CONTRACT NO. 4400033158

IDIQ CONTRACT FOR WIDE-AREA LIDAR AND PHOTOGRAMMETRY SUPPORT SERVICES – FOR STATEWIDE TOPOGRAPHIC MAPPING PROGRAM

Lousiana Department of Transportation and Development

SEPTEMBER 18, 2025

SUBMITTED BY

Dewberry Engineers Inc.
9026 Jefferson Highway, Suite 302
Baton Rouge, LA 70809

SUBMITTED TO

Louisiana Department of
Transportation and Development
Steve LeBlanc, DOTD Contract Manager (CM)
1201 Capital Access Road, Room 405 – E
Baton Rouge, LA 70802

DEWBERRY ENGINEERS INC.
9026 JEFFERSON HIGHWAY, SUITE 302
BATON ROUGE, LA 70809
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COVER LETTER

September 18, 2025

Louisiana Department of Transportation and Development (LA DOTD)
Attn: Steve LeBlanc, DOTD Contract Manager (CM)
1201 Capital Access Road, Room 405 – E
Baton Rouge, LA 70802

RE: Contract No. 4400033158 / IDIQ Contract for Wide-Area Lidar and Photogrammetry Support Services – For Statewide Topographic Mapping Program

Dear Mr. LeBlanc,

On behalf of Dewberry Engineers Inc. (Dewberry), we are pleased to submit our proposal to the Louisiana Department of Transportation and Development (LA DOTD) indefinite delivery/indefinite quantity (IDIQ) contract for Statewide Topographic Mapping support. Founded in 1956, **Dewberry** is a nationally recognized, family-owned consulting firm with a multidisciplinary geospatial practice that has served federal, state, and local government clients for decades.

1. **Location and Knowledge.** Dewberry has a local office located in Baton Rouge and 20 years of experience working on projects across Louisiana.
2. **Firm Experience.** Dewberry has two decades of experience working directly with DOTD on multiple CTP Lidar and GIS support contracts.
3. **Team Size.** The Dewberry team has ample equipment and personnel resources to collect and process ground survey, imagery, and Lidar services across Louisiana.
4. **Staff Experience.** Key personnel include ASPRS-certified and licensed (FAA and PLS) subject matter experts in aerial photography, remote sensing, topographic and bathymetric Lidar, photogrammetry, QA/QC, and GIS.

Dewberry has successfully completed similar contracts nationwide, including contracts with DOTD, multiple Geospatial Products and Services Contracts (GPSC) with USGS, and Coastal Geospatial Services Contracts (CGSC) with NOAA. These contracts demonstrate our ability to deliver quality, cost-effective, and timely mapping products that support transportation planning, engineering, and emergency management.

Dewberry and our teaming partners, **Forte & Tablada (ground survey), and Keystone (Lidar and aerial imagery)** collectively provide all the resources necessary to complete any task order (TO) issued under this contract. Our combined team approach provides DOTD with a team with specialized regional expertise and ample capacity.

Our team resources include all the required equipment outlined in the RFP including:

- Survey-grade GPS systems
- Airborne digital cameras capable of 3" resolution with four spectral bands
- Airborne Lidar sensors suitable for topographic and bathymetric acquisition
- Multiple aircraft instrumented for imagery and Lidar collection

Dewberry's Master Service Agreement (MSA) with Revolution Flight satisfies DOTD requirements for both sensors and aircraft; located in Section 20. The Dewberry team is built to surge and scale while maintaining consistency in data quality, timeliness, and cost-effectiveness based on DOTD's needs.

Additionally, our team exceeds all DOTD's Minimum Personnel Requirements (MPRs). Dewberry's Principal-in-Charge, **Jason Dolf, CP, CMS (MPR 1, 3, 4 and 6)** has over 28 years of experience in the geospatial industry including editing and processing imagery. **Meagan Anderson, CMS (MPR 2, 3 and 4)** is a well-respected industry expert in topographic Lidar acquisition and processing with over 14 years of expertise. **Bryan Deslauriers, CP, PMP, GISP (MPR 3)** brings over 20 years of experience in both photogrammetry and Lidar, while **Stephanie Padilla (MPR 4)** brings proven expertise with 8 years of experience in acquiring and processing bathymetric Lidar. **Bradley Holleman, PE, PLS (MPR 5)** from Forte & Tablada (F&T) is a Louisiana-licensed Professional Land Surveyor with over 19 years of experience in ground survey. Dewberry's **Nathanael Litter, CP, PMP, GISP (MPR 6)** is an FAA-certified pilot with over 19 years of experience in aerial data acquisition.

Together, our team of certified professionals and subject matter experts will provide DOTD with a team that has the expertise to successfully complete each TO on-time, within budget, and in full compliance with nationally recognized industry standards including the American Society for Photogrammetry and Remote Sensing (ASPRS) standards for imagery, and the latest USGS Lidar Base Specifications for both topographic and bathymetric Lidar.

The Dewberry team has the size, capacity, and expertise to complete every TO for DOTD successfully, no matter how large, complex or time-sensitive. We remain committed to supporting DOTD through responsive project management, open communication, and reliable delivery of mapping products that supports Louisiana's transportation infrastructure.

Should you need additional information, please contact our DOTD Client Manager, Ryan Ligon at 813.421.8626 or rligon@dewberry.com.

Sincerely,

Jason Dolf, CP, CMS
Associate Vice President
jdolf@dewberry.com
813.327.5069

DOTD FORM: 24-102

(Revised August 11, 2025)

PROPOSAL TO PROVIDE CONSULTANT SERVICES

Prime consultant shall complete the DOTD Form 24-102 without altering the Form's text; however, the instruction and/or guidance for Sections 12 through 23 can be removed but do not remove Section title and number.

ANY CONSULTANT FAILING TO SUBMIT ANY OF THE INFORMATION REQUIRED ON THE DOTD FORM 24-102, OR PROVIDING INACCURATE INFORMATION ON THE DOTD FORM 24-102, MAY BE CONSIDERED NON-RESPONSIVE.

1. Contract Name as shown in the advertisement	IDIQ Contract for Wide-Area Lidar and Photogrammetry Support Services – For Statewide Topographic Mapping Program
2. Contract Number(s) as shown in the advertisement	4400033158
3. State Project Number(s), if shown in the advertisement	N/A
4. Prime consultant name **(name must match exactly as registered with the Louisiana Secretary of State (SOS) where such registration is required by law; including punctuation; include screenshot from SOS at the end of Section 20)**	Dewberry Engineers Inc.
5. Prime consultant license number (as registered with the Louisiana Professional Engineering and Land Surveying Board (LAPELS) if registration is required under Louisiana law)	EF.0005045
6. Prime consultant mailing address	8401 Arlington Boulevard, Fairfax, VA 22031-4619
7. Prime consultant physical address (existing or to be established, if location is used as an evaluation criteria)	9026 Jefferson Highway, Suite 302. Baton Rouge, LA 70809
8. Name, title, phone number, and email address of prime consultant's contract point of contact	Ryan Ligon, GIS Technology Manager 813.421.3626, rligon@dewberry.com
9. Name, title, phone number, and email address of the official with signing authority for this proposal	Jason Dolf, CP, CMS Associate Vice President 813.327.5069, jdolf@dewberry.com

Prime consultant should enter the firm name in the footer at the bottom of this page. (It will carry over to subsequent pages.)

10. This is to certify that all information contained herein is accurate and true, and that the team presently has sufficient staff to perform these services within the designated time frame. By submitting this proposal, proposer certifies that it is not engaged in a boycott of Israel and it will, for the duration of its contract obligations, refrain from a boycott of Israel. Proposer also certifies and agrees that the following information is correct: In preparing its response, the proposer has considered all proposals submitted from qualified, potential subcontractors and suppliers, and has not, in the solicitation, selection, or commercial treatment of any subcontractor or supplier, refused to transact or terminated business activities, or taken other actions intended to limit commercial relations, with a person or entity that is engaging in commercial transactions in Israel or Israeli-controlled territories, with the specific intent to accomplish a boycott or divestment of Israel. The proposer also has not retaliated against any person or other entity for reporting such refusal, termination, or commercially limiting actions. DOTD reserves the right to reject the response of the bidder or proposer if this certification is subsequently determined to be false, and to terminate any contract awarded based on such a false response. **Pursuant to Act No. 581 of the 2024 Louisiana Legislature Regular Session, proposer further certifies that it does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association based solely on the entity's or association's status as a firearm entity or firearm trade association. In addition, proposer certifies it will not discriminate against a firearm entity or firearm trade association during the term of the contract based solely on the entity's or association's status as a firearm entity or firearm trade association.**	 Signature above shall be the same person listed in Section 9: Date: September 18, 2025	
11. If a Disadvantaged Business Enterprise (DBE) goal has been set for this advertisement, indicate which firm(s) will be used to meet the DBE goal and each firm(s)' percentage.	Firm(s):	Firm(s)' %:
	Per the RFP, the DBE goal is 0%. Therefore, at this time, a DBE goals is not applicable to this contract.	N/A

12: Discipline Table: As indicated in the advertisement, insert a completed table here. The percentages for the prime and sub-consultants must total 100% for each discipline, as well as the overall total percent of the contract.

