14. CONFLICT OF INTEREST

a. Elected or appointed officials or employees of the State of Missouri or any political subdivision thereof, serving in an executive or administrative capacity, must comply with sections 105.452 and 105.454, RSMo, regarding conflict of interest.
b. The contractor hereby covenants that at the time of the submission of the proposal the contractor has no other contractual relationships which would create any actual or perceived conflict of interest. The contractor further agrees that during the term of the contract neither the contractor nor any of its employees shall acquire any other contractual relationships which create such a conflict.

15. REMEDIES AND RIGHTS

a. No provision in the contract shall be construed, expressly or implied, as a waiver by the State of Missouri of any existing or future right and/or remedy available by law in the event of any claim by the State of Missouri of the contractor's default or breach of contract.
b. The contractor agrees and understands that the contract shall constitute an assignment by the contractor to the State of Missouri of all rights, title and interest in and to all causes of action that the contractor may have under the antitrust laws of the United States or the State of Missouri for which causes of action have accrued or will accrue as the result of or in relation to the particular equipment, supplies, and/or services purchased or procured by the contractor in the fulfillment of the contract with the State of Missouri.

16. CANCELLATION OF CONTRACT

a. In the event of material breach of the contractual obligations by the contractor, Purchasing may cancel the contract. At its sole discretion, Purchasing may give the contractor an opportunity to cure the breach or to explain how the breach will be cured. The actual cure must be completed within no more than 10 working days from notification, or at a minimum the contractor must provide Purchasing within 10 working days from notification a written plan detailing how the contractor intends to cure the breach.
b. If the contractor fails to cure the breach or if circumstances demand immediate action, Purchasing will issue a notice of cancellation terminating the contract immediately. If it is determined Purchasing improperly cancelled the contract, such cancellation shall be deemed a termination for convenience in accordance with the contract.
c. If Purchasing cancels the contract for breach, Purchasing reserves the right to obtain the equipment, supplies, and/or services to be provided pursuant to the contract from other sources and upon such terms and in such manner as Purchasing deems appropriate and charge the contractor for any additional costs incurred thereby.
d. The contractor understands and agrees that funds required to fund the contract must be appropriated by the General Assembly of the State of Missouri for each fiscal year included within the contract period. The contract shall not be binding upon the state for any period in which funds have not been appropriated, and the state shall not be liable for any costs associated with termination caused by lack of appropriations.

17. COMMUNICATIONS AND NOTICES

Any notice to the vendor/contractor shall be deemed sufficient when deposited in the United States mail postage prepaid, transmitted by facsimile, transmitted by e-mail or hand-carried and presented to an authorized employee of the vendor/contractor.

18. BANKRUPTCY OR INSOLVENCY

a. Upon filing for any bankruptcy or insolvency proceeding by or against the contractor, whether voluntary or involuntary, or upon the appointment of a receiver, trustee, or assignee for the benefit of creditors, the contractor must notify Purchasing immediately.
b. Upon learning of any such actions, Purchasing reserves the right, at its sole discretion, to either cancel the contract or affirm the contract and hold the contractor responsible for damages.

19. INVENTIONS, PATENTS AND COPYRIGHTS

The contractor shall defend, protect, and hold harmless the State of Missouri, its officers, agents, and employees against all suits of law or in equity resulting from patent and copyright infringement concerning the contractor's performance or products produced under the terms of the contract.

20. NON-DISCRIMINATION AND AFFIRMATIVE ACTION

In connection with the furnishing of equipment, supplies, and/or services under the contract, the contractor and all subcontractors shall agree not to discriminate against recipients of services or employees or applicants for employment on the basis of race, color, religion, national origin, sex, age, disability, or veteran status unless otherwise provided by law. If the contractor or subcontractor employs at least 50 persons, they shall have and maintain an affirmative action program which shall include:

a. A written policy statement committing the organization to affirmative action and assigning management responsibilities and procedures for evaluation and dissemination;
b. The identification of a person designated to handle affirmative action;
c. The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to layoff, recall, discharge, demotion, and discipline;
d. The exclusion of discrimination from all collective bargaining agreements; and
e. Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

If discrimination by a contractor is found to exist, Purchasing shall take appropriate enforcement action which may include, but not necessarily be limited to, cancellation of the contract, suspension, or debarment by Purchasing until corrective action by the contractor is made and ensured, and referral to the Attorney General's Office, whichever enforcement action may be deemed most appropriate.

21. AMERICANS WITH DISABILITIES ACT

In connection with the furnishing of equipment, supplies, and/or services under the contract, the contractor and all subcontractors shall comply with all applicable requirements and provisions of the Americans with Disabilities Act (ADA).

22. FILING AND PAYMENT OF TAXES

The commissioner of administration and other agencies to which the state purchasing law applies shall not contract for goods or services with a vendor if the vendor or an affiliate of the vendor makes sales at retail of tangible personal property or for the purpose of storage, use, or consumption in this state but fails to collect and properly pay the tax as provided in chapter 144, RSMo. For the purposes of this section, "affiliate of the vendor" shall mean any person or entity that is controlled by or is under common control with the vendor, whether through stock ownership or otherwise. Therefore the vendor's failure to maintain compliance with chapter 144, RSMo, may eliminate their proposal from consideration for award.

23. TITLES

Titles of paragraphs used herein are for the purpose of facilitating reference only and shall not be construed to infer a contractual construction of language.

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