The **only** disciplines to be used are listed in the drop down in each row (Appraiser, Bridge, CE&I/OV, CPM, Data Collection, Environmental, Geotech, ITS, Other (must specify), Planning, Right-of-Way, Road, Survey, and Traffic). **Remove rows as needed.**

DISCIPLINE(S)	% OF OVERALL CONTRACT	DEWBERRY (PRIME)	KEYSTONE	FORTE & TABLADA	EACH DISCIPLINE MUST TOTAL TO 100%
Data Collection	30%	90%	10%		100%
Survey	15%			100%	100%
Other (Lidar and Photogrammetry Processing)	55%	95%	5%		100%
Identify the percentage of work for the **overall contract** to be performed by the prime consultant and each sub-consultant.					
Percent of Contract	100%	79.25%	5.75%	15%	

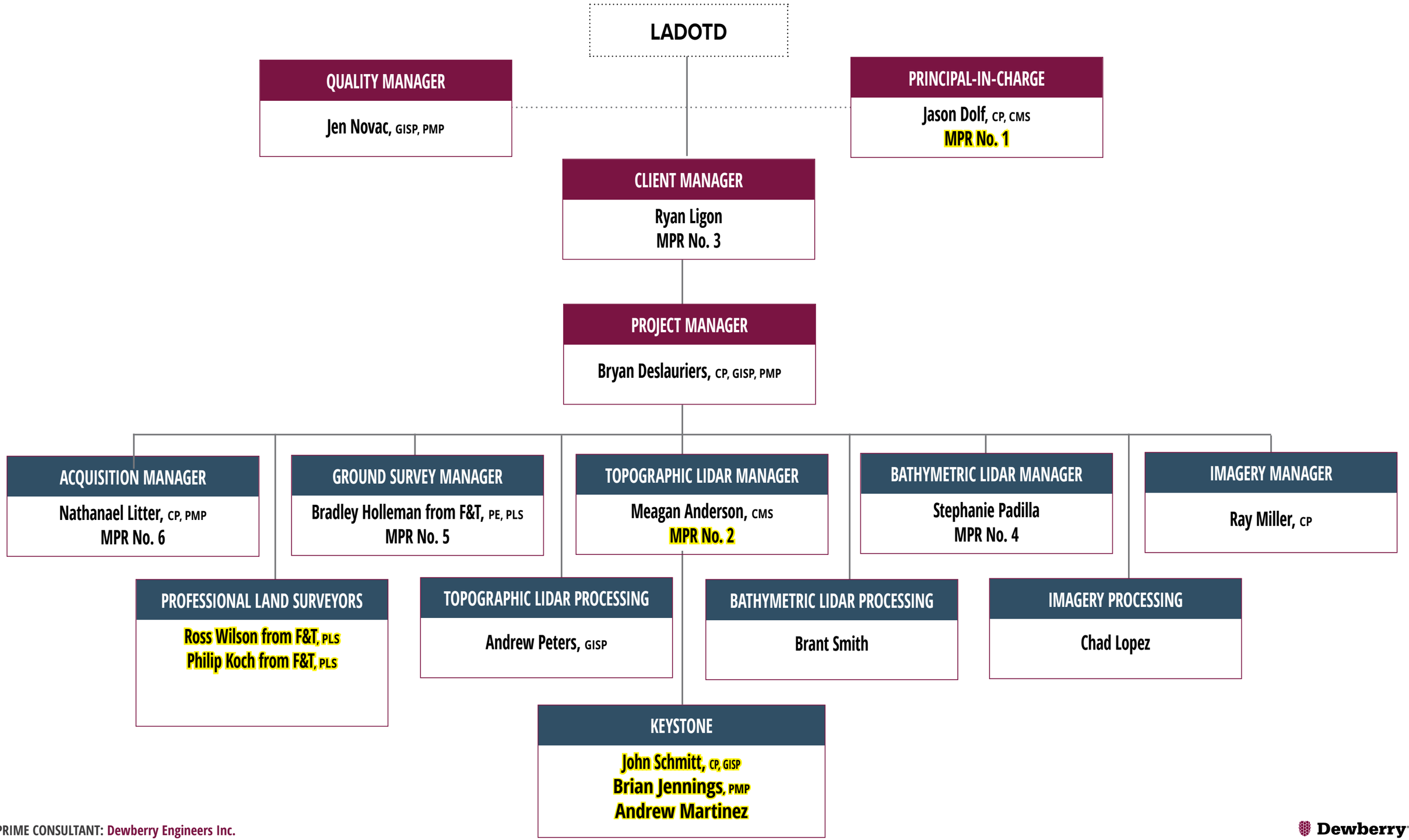
13. Team Size: For all firms that are part of this team, indicate the approximate number of personnel to be committed to this contract, by DOTD Job Classification and the total number of personnel within the firm that could provide support, if needed. If a specialized job classification is required and not included on the DOTD job classification list, specify "Other (must specify)" and include the classification title inside the parentheses. The DOTD Job Classification(s) to be used can be found at the following link: https://bit.ly/DOTDJobClassifications

FIRM NAME	DOTD JOB CLASSIFICATION	NUMBER OF PERSONNEL COMMITTED TO THIS CONTRACT*	TOTAL NUMBER OF PERSONNEL AVAILABLE IN THIS DOTD JOB CLASSIFICATION (IF NEEDED)
Dewberry Engineers Inc.	GIS Analyst	11	125
Keystone	Other (Imagery acquisition)	3	12
Forte & Tablada	Surveyor	3	27

(Add rows as needed)

***For evaluation purposes only**, and as referenced in the Scope of Services on page 2 of IDIQ advertisements only, the consultant shall assume the number of concurrently active task orders specified in the advertisement and shall identify the number of **committed** personnel accordingly.

14. Organizational Chart: Provide an organizational chart showing ALL **relevant** prime consultant and sub-consultant (if applicable) personnel assigned to the contract, area of project responsibility for each, and reporting lines for the purposes of this contract. An individual's role does not necessarily have to match their DOTD job classification identified in Section 13. **If applicable, identify all personnel performing traffic engineering analysis and/or QC of traffic engineering analysis by placing an asterisk next to their name. Include the certificates required by the Traffic Engineering Process and Report Training Requirements article of the Advertisement in Section 20.** It is acceptable to use an 11x17 format for Section 14.



15. Minimum Personnel Requirements: Use the table below to identify both prime consultant and sub-consultant staff designated to work on this contract meeting the Minimum Personnel Requirements (MPRs) specified in the advertisement. Ensure the résumé reflects the required experience stated in the MPR. Make sure the P.E. discipline is also listed (highlighted in table) that is meeting the MPR; e.g. professional civil engineer should show the discipline of the license as civil if meeting that MPR.

MPR NO. Do not insert wording from ad	**PERSONNEL BEING USED TO MEET THE MPR** (Individual(s) may not satisfy more than one MPR unless specifically allowed by Attachment B of the advertisement)	**FIRM EMPLOYED BY**	**TYPE OF LICENSE AND DISCIPLINE MEETING MPR/CERTIFICATION & NUMBER (EX: PE # - CIVIL)**	**STATE OF LICENSE**	**LICENSE / CERTIFICATION EXPIRATION DATE**
1	Jason Dolf, CP, CMS	Dewberry Engineers Inc.	ASPRS CP #R1488, ASPRS CMS #R017UAS, FAA Pilot #3904366	US	4/19/2026 and 4/19/2028
2	Meagan Anderson, CMS	Dewberry Engineers Inc.	ASPRS CMS-L #R026L	US	6/24/2026
3	Ryan Ligon	Dewberry Engineers Inc.	N/A		
4	Stephanie Padilla	Dewberry Engineers Inc.	N/A		
5	Bradley Holleman, PE, PLS	Forte & Tablada	LA PLS.0005082, PE.0047165	LA	9/30/2026
6	Nathanael Litter, CP, PMP, GISP	Dewberry Engineers Inc.	ASPRS CP #R1642CP, FAA Pilot # 2835979	US	11/1/2028

16. Staff Experience: Résumés shall be provided for all prime and sub-consultant personnel listed in Sections 14 and/or 15 of the proposal. Résumés of personnel not identified in Section 14 or Section 15 of the proposal should not be included and **will not be** evaluated. Résumés are **limited to 2 pages per person**. Any certificates **required** by the advertisement are to be placed in Section 20. (Add rows as needed)

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Jason Dolf, CP, CMS**	**Year of Relevant Experience with this employer**	3
Title	Principal-in-Charge (MPR No 1, 3, 4, & 6)	**Years of relevant experience with other employer(s)**	25
Degree(s) / Years / Specialization	AAS/2013/Fire Science Management Certificate		
Active registration number / state / expiration date	3904366/US/ No expiration; R1488/US/4.19.2026; R017UAS/US/4.19.2028		
Year registered	2016, 2011, 2018 **Discipline**	FAA Pilot, Certified Photogrammetrist, and Certified Mapping Scientist-UAS	
Contract role(s) / brief description of responsibilities	**Principal-In-Charge.** Jason will offer his subject matter expertise in Lidar (topographic and bathymetric) and imagery acquisition, setting primary and secondary control, processing, and product development for this project. He will also confirm availability of corporate resources, and will enforce accountability across the contract to include compulsory adherence to QA/QC policies and procedures.		

EXPERIENCE DATES (MM/YY - MM/YY)	**EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).**
Jason is a geospatial professional with over 28 years of experience. He currently serves as Business Unit Manager of acquisition and initial processing in our Tampa, Florida office. His technical background includes photogrammetry, Lidar, aviation, unmanned aircraft systems, geographic information systems, and emergency management. As the aerial acquisition program manager for Dewberry, he is responsible for the oversight and management of the aerial acquisition remote sensing assets and Lidar calibration program. He has encountered and mitigated various acquisition challenges nationwide and is knowledgeable acquiring quality data and managing acquisition partners.	
09/22 – 07/24	**NOAA, Big Bend Topobathy Lidar and Imagery Project, Acquisition Manager.** Responsible for all phases of data acquisition of Lidar and imagery. Certified the adequate distribution of the required number of control prints throughout the project area at suitable ground cover locations such as bathymetry, vegetated, and bare ground. Approved the appropriate selection of GNSS survey approach to achieve the desired accuracy of the ground survey. Verified the use of ground survey points for the calibration and validation of topobathy Lidar and imagery. Verify standards are followed and specifications are met throughout the survey process. The project consists of topobathy Lidar and concurrent imagery mapping.
01/24 – 02/24	**Leon County QL0 Topographic Lidar, Aerial Imagery, and Planimetric Mapping Project, Acquisition Manager.** Responsible for overall quality management and team training. Dewberry performed airborne Lidar and imagery data acquisition and processing, plus updating the TLCGIS Land Base Map. The Lidar component was co-funded by the USGS to process 783 square miles of high-resolution airborne topographic Lidar data. Leon County engaged Dewberry to acquire the Lidar data, and with this cooperative funding from USGS' 3D Elevation Program, we performed all data processing activities including Lidar classification and breakline compilation to produce a seamless DEM of Leon County. Dewberry also acquired high-resolution color infrared aerial imagery that was used to produce a seamless orthoimagery mosaic of the county.
03/23 – 10/23	**Connecticut Office of Policy Mgmt., Connecticut Statewide QL1+ Lidar & 3" Orthoimagery, Acquisition Manager.** Responsible for and supervised flight planning, flight crew coordination, and data acquisition of approximately 342 square miles of 8 ppsm Lidar and 4" Orthoimagery over a densely populated area spanning San Diego County, CA, and surrounding areas. Final deliverables consisted of calibrated LAS and 4" orthophotos.
02/24 – 11/24	**Ortho/Lidar Basemap Project, Project Manager.** Leads and coordinates Dewberry's support of Hamilton County's 2024 collection of orthoimagery and Lidar. Responsible for delivery of all components from data acquisition and review through product development and internal QA/QC. Products include orthorectified imagery, digital elevation models, elevation-derived hydrography, contours, and AI-derived 2D/3D land cover layers.

FIRM EMPLOYED BY:	Dewberry Engineers Inc.
Name	**Jason Dolf, CP (Continued)**

EXPERIENCE DATES (MM/YY - MM/YY)	**EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).**
02/24 – 11/24	**Ortho/Lidar Basemap Project Manager.** Leads and coordinates Dewberry's support of Hamilton County's 2024 collection of orthoimagery and Lidar. Responsible for delivery of all components from data acquisition and review through product development and internal QA/QC. Products include orthorectified imagery, digital elevation models, elevation-derived hydrography, contours, and AI-derived 2D/3D land cover layers.
06/24 – 11/24	**USFWS, Klamath Falls Topobathy Lidar, Acquisition Manager.** The U.S. Fish and Wildlife Service sought Lidar and topobathymetric data for 895 square miles of the Upper Klamath Lake Watershed near Klamath Falls, Oregon, including the Sprague and Sycan river basins and Wood River Valley tributaries. The Service developed an initial data collection coverage area with a goal of maximizing the areal coverage of Lidar and topobathymetric data able to be collected with available funding. The areas of interest (AOIs) for this data collection effort included three watersheds in the Upper Klamath River Basin: the Sprague River, Sycan River, and the Upper Klamath Tributaries. The AOIs were buffered by >50m to ensure complete coverage and adequate point densities around study area boundaries. As acquisition manager, Jason was responsible for all phases of Lidar data acquisition.

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Ryan Ligon**	**Year of Relevant Experience with this employer**	17
Title	Client Manager (MPR No 3)	**Years of relevant experience with other employer(s)**	2
Degree(s) / Years / Specialization	BA/2007/Geography		
Active registration number / state / expiration date	N/A		
Year registered	N/A **Discipline**	N/A	
Contract role(s) / brief description of responsibilities	**Client Manager.** Ryan will serve as the primary point of contact for Dewberry to facilitate seamless communication between our team and DOTD including coordination of TO pre-planning, execution, and delivery.		

EXPERIENCE DATES (MM/YY - MM/YY)	**EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).**
Ryan has 19 years of experience in photo interpretation, field surveys, environmental mapping, Lidar, photogrammetry, and GIS project management. He has been responsible for leading and performing photo interpretation efforts on several projects performed for Louisiana DOTD, Anne Arundel County, Virginia DOT, FL State Water Management Districts, the Fish and Wildlife Conservation Commission and the National Park Service. His responsibilities primarily include project management of photo interpretation and in field documentation of land cover/land use types, vegetation, wetlands, planimetric data, and benthic habitats. His responsibilities require the use of imagery or other remotely sensed data in stereo photo interpretation using softcopy stereoplotters and data development using ArcGIS. He is highly experienced in the use of GPS survey equipment coupled with ArcGIS both of which are used for the field documentation. He completed fieldwork and photo interpretation for wetland vegetation and benthic habitats.	
05/19 - 05/25	**LA DOTD GIS Services Contract, Project Manager.** Responsible for project management of consulting and on-site services for the statewide topographic mapping effort of Louisiana. Dewberry was selected by the LA DOTD to provide consulting services related to the acquisition and processing of Lidar and photogrammetric data to support the development of a statewide geospatial database for topographic mapping. Dewberry was tasked with assisting the LA DOTD with the training, collecting, processing, data management, and distribution of Lidar and Photogrammetric data that will be acquired with the LA DOTD aircraft, digital camera, and Lidar sensor. Dewberry is also preparing an updated Master Program Management Plan to provide LA DOTD a guide for acquisition, processing, production, maintenance, and storage of geospatial data requirements for the state of Louisiana.
06/17 – 08/18	**LA DOTD, CTP Contract – Task Order #6 Amite River Watershed Lidar, Project Manager.** Ryan managed the acquisition, processing, and validation of new QL1 Lidar data for the Amite River Watershed, approximately 1884 square miles. This included review and approval of the Lidar acquisition plan and the coordination of the survey team to complete the calibration point and check point surveys. He managed the final data post processing and classification steps to complete the deliverables.
12/17 - 6/21	**USGS, Louisiana Sabine River Lidar, Project Manager.** Responsible for managing the acquisition, processing and development of QL1 Lidar-derived elevation products for the 10,535 mi2 LA Sabine River Lidar. Managing subcontractors for data acquisition and all necessary ground control and accuracy checkpoint surveys. Coordinating with USGS and DOTD to make sure that the data meet the requirements of the Louisiana Statewide Topographic Mapping Program and the USGS QL1 Lidar Specifications.
12/13 – 08/15	**National Geodetic Survey (NGS) Supplemental Sandy Topobathymetric Lidar and Imagery, Geospatial Analyst.** Responsible for photo interpretation of land cover/land use types, vegetation, wetlands, planimetric data, and benthic habitats. The data was used to enable accurate and consistent measurement of the national shoreline and provide a seamless topobathymetric data product for various applications within the entire coastal community. The shoreline is defined as the land water interface at a specific tidal datum. Topobathymetric Lidar is employed as an accurate, efficient way to collect data for generation of a Digital Elevation Model (DEM), which is in turn used to extract vectors for generating the tidal datum shoreline of interest.
04/16 – 06/18	**USGS, Everglades Lidar Everglades National Park (ENP), Geospatial Analyst.** Responsible for photo interpretation, ground control point survey collection, and in field documentation of land cover/land use types, vegetation, wetlands, planimetric data, and benthic habitats. All Lidar data was processed in accordance with the NGP Lidar Base Specification Version 1.2, and all point deliverables will be compliant in LAS format, v1.4. Dewberry managed the project, completed ground surveying and performed all final data post-processing and classification steps to develop the requisite deliverables.

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Bryan Deslauriers, CP, PMP, GISP**	**Year of Relevant Experience with this employer**	4
Title	Senior Project Manager (MPR No 3)	**Years of relevant experience with other employer(s)**	16
Degree(s) / Years / Specialization	BS/2004/Earth Science		
Active registration number / state / expiration date	R1533/US/9.6.2027; 2799762/9.8.2026; 161047/FL/7.25.2027		
Year registered	2012, 2012, 2021 **Discipline**	Certified Photogrammetrist, Project Management Professional, and Geographic Information Systems Professional	
Contract role(s) / brief description of responsibilities	**Project Manager.** Bryan will be responsible for managing the daily operations of the program support for DOTD. Bryan will also be responsible for working closely with you to help coordinate DOTD's in-house Lidar and imagery efforts, and to provide any technical guidance and documentation for the Lidar, photogrammetry, survey, and data production support needed under this task.		

EXPERIENCE DATES (MM/YY - MM/YY)	**EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).**
Bryan has more than 20 years of experience in the geospatial industry with a background in photogrammetry, remote sensing, feature extraction, and geographic information systems (GIS). During his career, Bryan has supported a variety of clients at the state/local and federal level, including the national Oceanic and Atmospheric Administration, U.S. Army Corps of engineers, environmental Protection Agency, state departments of transportation, and water management districts.	
03/21 – 08/22	**USGS Coastal Lidar Acquisition and Products, Project Manager.** Dewberry was tasked with the acquisition and processing of approximately 2,399 square miles of quality level 1 Lidar in southeast coastal Louisiana. Acquisition was completed during the winter of 2020/2021. Deliverables will include classified Lidar data, digital elevation models, breakline database, and intensity imagery.
05/23 – 08/23	**NOAA Airborne Gravity Data Collection GRAV-D US22 Task Order #1, Photogrammetrist Supervisor.** Responsible for coordinating the placement of Dynamic Aviation air crews and NOAA gravimetric sensor operators across various CONUS points of interest to NOAA. These efforts are to supplement the previous acquisition of data of lower quality or gaps in coverage. The Dewberry team provided suitable aircraft, project oversight, and daily project management of aircraft services and personnel for GRAV-D across multiple states in the Western U.S. to produce a new U.S. vertical datum for all geospatial data users and replace NAVD88 moving forward.
11/22 – 06/23	**USACE, St. Louis Photogrammetric and Lidar, Staff Member.** Dewberry, as a prime contractor, was selected for a second term IDIQ contract with USACe St. Louis District to continue providing a variety of geospatial services. Work will consist of performing and/or producing aerial photogrammetric and Lidar surveys, ground control, analytical aero-triangulation, geo-rectification, ortho-rectification, pan-sharpening, tiling, mosaicing, digital elevation model/digital terrain model(DeM/DTM) data, collection and manipulation of photogrammetric mapping, aerial photography, GIS mapping, remote sensing, large and small-scale topographic maps, planimetrics compilation and contouring , geo-database development, maintenance and support and landuse/landcover analysis and mapping, satellite imagery, and other geospatial processes.
02/21 – 04/21	**Tampa Bay Topographic Lidar Shoreline Mapping, Staff Member.** This project covers 300 square miles of northern Tampa Bay, including the coastline of Hillsborough and Pinellas Counties. After careful consideration of NOAA's National Geodetic Survey requirements and water conditions, we selected the VQ-880-GII topobathy Lidar system to acquire the Lidar data, and the Vexcel UltraCam Falcon M2 medium format camera system to acquire the imagery data. Dewberry's ground survey teams collected survey ground control and accuracy checkpoints.
02/21 – 04/21	**PR-USV1 Topographic Lidar Shoreline, Staff Member.** Following the aftermath of Hurricane Maria, nOAA tasked Dewberry to acquire and process over 1,400 mi^2 of topobathy Lidar and high resolution 4-band aerial imagery. After careful consideration of nGS' requirements and water conditions, we selected the VQ-880-GII topobathy Lidar system equipped with a Phase One medium format camera system to acquire the Lidar and imagery data. We will also be sending Dewberry's ground survey team's to survey ground control and accuracy checkpoints for the project. Once the data are acquired and the ground survey is completed Dewberry will perform all data processing to produce a high resolution Digital elevation Model of the topography and bathymetry of the coastline. This model will be used by nOAA to generate Mean High Water and Mean Lower Low Water shoreline contours that will be edited by Dewberry using the Lidar and aerial imagery data.

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Jen Novac, GISP**	**Year of Relevant Experience with this employer**	17
Title	QA/QC Manager	**Years of relevant experience with other employer(s)**	3
Degree(s) / Years / Specialization	BA/2006/Anthropology/Geography Minor		
Active registration number / state / expiration date	51440/IL/4.25.2027; 3222172/PA/3.3.2028		
Year registered	2013	**Discipline**	Geographic Information Systems Professional, Project Management Professional
Contract role(s) / brief description of responsibilities	**Quality Manager.** Jen will oversee data management and develop checklists used to make sure consistent QA/QC on all products. She will be responsible for ensuring correct QA methods and tools are used on all task orders by providing guidance on Standard Operating Procedures (SOP) methods and validating all checklists throughout the duration of a project and at the end of a project prior to submittal. She will provide technical guidance and respond to questions from the client or 3rd party contractors about identified issues during independent QA/QC.		

EXPERIENCE DATES (MM/YY - MM/YY)	**EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).**
	Jen has 20 years of experience in airborne bathymetric and topographic Lidar, orthophotography, photogrammetry, remote sensing, IFSAR, and GIS. She provides technical support, guidance, and training on geospatial QA/QC processes and oversees all methods, templates, and processes used for QC inspections. Her responsibilities include developing innovative and advanced workflows for data production and QA which increase efficiency and improve quality. Jen authored Chapter 15: Quality Assessment of Elevation Data in the ASPRS published DEM User's Manual, 3rd edition and has authored or peer reviewed numerous Standard Operating Procedures and specifications used internally as well as some used externally within the industry and by USGS. Dewberry has 80+ SOPs under version control, of which Jen is a contributor, editor, reviewer, and approver. As part of her role as a QA/QC Manager, Jen helped Dewberry's Quality Management System (QMS) become certified by National Quality Assurance (an ANAB accredited organization) to be in full compliance with the ISO 9001:2015 standard.
03/18 – 10/18	**Leon County QL0 Topographic Lidar, Aerial Imagery, and Planimetric Mapping Project, Senior Quality Manager.** Responsible for overall quality management and team training. Dewberry performed airborne Lidar and imagery data acquisition and processing, plus updating the TLCGIS Land Base Map. The Lidar component was co- funded by the USGS to process 783 square miles of high-resolution airborne topographic Lidar data. Leon County engaged Dewberry to acquire the Lidar data, and with this cooperative funding from USGS' 3D Elevation Program, we performed all data processing activities including Lidar classification and breakline compilation to produce a seamless DEM of Leon County. Dewberry also acquired high-resolution color infrared aerial imagery that was used to produce a seamless orthoimagery mosaic of the county.
04/17 – 09/17	**Lidar Topographic Mapping for Hillsborough County, Senior Quality Manager.** Assisted with establishing the production workflow and checklists used on this project; reviewed data and reports prior to submittal to the client. Developed the project report templates used for all Lidar projects, and helped develop Lidar assessment processes to determine how well Lidar sensors performed in regard to project density, ground penetration/density, spatial distribution of the point cloud, and the identification of sensor anomalies.
11/16 – 03/18	**Alaska IFSAR: Statewide Surveying and Mapping, USGS, Senior Quality Manager.** Responsible for overall quality management, developing unique workflows, checklists, and team training. Dewberry served as a prime contractor overseeing and managing task orders to provide GIS and remote sensing services. USGS assigned task orders to Dewberry on an as-needed basis, primarily requiring airborne Lidar and IFSAR acquisition and processing, high- resolution topographic product generation, orthoimagery acquisition and processing, photogrammetric mapping, and cadastral surveying.
09/13 – 11/15	**National Geodetic Survey (NGS) Supplemental Sandy Topobathymetric Lidar and Imagery, Quality Manager.** Jen not only developed the workflows for QA/QC of topobathymetric Lidar and ortho-imagery deliverables, but also developed the SOP for processing and production development of topobathymetric Lidar for the Post-Sandy project. Created an 85-page workflow manual specific to this complex project and used by all NOAA subcontractors. Oversees all QA/QC for Lidar and DEM products, as well as QA/QC for all orthophoto products. Coordinates with all subcontractors for both production and QA/QC methods to make sure the client receives consistent products meeting all requirements.

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Nathanael Litter, CP, PMP**	**Year of Relevant Experience with this employer**	1
Title	Acquisition Manager (MPR No 6)	**Years of relevant experience with other employer(s)**	18
Degree(s) / Years / Specialization	BS/2004/Aeronautical Science		
Active registration number / state / expiration date	2835979/US/ No expiration; R1642CP/US/11.1.2028; 2641989/US/9.17.2028		
Year registered	2002, 2018, 2019	**Discipline**	FAA Pilot, Certified Photogrammetrist, Project Management Professional
Contract role(s) / brief description of responsibilities	**Acquisition Manager.** Nathanael is an FAA-licensed pilot and will be responsible for supporting the planning and coordination of data collection activities throughout this contract.		

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	Nathanael joined Dewberry in mid-2024 bringing more than 18 years of program/project management experience in the geospatial mapping and survey industry, while consistently delivering quality results and adding value to client's projects. He has a strong operations management background and is effective at leading remote teams of field-based professionals. For the last decade, he has focused on project management and business development, while successfully managing projects throughout North and South America. His recent experience involved program management of a large nationwide data collection program. He has managed several statewide projects, and dozens of projects for counties, cities, and municipalities with deliverables ranging from subsurface utility mapping, ground survey, planimetric updates, orthophotography, Lidar and Lidar-derived products, and more. He is a member in good standing with the North Alabama Chapter of Project Management Institute (PMI), Society of American Military Engineers (SAME) Huntsville Post, and American Society of Photogrammetry and Remote Sensing (ASPRS).
5/24 - Present	**USACE St. Louis District, Upper Mississippi River Restoration (UMRR) Aerial Topobathy Lidar Acquisition and Processing (Pool 8 – LaCrosse, WI and Pool 4 – Red Wing, MN).** Responsible for providing technical support to project management, including subcontractor communication and budget review and analysis. Dewberry provided UMRR and its partner's high resolution aerial topographic and bathymetric Lidar, in conjunction with multi-beam, parametric dual frequency single-beam sweep system, and side scan sonar hydrographic survey data collected and processed over two separate areas along the Mississippi River totaling 35 square miles.
9/24 - Present	**USACE St. Louis District, Upper Mississippi River System (UMRS) Aerial Topobathy Lidar Acquisition and Processing, in conjunction with Hydrographic Surveying, (Marseilles to Lockport Pools) AOI (Marseilles to Chicago, IL).** Responsible for the management of acquisition, processing and deliverables of airborne topobathymetric Lidar data, ground survey data, hydrographic survey data, and derivative products covering approximately 207 mi2 over the Illinois River, stretching from Marseilles to Lockport Pools and will support updating river models, various planning, design, research, and mapping purposes, and is a preliminary step in the overall comprehensive surveys of the Upper Mississippi and Illinois Rivers.
4/21-12/21	***Mobile County Planimetric Updates, Project Manager.** Project manager responsible for updating the City of Mobile, Mobile County, and Mobile Area Water and Sewer System's planimetric geodatabase. This significant update covered nearly 1,000 square miles utilizing client supplied, third party imagery to address seven years of growth/change. This project required significant communication between three individual stakeholders with varying levels of needs. We worked with these clients to develop a comprehensive data dictionary, update their existing data, and modified more than 500,000 features to deliver a project that was topologically sound and met the clients' specifications.
2/21 - 12/21	***Alabama Statewide Imagery Program, Statewide, Project Manager.** Managed the airborne and ground survey acquisition of more than 52,000 square miles of high-resolution aerial imagery covering Alabama's 67 counties. This program divided the state into three distinct regions with annual acquisitions, resulting in statewide updates every three years. This program required coordination between multiple survey and flight crews, as well as individual counties through "buy-up" options, resulting in standard and non- standard deliverable data sets.

**Experience from previous firm.*

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Meagan Anderson, CMS**	**Year of Relevant Experience with this employer**	11
Title	Topographic Lidar Manager (MPR No 2,3 and 4)	**Years of relevant experience with other employer(s)**	3
Degree(s) / Years / Specialization	BS/2011/Geography		
Active registration number / state / expiration date	R026L/US/6.4.2028		
Year registered	2018 **Discipline**	Certified Mapping Scientist-Lidar	
Contract role(s) / brief description of responsibilities	**Topographic Lidar Manager.** Responsible for leading the production of Lidar data for this contract. Supporting data acquisition activities and working directly with subconsultants to make sure data acquisition and calibration meet requirements.		

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Meagan is a Senior Quality Manager in our Tampa, FL office. She works closely with data acquisition partners to calibrate Lidar data; supports Lidar production to include breaklines, editing, and creating deliverables; converts spatial data from/to various formats; manages data collection/production of various geospatial projects; communicates with internal and external teams to produce quality deliverables to the client's standards; and creates a variety of digital mapping products using various software platforms. Meagan leads a team of quality control analysts and helps oversee the training of staff.	
05/19-05/25	**LA DOTD GIS Services Contract, Louisiana, Training Lead.** Responsible for training, QA/QC, deliverable review, and SOP development. Part of the team providing consulting services related to the acquisition and processing of Lidar and photogrammetric data to support the development of a statewide geospatial database for topographic mapping. Responsible for managing analysts; finalizing deliverables; Lidar production, including breaklines, editing, and creating deliverables; developing various mapping products using various software platforms for the training, collection, processing, data management, and distribution of Lidar and photogrammetric data that was acquired with the DOTD aircraft digital camera and Lidar sensor.
02/17 – 07/18	**SWFWMD Lidar Topographic Mapping for Hillsborough County, Lidar Processing/Quality Lead.** Performed quality reviews of the Lidar classification, building footprints, while leading a team of 10+ staff working over one year on this project to meet the SWFWMD Lidar specifications for Lidar and breakline collection. Produced DEMs and quality checked data acquired for this 1,200 square mile project.
09/23 – 04/25	**Skagway QL1 Lidar, Quality Manager.** The state of Alaska tasked Dewberry with acquiring and producing Lidar data for 392 square miles around Skagway, Alaska. Meagan was responsible for ensuring data met USGS Lidar Base Specification 2021 Rev. A at every phase.
12/18 – 07/21	**Florida Peninsular Lidar, FL, Processing/Quality Lead.** Dewberry completed a comprehensive study for USGS on what Lidar data was needed for Florida to maximize the uses by state agencies. Meagan led the quality reviews for all aspects of this large 35,000 mi^2 QL1 project. She prepared the documents for Lidar processing that were shared with our subconsultants to produce consistent deliverables for this project. Meagan presented the guidelines, requirements, and specifications at the technical workshop and was in charge of ensuring that our data was processed to meet the stringent Florida classification and breakline requirements.
11/16 – 12/16	**Puerto Rico Lidar, Training Manager.** Responsible for reviewing intermediate and final deliverables for this task. Prepared training material that was used by analysts to classify bare earth data and delineate breaklines. Dewberry acquired and processed 3,500+ mi^2 of topographic Lidar for the Commonwealth of Puerto Rico.
01/14 – 01/15	**National Geodetic Survey (NGS) Supplemental Sandy Topobathymetric Lidar and Imagery, Geospatial Training Manager.** Responsible for training personnel on Lidar editing, breakline collection, QA/QC, and finalizing deliverables. Dewberry acquired and process over 250 mi^2 of topobathy Lidar and high resolution 4-band aerial imagery.

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Andrew Peters, GISP**	**Year of Relevant Experience with this employer**	16
Title	Topographic Lidar Processing	**Years of relevant experience with other employer(s)**	2
Degree(s) / Years / Specialization	BA/2007/Geography		
Active registration number / state / expiration date	90982/US/6.25.2026		
Year registered	2015	**Discipline**	Geographic Information Systems
Contract role(s) / brief description of responsibilities	**Topographic Lidar Processing.** Andrew is responsible for overseeing all aspects of post-acquisition topographic Lidar data processing to meet TO specifications and DOTD requirements.		

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Andrew has 18 years of experience managing and producing more than 30 large-scale GIS projects for federal clients such as NOAA, USGS, and FEMA. He is proficient in Esri's ArcGIS software for geospatial analysis and has extensive experience using various software for Lidar processing, analysis, and QA/QC. As project manager for state and local projects, his work has supported a county-wide asset mapping initiative by developing new GIS data and record drawings that accurately reflect the location and condition of these assets.	
05/23 – 02/24	**Connecticut Office of Policy Management, Connecticut Statewide QL1+ Lidar & 3" Orthoimagery, Deputy Project Manager.** Responsible for serving as the deputy project manager for Dewberry's state of Connecticut contract to verify data production, budget, schedule, and deliverables are met. Responsibility also includes working with the state of Connecticut for contract negotiations and buy-up options for the state. We currently hold the contract from 2023 to 2026, which consists of QL1+ 14ppsm Lidar and 3" ortho imagery acquisition and processing in the years of 2023, and 2026.
12/23 - 12/24	**Ortho/Lidar Basemap Project, Hamilton County, Lidar Production Lead.** Leads and coordinates Dewberry's support of Hamilton County's collection of orthoimagery and Lidar. Responsible for the delivery of all components from data acquisition and review through product development and internal QA/QC. Products include orthorectified imagery, digital elevation models, elevation-derived hydrography, contours, and AI-derived 2D/3D land cover layers .
1/20 - Present	**USGS, Geospatial Products and Services Contract, Project Manager.** Responsible for overseeing the development of the final deliverable products for a USGS contract to map roughly 13,600 square miles of land in Utah and analyze the produced data. This project supported the USGS 3DEP; FEMAs Risk Mapping, Assessment, and Planning program, the National Resources Conservation Service high resolution elevation enterprise program, the USDA Forest Service conservation and management of watersheds, and resources related to the Collaborative Forest Landscape Restoration Program. Tasks under this contract include airborne Lidar and IFSAR acquisition and processing; high-resolution topographic product generation; orthoimagery acquisition and processing; photogrammetric mapping; and cadastral surveying.
5/19 -12/19	**USGS MA/CTState Ortho QA/QC 2019, Project Manager.** Led project management for a quality assurance task covering orthophotography acquisition across 8,850 square miles in Massachusetts and 5,242 square miles in Connecticut. Oversaw vendor coordination under the GPSC3 contract and ensured compliance with technical standards. Delivered a comprehensive Quality Assessment Summary Report as the final project deliverable.

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Stephanie Padilla** (MPR No 4)	**Year of Relevant Experience with this employer**	7
Title	Topographic Lidar Processing	**Years of relevant experience with other employer(s)**	1
Degree(s) / Years / Specialization	MS/2017/Marine Science; BS/2014/Biology and Marine Sciences		
Active registration number / state / expiration date	N/A		
Year registered	N/A	**Discipline**	N/A
Contract role(s) / brief description of responsibilities	**Bathymetric Lidar Manager.** Responsible for directing daily workflows, coordinating staff assignments, and providing technical guidance for bathymetric Lidar calibration, processing, and delivery to DOTD.		

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Stephanie is a geospatial technology manager responsible for managing airborne acquisition operations. Her areas of expertise include acquiring and processing topobathymetric Lidar, hyperspectral imagery, and digital imagery. She is experienced in managing projects through the full acquisition cycle: sensor integration, calibration, flight planning, and collection.	
07/20 – 12/21	**Hurricane Michael QL1 Lidar, Topobathy Lidar Manager.** As Topobathy Lidar Manager, Stephanie was responsible for coordinating the Lidar acquisition and overseeing the sensor operator team. Under a USGS task order, Dewberry collected and processed over 8,200 square miles of Lidar in the Florida panhandle in response to Hurricane Michael. Dewberry was the prime contractor responsible for planning, acquisition, processing, and derivative products of QL1 Lidar data collected at an aggregate nominal pulse density (ANPD) of >8 points per square meter. All Lidar data and derivative products were produced in compliance with the National Geospatial Program Lidar Base Specification Version 2.1.
02/18 – 04/18	**SWFWMD Lidar Topographic Mapping for Hillsborough County, Topobathy Lidar Manager.** As Topobathy Lidar Manager, Stephanie was responsible for coordinating the Lidar acquisition. High-density 24+ ppsm Lidar covering Hillsborough County FL was collected using a prototype Riegl VQ1560i sensor in January 2017. Ensured SWFWMD's Lidar surveying and mapping specifications were followed. Dewberry was responsible for all phases of the project including Lidar data acquisition, managing the work in progress, monitoring schedules and budgets, and verifying the quality of deliverables.
04/21 – 02/22	**Florida Statewide Lidar Assessment, Topobathy Lidar Manager.** As Topobathy Lidar Manager, Stephanie was responsible for coordinating the Lidar acquisition and overseeing the sensor operator team. In support of the USGS 3DEP goal to acquire consistent topographic Lidar coverage nationwide, the state of Florida selected Dewberry to perform a Lidar assessment in order to determine requirements for and benefits from statewide topographic Lidar, bathymetric Lidar, and/or topobathymetric Lidar that would facilitate mission-critical applications across governmental and non-governmental agencies and spur innovations not possible with current Lidar coverage. The assessment determined the state's ROI on a statewide Lidar acquisition program using best-available technologies.

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Brant Smith**	**Year of Relevant Experience with this employer**	1
Title	Senior Geospatial Analyst	**Years of relevant experience with other employer(s)**	13
Degree(s) / Years / Specialization	BS/2010/Geosciences		
Active registration number / state / expiration date	N/A		
Year registered	N/A	**Discipline**	N/A
Contract role(s) / brief description of responsibilities	**Bathymetric Lidar Processing.** Brant is responsible for overseeing all aspects of post-acquisition bathymetric Lidar data processing to meet TO specifications and DOTD requirements.		

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Brant brings extensive experience as a senior geospatial analyst in topobathymetric Lidar, specifically coastal zone mapping and imaging Lidar. He has worked with multiple government agencies such as JALBTCX (Joint Airborne Lidar Bathymetric Technical Center for Expertise, NAVO, USACE) as well as foreign agencies. Brant's experience also spans Lidar training, calibration, analysis, and support.	
01/24 – 08/24	**Florida Department of Environmental Protection, Florida Sea Floor Map, RG 4 SW Gulf Data Collect, Senior Geospatial Analyst.** Region of the Florida Seafloor Mapping Initiative, as a portion of the effort to collect statewide bathymetric Lidar and sonar. The bathymetric Lidar goal is to collect full coverage of depths to 20m. As Senior Geospatial Analyst, Brant supported the planning, processing, analysis, and improvement of bathymetric Lidar data.
01/24 – 08/24	**NOAA National Geodetic Survey Shoreline Mapping, TB FL2310 FL2311, Senior Geospatial Analyst.** Topobathymetric Lidar survey, using the CZMIL SuperNova sensor in a coastal environment. As Senior Geospatial Analyst, Brant supported the planning, processing, analysis, and improvement of bathymetric Lidar data.
01/24 – 08/24	**NOAA National Geodetic Survey Shoreline Mapping, TB Riverine VA 2302, Senior Geospatial Analyst.** Topobathymetric Lidar survey, using the CZMIL SuperNova sensor in an inland riverine environment. As Senior Geospatial Analyst, Brant supported the planning, processing, analysis, and improvement of bathymetric Lidar data.
04/24 – 07/24	**NOAA National Geodetic Survey Shoreline Mapping, Big Bend Topobathy/Bathymetric Lidar, Senior Geospatial Analyst.** Dewberry collected airborne bathymetric Lidar using the CZMIL SuperNova sensor and concurrent digital camera imagery across 1,375 square miles in the Florida Big Bend area. Deliverables include classified LAS, DEMs, georeferenced imagery, normalized reflectance, TPU, and metadata. As Senior Geospatial Analyst, Brant supported the planning, processing, analysis, and improvement of bathymetric Lidar data.
01/24 – 08/24	**Florida Department of Environmental Protection, Florida Sea Floor Map, Region 6 Panhandle, Senior Geospatial Analyst.** Region of the Florida Seafloor Mapping Initiative, as a portion of the effort to collect statewide bathymetric Lidar and sonar. The bathymetric Lidar goal is to collect full coverage of depths to 20 meters. As Senior Geospatial Analyst, Brant supported the planning, processing, analysis, and improvement of bathymetric Lidar data.

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Ray Miller, CP**	**Year of Relevant Experience with this employer**	16
Title	Senior Project Manager/Orthophotograghy Lead	**Years of relevant experience with other employer(s)**	7
Degree(s) / Years / Specialization	MA/2005/Geography; BA/2003/Geography		
Active registration number / state / expiration date	RS208/US/10.26.2022; R1645CP/US/1.23.2029; 00014893/US/2.25.2026; 1991077/US/12.23.2025		
Year registered	2012, 2019, 2010, 2016	**Discipline**	Certified Mapping Scientist-Remote Sensing, Certified Photogrammetrist, Geographic Information Systems Professional, Project Management Professional
Contract role(s) / brief description of responsibilities	**Imagery Manager.** Ray is responsible for managing the imagery acquisition, aerotriangulation, orthomosaic processing for this contract.		

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Ray has extensive experience in geospatial services. He has developed geospatial solutions for hazard mitigation, environmental, and water resources projects for clients that include the United States Geological Survey, Florida Dept. of Emergency Management, and the St. Johns River Water Management District. He has extensive experience in GIS and remote sensing that includes digital terrain modeling, Lidar, photogrammetry, stereographic aerial photo interpretation, watershed analysis and floodplain mapping, geostatistics, and cartography. His graduate education concentrated on hurricane evacuation modeling and social vulnerability analysis using geospatial applications, especially HAZUS-MH. Furthermore, Ray has specialized training in HAZUS-MH, Hurrevac, and SLOSH modeling software.	
7/18 - 8/23	**PEMA Pennsylvania Emergency Management Agency (PEMA), Quality Control Project, Project Manager.** Project Manager for the orthoimagery QA/QC contract for PEMA where he was responsible for the successful completion of independent QA/QC of the statewide orthoimagery and updated eastern and western sectors. Ray oversaw all project tracking, budget and invoicing, quality assurance, and delivery of final products to the client and primary vendor. Dewberry's team has successfully delivered all deliverables within schedule and under budget.
08/11 – 03/12	**LARIAC Oblique & Orthoimagery Independent QA/QC, Project Manager.** Responsible for the overall performance of this project. Dewberry performed independent QA/QC of oblique and orthoimagery for the LARIAC1 contract through the current LARIAC5 contract. Multiple prime contractors performed aerial image acquisition, aerial triangulation, and delivery of orthoimagery for LARIAC1 through LARIAC5.
01/18 – Present	**Leon County, Topographic Lidar, Aerial Imagery, and Planimetric Mapping, Project Manager.** Under contract with the Leon County Board of County Commissioners, Dewberry is acquiring and processing QL0 topographic Lidar data at 8 points-per-square-meter and 6-inch color infrared orthoimagery for 783 square miles in Leon County, Florida. We are also updating the County's planimetric data base on the updated Lidar data and aerial imagery. As Project Manager, Ray is responsible for the overall performance of this project, including developing the project plan achieves the requirements of the SOW and deliverables are submitted on time.

FIRM EMPLOYED BY:	Dewberry Engineers Inc.		
Name	**Chad Lopez**	**Year of Relevant Experience with this employer**	7
Title	Senior Geospatial Analyst	**Years of relevant experience with other employer(s)**	17
Degree(s) / Years / Specialization	MS/2005/Marine Science; BS/1997/Biology and Marine Science		
Active registration number / state / expiration date	N/A		
Year registered	N/A	**Discipline**	N/A
Contract role(s) / brief description of responsibilities	**Imagery Processing.** Chad will be responsible for overseeing all aspects of post-acquisition digital imagery processing and orthorectification to meet TO specifications and DOTD requirements.		

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Chad has more than 24 years of experience providing remote sensing and GIS services. His geospatial experience includes imagery and GIS analysis, photointerpretation and feature extraction, object-oriented image analysis, semi-automated classification, imagery aerotriangulation and orthorectification, cartography, field planning and data collection, flight planning, and object-oriented image analysis for land cover/land use classification. Additional skills include aerotriangulation of digital airborne imagery, Lidar editing and processing, and shoreline data compilation to create nautical charts.	
09/18 – Present	**Leon County, Topographic Lidar, Aerial Imagery, and Planimetric Mapping, Senior Geospatial Analyst.** Dewberry is performing airborne Lidar and imagery data acquisition and processing, as well as updating the Tallahassee-Leon County Geographic Information Systems (TLCGIS) Land Base Map. The Lidar component of this project was co-funded by the USGS to process 783 square miles of high-resolution airborne topographic Lidar data that will be used to update USGS' National Elevation Dataset and the TLCGIS Land Base Map.
12/19 – 05/21	**NOAA NGS, Tampa Bay Shoreline Topobathymetric Lidar, Resource Lead.** Served as the main Resource Lead for this project which involves managing the personnel resources for data production. This project covers 300 square miles of northern Tampa Bay, including the coastline of Hillsborough and Pinellas Counties. After careful consideration of NOAA's National Geodetic Survey requirements and water conditions, we selected the VQ-880-GII topobathy Lidar system to acquire the Lidar data, and the Vexcel UltraCam Falcon M2 medium format camera system to acquire the imagery data. Dewberry's ground survey teams collected survey ground control and accuracy checkpoints.
11/19 – 08/22	**USGS Florida Peninsular Lidar, Resource Lead.** Served as the main Resource Lead for this project which involves managing the personnel resources for data production. Dewberry, as the prime contractor for this project, performed the majority of the data production. This 34,000 square mile, $20 million project includes airborne Lidar data acquisition, ground survey, and preparation of bare earth point cloud and Digital Elevation Model (DEM) products for various applications to support the response, recovery, and preparation for future storm events.
11/18 – 12/19	**Leon County Year 2 Lidar Imagery Plan, Ortho Technician.** Responsible for orthoimagery final QA/QC and planimetric map production and final QA/QC. Under a three-year contract with Leon County, Dewberry performed airborne Lidar and imagery data acquisition and processing, as well as updating the Tallahassee-Leon County Geographic Information Systems (TLCGIS) Land Base Map. Leon County engaged Dewberry to acquire the Lidar data, and with this cooperative funding from USGS' 3DEP, we performed all data processing activities including Lidar classification and breakline compilation to produce a seamless DEM of Leon County. Dewberry also acquired high-resolution color infrared aerial imagery that was used to produce a seamless orthoimagery mosaic of the county. By combining the imagery and topographic Lidar into Dewberry's mapping workflow, we will also be updating many elements of the TLCGIS land base map including building footprints, impervious surfaces such as roads and parking lots, tree canopy and vegetation maps, topographic contours, and spot elevations.

FIRM EMPLOYED BY:	Keystone Aerial Surveys, Inc.		
Name	**John Schmitt, CP, GISP**	**Year of Relevant Experience with this employer**	37
Title	President	**Years of relevant experience with other employer(s)**	N/A
Degree(s) / Years / Specialization	High School Diploma		
Active registration number / state / expiration date	FAA Commercial/Single- & Multi-Engine/Land Certificate; 61839/US/2028 1389/ US/ 2029		
Year registered	1991, 2009, 2009 **Discipline**	Certified Geographic Information Systems (GISP) Professional; ASPRS Certified Photogrammetrist.	
Contract role(s) / brief description of responsibilities	**President.** Responsible for strategic planning and implementation.		

EXPERIENCE DATES (MM/YY - MM/YY)	EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).
John has 37 years of experience as a leader in the geospatial field. He oversees the company operations to make sure teams deliver quality first when delivering for customers. With a strong background in geospatial data acquisition and project management, John has the ability to drive accuracy and efficiency from kick-off to closeout.	
03/16 - 05/25	**Aerial Data Acquisition Services for the North Carolina Geographic Information Coordinating Council, Primary Quoter/Planner, Program Manager.** Since 2016, John has been the primary quotation generator and flight planner for this project. He reviews all plans to make sure specifications will be met. During the acquisition and delivery phase, John is in constant communication with the crew and customers to make sure all specifications are met and deliverables are provided within the proposed schedule. In 2025, Keystone flew 75 flight lines, acquiring nearly 5000 images at 14cm GSD with the UltraCam Eagle high-resolution digital mapping camera system.
08/20 - Present	**Digital Imagery Acquisition for the Ecosystems Research Institute for the San Juan River Research Project, Primary Quoter/Planner, Program Manager.** Since 2020, John has been the primary quotation generator and flight planner for this project. He reviews all plans to make sure specifications will be met. During the acquisition and delivery phase, John is in constant communication with the crew and customers to make sure all specifications are met and deliverables are provided within the proposed schedule. Orthoimagery was also provided as a deliverable. In 2025, Keystone flew 68 flight lines, acquiring over 2000 images at 10cm GSD using their UltraCam Falcon Prime high-resolution digital mapping camera system.
07/19 - Present	**Digital Imagery Acquisition for the USFS Aquatic Riparian Inventory Program, Primary Quoter/Planner, Program Manager.** Since 2019, John has been the primary quotation generator and flight planner for this project. He reviews all plans to ensure specifications will be met. During the acquisition and delivery phase, John is in constant communication with the crew and customers to ensure all specifications are met and deliverables are provided within the proposed schedule. In 2025, Keystone flew 87 flight lines, acquiring over 300 images at 5cm GSD using their UltraCam Falcon Prime high-resolution digital mapping camera system.

FIRM EMPLOYED BY:	Keystone Aerial Surveys, Inc.		
Name	**Brian Jennings, PMP**	**Year of Relevant Experience with this employer**	18
Title	Senior Project Manager	**Years of relevant experience with other employer(s)**	N/A
Degree(s) / Years / Specialization	BA /2021/Biblical Studies		
Active registration number / state / expiration date	#1942111/ US/ 2029		
Year registered	2018	**Discipline**	Project Management Professional Certificate
Contract role(s) / brief description of responsibilities	**Project Manager** Responsible for creating and executing work plans.		

EXPERIENCE DATES (MM/YY - MM/YY)	EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).
Brian is a geospatial project manager with extensive experience leading large-scale aerial acquisition programs across the U.S., Mexico, and Canada. He oversees project planning, flight coordination, and deliverable review, ensuring accuracy and efficiency in complex airspaces. His expertise with mapping technologies and data collection has supported major initiatives such as USDA NAIP and Microsoft's Global Ortho program, as well as numerous international and domestic projects requiring high-volume image acquisition.	
03/16 - 05/25	**Aerial Data Acquisition Services for the North Carolina Geographic Information Coordinating Council, Primary Quoter/Planner, Program Manager.** Since 2016, Brian has been the primary Project Manager for this project. He reviews all plans to make sure specifications will be met. During the acquisition and delivery phase, Brian is in constant communication with stakeholders to make sure all specifications are met and deliverables are provided within the proposed schedule. In 2025, Keystone flew 75 flight lines, acquiring nearly 5000 images at 14cm GSD with the UltraCam Eagle high-resolution digital mapping camera system.
08/20 - Present	**Digital Imagery Acquisition for the Ecosystems Research Institute for the San Juan River Research Project, Project Manager.** Since 2020, Brian has been the Project Manager for this project. He reviews all plans to make sure specifications will be met. During the acquisition and delivery phase, Brian is in constant communication with stakeholders to make sure all specifications are met and deliverables are provided within the proposed schedule. Orthoimagery was also provided as a deliverable. In 2025, Keystone flew 68 flight lines, acquiring over 2000 images at 10cm GSD using their UltraCam Falcon Prime high-resolution digital mapping camera system.
07/19 - Present	**Digital Imagery Acquisition for the USFS Aquatic Riparian Inventory Program, Project Manager.** Since 2019, Brian has been Project Manager for this project. He reviews all plans to make sure specifications will be met. During the acquisition and delivery phase, Brian is in constant communication with stakeholders to make sure all specifications are met and deliverables are provided within the proposed schedule. In 2025, Keystone flew 87 flight lines, acquiring over 300 images at 5cm GSD using their UltraCam Falcon Prime high-resolution digital mapping camera system.

FIRM EMPLOYED BY:	Keystone Aerial Surveys, Inc.		
Name	**Andrew Martinez**	**Year of Relevant Experience with this employer**	8
Title	Aerial Survey Pilot	**Years of relevant experience with other employer(s)**	4
Degree(s) / Years / Specialization	2010/Coursework, General Studies		
Active registration number / state / expiration date	CFII/MEI 3688616CFI / US; FCC Radio Operator's License/US/No expiration		
Year registered 2012	**Discipline**	FAA Commercial Pilot / FCC Radio Operator's License	
Contract role(s) / brief description of responsibilities		**Aerial Survey Pilot** Responsible for day-to-day operations at the TX branch, safe and accurate flights, and scheduled maintenance.	

EXPERIENCE DATES (MM/YY - MM/YY)	EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).
Andrew is an aviation specialist responsible for preflight planning and aerial survey coordination. He partners closely with air traffic control and sensor operators to design safe, efficient flight missions that maximize data quality. With strong expertise in crew resource management and operational planning, Andrew make sures each mission delivers precise and reliable geospatial data products.	
03/16 - 05/25	**Aerial Data Acquisition Services for the North Carolina Geographic Information Coordinating Council. Survey Pilot.** Andrew has been a Survey Pilot for this project responsible for safe data acquisition and appropriate communication. In 2025, Keystone flew 75 flight lines, acquiring nearly 5000 images at 14cm GSD with the UltraCam Eagle high-resolution digital mapping camera system.
08/20 - Present	**Digital Imagery Acquisition for the Ecosystems Research Institute for the San Juan River Research Project. Survey Pilot.** Andrew has been a Survey Pilot for this project responsible for safe data acquisition and appropriate communication. In 2025, Keystone flew 68 flight lines, acquiring over 2000 images at 10cm GSD using their UltraCam Falcon Prime high-resolution digital mapping camera system.
07/19 - Present	**Digital Imagery Acquisition for the USFS Aquatic Riparian Inventory Program. Survey Pilot.** Andrew has been a Survey Pilot for this project responsible for safe data acquisition and appropriate communication. In 2025, Keystone flew 87 flight lines, acquiring over 300 images at 5cm GSD using their UltraCam Falcon Prime high-resolution digital mapping camera system.

FIRM EMPLOYED BY:	Forte and Tablada		
Name	**Bradley S. Holleman, P.E., P.L.S.**	**Year of Relevant Experience with this employer**	4
Title	Senior Vice President, Survey/AMM	**Years of relevant experience with other employer(s)**	15
Degree(s) / Years / Specialization	B.S. /2009 /Civil Engineering with Minor in Land Surveying		
Active registration number / state / expiration date	PLS 5082 / Louisiana / 09/30/2026; PE 47165 / Louisiana / 03/31/2025		
Year registered 2012	**Discipline** Land Surveying		
Contract role(s) / brief description of responsibilities	**Survey Principal-in-Charge.** Bradley will serve as Survey Principal-in-Charge during this contract, and in that role he will coordinate with the Project Manager to assure task orders are estimated, started, and completed to meet scheduled deadlines, while also satisfying LADOTD deliverable standards and Forte and Tablada's quality standard.		

EXPERIENCE DATES (MM/YY - MM/YY)	EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).
Bradley has 12 years of experience of managing field crews and office work on on-system LADOTD Control Surveys, Topographic Surveys, Boundary Surveys, and Right- of-Way Mapping with 8 years being the Supervising Professional and three years as Principal. He has managed over 130 task orders under 10 separate Topographic and Right of Way Mapping IDIQ Contracts with LADOTD. Bradley fulfills the minimum personal requirements of being a professional land surveyor, registered in the state of Louisiana, having a minimum of five years of experience in conducting Control Surveys as shown below.	
12/21-Ongoing	**IDIQ Contract No. 4400021974 for Professional Surveying Services – Statewide with Majority of Work in Districts 03 and 07 – Principal-in-Charge.** Performing Topographic Surveys for LA DOTD. To date, this IDIQ contract has included a total of 9 separate Task Orders for 7 State Highway Projects. Survey tasks included Control Survey, Conventional Topo, Hydrographic Survey, terrestrial and mobile Lidar Survey, and producing Existing Drainage Maps.
01/21-Ongoing	**H.004273.5 – I-49 Connector – Lafayette Parish, LA– Principal-in-Charge.** Responsible for providing control survey, topographic, terrestrial Lidar scanning, and property surveying services for the I-49 Connector. The project is in a dense urban area and is approximately 5 miles long.
08/19-Ongoing	**H.011670- I-10/Loyola Interchange Improvements- Kenner, LA- Surveyor-in-Charge/Principal-in-Charge.** Responsible for providing Control Survey, Topographic Survey, Right-of-Way Survey, Drainage Survey, and Right-of-Way Monument Mapping. The project stretches along I-10, from the levee in Kenner to the Williams Blvd. off ramp, as well as Loyola Avenue and portions of Veterans Blvd for approximately 3.2 miles of roadway. Bradley originally managed SJB Group's portion of the Survey and is now serving as Principal-in-Charge for any ongoing or new work Forte and Tablada is tasked with.
01/23- 01/24	**H.014218 US190-Livingston Parish Line – East Baton Rouge Parish, LA (4400021974- Task Order 2) – Principal-in-Charge.** Responsible for this project providing survey control, topographic survey and drainage mapping. This project is in a dense urban area and is approximately 4 miles long. Mobile Lidar was utilized, throughout the project, which was tied to the survey with established ground control targets.
01/21-06/22	**Retainer Contract No. 4400010587 for Professional Surveying Services – Statewide with Majority of Work in Districts 02, 03, 07, 61 and 62– Principal-in-Charge.** Performing Topographic Surveys for LA DOTD. This Retainer contract included a total of 18 separate Task Orders for 11 State Highway Projects. Survey tasks included Control Survey, Conventional Topo, Hydrographic Survey, terrestrial and mobile Lidar Survey, and producing Existing Drainage Maps.
10/22 -12/22	**Lafayette Streetscape Survey- Congress Street, Lafayette Parish, LA – Principal-in-Charge.** Reponsible for providing survey control, topographic and property survey to establish existing right-of-way for approximately a mile of roadway along Congress Street. This survey included mobile Lidar scanning of all roadway features, which was tied to the survey with established ground control targets.

FIRM EMPLOYED BY:	Forte and Tablada
Name	**Bradley S. Holleman (Continued)**

EXPERIENCE DATES (MM/YY - MM/YY)	EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).
01/21-12/22	Contracts 4400010587- Task Order 18; 4400015237- Task Order 1; 4400021974- Task Orders 1, 3, and 4- H.003931- Calcasieu River Bridge (HBI) – Calcasieu Parish, LA– Principal-in-Charge for this project providing control survey, topographic survey, Mobile and Terrestrial Lidar, Multibeam Hydrographic survey of Lake Charles, and drainage mapping. This project is in a high-traffic industrial area along I-210 and is approximately 7 miles long. Mobile Lidar data was tied to the survey with established ground control targets.
03/21 – 12/21	MOVEBR (20-EN-HC-0003) Florida Blvd. Corridor Enhancement – East Baton Rouge Parish, LA – Principal-in-Charge for this project providing survey control, and topographic surveying. This project is in a dense urban area and is approximately 4 miles long. Forte and Tablada completed Mobile Lidar services, which was tied to the survey with established ground control targets.
11/19-12/20	H.012083- Calcasieu River Bridge Investigation, Calcasieu Parish, LA- Surveyor to provide Mobile Lidar scanning services for the I-10/Lake Calcasieu bridge in Lake Charles, LA. Terrestrial scans were done underneath the bridge for 10 spans on the East and West side, on top the deck to capture the superstructure, as well as from the water below to capture the sub structure. Mobile Lidar data was tied to the survey with established ground control targets.
1/2018 – 4/2020	H.004100- I-10: LA 415 to Essen Lane - Surveyor-in-Charge for the control survey, topographic survey and 3D Mobile laser scanning. This project was for the widening design of Interstate 10 from LA 415 to Essen Lane in East Baton Rouge Parish. This Survey was part of a larger project that extended West to LA 415 and included a team of 4 Survey firms to complete the work on schedule. Mobile Lidar data was tied to the survey with established ground control targets.
5/2018 – 4/2019	H.012591- I-10: Paris Road Lake Pontchartrain - Surveyor-in-Charge for the control survey, topographic survey, 3D Mobile laser scanning and existing drainage map. This project was for the design of Interstate 10 improvements of an 8 mile stretch in New Orleans East. Mobile Lidar data was tied to the survey with established ground control targets.
6/2016 – 2/2017	H.000263- Chef Menteur Pass Bridge - Surveyor-in-Charge for the control survey, topographic survey, 3D laser scanning and existing drainage map. This project was for the design of new bridge to replace the existing swing bridge on US 90 over Chef Menteur Pass.
12/2014 – 3/2016	H.011137 & H.011152- I-12 (LA 21 to LA 59) St Tammany, LA – Surveyor-in-Charge for the control survey, topographic survey, 3D laser scanning and existing drainage map. This project was for widening of Interstate 12 from LA 21 to La 59 in St. Tammany Parish.

FIRM EMPLOYED BY:	Forte and Tablada		
Name	**Ross A. Wilson, P.L.S.**	**Year of Relevant Experience with this employer**	14
Title	Senior Professional Land Surveyor	**Years of relevant experience with other employer(s)**	2
Degree(s) / Years / Specialization	B.S. /2010 /Geomatics		
Active registration number / state / expiration date	5148 / Louisiana / 03/31/2026; Also Registered PLS in TX, MS, AR, FL, KY, TN, GA. Certified Federal Surveyor (CFedS 1897)		
Year registered 2015	**Discipline** Land Surveying		
Contract role(s) / brief description of responsibilities	**Survey-in-Charge.** Ross will serve as Surveyor-In-Charge during this contract, and in that role he will supervise all field and office work performed on task orders. He will also lead the effort on estimating task orders and producing project deliverables. He will be responsible for all QA/QC efforts from beginning to end of each task order, including the final project deliverables.		

EXPERIENCE DATES (MM/YY - MM/YY)	EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).
Ross has 14 years of experience of managing field crews and office work on on-system LADOTD Control and Topographic Surveys, with nine years being the Professional Surveyor-in-Charge on these projects. Ross has managed 37 task orders under three separate Topographic IDIQ Contracts with LADOTD with Control Surveys varying from small to large scale. He fulfills the minimum personal requirements of being a professional land surveyor, registered in the state of Louisiana, having a minimum of five years of experience in conducting Control Surveys as shown below.	
12/21-Ongoing	**IDIQ Contract No. 4400021974 for Professional Surveying Services – Statewide with Majority of Work in Districts 03 and 07 – Surveyor-in-Charge.** Responsible for performing Topographic Surveys for LA DOTD. This contract showcases Mr. Wilson's familiarity with the process of managing LADOTD Survey IDIQ Task Orders from beginning to end. To date, this IDIQ contract has included a total of 9 separate Task Orders for 7 State Highway Projects. Survey tasks included Control Survey, Conventional Topo, Hydrographic Survey, terrestrial and mobile Lidar Survey, and producing Existing Drainage Maps.
08/19-Ongoing	**H.011670- I-10/Loyola Interchange Improvements- Kenner, LA- Surveyor-in-Charge.** Responsible for providing Control Survey, Topographic Survey, Right-of-Way Survey, Drainage Survey, and Right-of-Way Monument Mapping. The project stretches along I-10, from the levee in Kenner to the Williams Blvd. off ramp, as well as Loyola Avenue and portions of Veterans Blvd for approximately 3.2 miles of roadway.
08/15-Ongoing	**H.004273.5 – I-49 Connector – Lafayette Parish, LA – LA DOTD – Survey Manager/ Surveyor-in-Charge.** Responsible for providing survey control, topographic, terrestrial Lidar scanning, and property surveying services for the I-49 Connector. The project is in a dense urban area and is approximately 5 miles long.
01/23- 01/24	**H.014218 US190-Livingston Parish Line – East Baton Rouge Parish, LA (4400021974- Task Order 2) – Surveyor-in-Charge.** Responsible for this project providing survey control, topographic survey and drainage mapping. This project is in a dense urban area and is approximately 4 miles long. Mobile Lidar was utilized, throughout the project, which was tied to the survey with established ground control targets.
10/22 -12/22	**Lafayette Streetscape Survey- Congress Street, Lafayette Parish, LA – Surveyor-in-Charge.** Responsible for providing survey control, topographic and property survey to establish existing right-of-way for approximately a mile of roadway along Congress Street. This survey included mobile Lidar scanning of all roadway features, which was tied to the survey with established ground control targets.
05/21 – 12/22	**Contracts 4400010587- Task Order 18; 4400015237- Task Order 1; 4400021974- Task Orders 1, 3, and 4- H.003931- Calcasieu River Bridge (HBI) – Calcasieu Parish, LA– Surveyor-in-Charge.** Responsible for this project providing survey control, topographic survey, Mobile and Terrestrial Lidar, Multibeam Hydrographic survey of Lake Charles, and drainage mapping. Mobile Lidar data was tied to the survey with established ground control targets. This project is in a high-traffic industrial area along I-210 and is approximately 7 miles long.

FIRM EMPLOYED BY:	Forte and Tablada
Name	**Ross A. Wilson (Continued)**

EXPERIENCE DATES (MM/YY - MM/YY)	EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).
06/17-06/22	Retainer Contract No. 4400010587 for Professional Surveying Services – Statewide with Majority of Work in Districts 02, 03, 07, 61 and 62– Surveyor-in-Charge performing Topographic Surveys for LA DOTD. This contract showcases Mr. Wilson's familiarity with the process of managing LADOTD Survey IDIQ Task Orders from beginning to end. This Retainer contract included a total of 18 separate Task Orders for 11 State Highway Projects. Survey tasks included Control Survey, Conventional Topo, Hydrographic Survey, terrestrial and mobile Lidar Survey, and producing Existing Drainage Maps.
03/21 – 12/21	MOVEBR (20-EN-HC-0003) Florida Blvd. Corridor Enhancement – East Baton Rouge Parish, LA – Surveyor-in-Charge for this project providing survey control, and topographic surveying. This project is in a dense urban area and is approximately 4 miles long. Forte and Tablada completed Mobile Lidar services, which was tied to the survey with established ground control targets.
01/20-10/20	Contract 4400010587- Task Orders 6, 7, and 8- H.012588, H.012169, H.012587 I-10: Atch Basin Br-W. Baton Rouge P/L, I-10: Iberville P/L-W End Miss Br, I-10: W End of Br 290-W End of LA 415- West Baton Rouge & Iberville Parishes, LA- Surveyor-in-Charge for complete survey control, topographic survey and Mobile Lidar of approximately 18.3 miles along I-10, from the East end of the Atchafalaya Bridge to the West end of the I-10/LA 415 Interchange. The Mobile Lidar data was tied to the survey with established ground control targets.
01/18-06/19	Contract 4400012323- H.004100- I-10: LA 415 to Essen Lane to I-10 and I-12- East and West Baton Rouge Parishes- LA DOTD- Survey Manager for survey control, topographic survey, and terrestrial Lidar survey of approximately 5 miles of roadway along I-10 and I-12 between LSU lakes and Essen Lane. Mobile Lidar data was tied to the survey with established ground control targets.
10/18-02/19	Contract 4400010587- Task Orders 2, 3, 4, 5, and 10- H.012343 Sunshine Bridge Repair – St. James Parish, LA- Surveyor-in-Charge responsible for establishing survey control on and near the Sunshine Bridge to use conventional survey and terrestrial Lidar scanning methods to monitor the damage on the bridge.
05/17-10/18	H.004791.5 Belle Chasse Bridge and Tunnel (HBI)- Plaquemines Parish, LA (4400009387- Task Orders 2 and 5)- Surveyor-in-Charge for survey control, topographic surveying and drainage mapping for the Belle Chase Bridge and Tunnel Replacement project for LA DOTD. Included in this work was a survey performed utilizing traditional methods, terrestrial laser scanning of roadway, bridge and tunnel features, and multi-beam hydrographic surveying of the Algiers Canal and exterior features of the existing tunnel.

FIRM EMPLOYED BY:	Forte and Tablada		
Name	**Philip Koch, P.L.S.**	**Year of Relevant Experience with this employer**	6
Title	Professional Land Surveyor	**Years of relevant experience with other employer(s)**	0
Degree(s) / Years / Specialization	BS /2008 /Business Management		
Active registration number / state / expiration date	PLS 5296 / LA / 03/31/2027		
Year registered	2022	**Discipline**	Land Surveying
Contract role(s) / brief description of responsibilities	**North LA Survey Task Manager.** Brief description of responsibilities are below.		

EXPERIENCE DATES (MM/YY - MM/YY)	EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).
Philip will serve as North LA Survey Task Manager during this contract, and in that role he will provide daily supervision over field and office work being performed out of Forte and Tablada's Shreveport office, in the event that a task order requires field work in North LA. Philip has six years of Survey related experience, including three years as a Party Chief, and two years as a Professional Surveyor. He currently leads Survey field and office production in Forte & Tablada's Shreveport office.	
01/25-04/25	**Calumet Brown Station Containment Surveys and Dike Analysis, Caddo Parish, LA- Surveyor.** Responsible for providing control survey, targets and verification points for Aerial Lidar around Calumet plant. The purpose of the project was to calculate capacity and assess damage of dike walls around silos.
01/25	**Contract 4400021974 - Task Order 12; H.016332- LA 520: Drain Bridge, Claiborne Parish, LA- Surveyor.** Responsible for providing topographic survey services for bridge site on a 2-lane rural roadway. The purpose of this project was to replace a small bridge with a large box culvert.
01/23 – 02/23	**Contract 4400021974 - Task Order 6 - H.001234 LA 1: Port Allen Canal BR Replacement, Port Allen, LA - Surveyor.** Responsible for monitoring survey. Reestablish control from original contractor and created new control to monitor four bents on the LA1 Bridge. Established baseline for future monitoring of bridge by shooting elevations of footings and top of bent caps. Forte and Tablada was retained by LA DOTD to perform a bridge monitoring survey. Settlement occurred on several of the bridge piers and the department would like to have a more comprehensive understanding of the settlement and moving issues.
04/18 – 02/23	**H.004273.5 – I-49 Connector, Lafayette Parish, LA – LA DOTD – Party Chief, Survey Intern, and Surveyor.** Responsible for providing control and topographic survey services for the I-49 Connector. The project is in a dense urban area and is approximately 5 miles long.
06/21 – 01/23	**Amite River and Tributaries – Comite River Diversion Project, Zachary, LA - Party Chief, Survey Intern, and Surveyor.** Work performed on McHugh Road Bridge Construction. Established control on site, created monitoring points, performed QA/QC cross sections on canal.
11/22 – 12/22	**West Colyell Improvement Survey - Phase II, Livingston Parish, LA - Survey Intern and Surveyor.** Responsible for providing control, topographic, and waterway survey services for the 8 mile stretch of West Colyell waterway from Buddy Ellis Rd to Colyell Bay. Checked control from previous phase and established control and benchmarks for this phase. Obtained Cross sections and Bridge Topo information for the length of the project.
11/20-09/22	**Clean Harbors Eroded Pipeline Scan and Devils Swamp Drone Survey, East Baton Rouge Parish, LA- Survey Intern.** Responsible for establishing control and Lidar targets for pipeline scans and drone flights for remediation of eroded areas. The Aerial Lidar data was tied to the survey with established ground control targets.
01/21 – 03/21	**Crestwood Drive, 11th St., & North St. Drainage Topographic and Right of Way Survey, St. Tammany Parish, LA - Party Chief.** Responsible for control, topographic, and property boundary survey, for the Crestwood Drive, 11th Street, and North Street corridors. Provided right of way maps showing property ownership, servitudes, and public Right of ways for the purposes of acquiring drainage servitudes along these corridors to maintain and potentially improve the drainage in these areas.

FIRM EMPLOYED BY:	Forte and Tablada
Name	**Philip Koch (Continued)**

EXPERIENCE DATES (MM/YY - MM/YY)	EXPERIENCE AND QUALIFICATIONS RELEVANT TO THE PROPOSED CONTRACT; I.E., "DESIGNED DRAINAGE", "DESIGNED GIRDERS", "DESIGNED INTERSECTION", ETC. EXPERIENCE DATES SHOULD COVER THE YEARS OF EXPERIENCE SPECIFIED IN THE APPLICABLE MPR(S).
08/20 – 03/21	H.013543 Sims Road Improvements, East Baton Rouge Parish, LA – Party Chief providing control and topographic survey along Sims Road from LA 16 and Renniger Road for approximately 2.9 miles. The purpose of the project was to provide an overlay and closed drainage.
01/20 – 07/20	East Baton Rouge Stormwater Masterplan, East Baton Rouge Parish, LA - Survey Technician for hydrographic surveying of bayous and creeks located within East Baton Rouge Parish for the EBR Stormwater Masterplan. The work consisted of establishing cross-sections and stream bed profiles along their length as well as locating over 14,000 subsurface structures for the purposes of hydraulic modeling.
11/19 – 01/20	Walker City-Wide Drainage Study, Walker, LA - Party Chief responsible for numerous topographic and waterway surveys for several bridges, streams, creeks, and tributaries to evaluate existing drainage issues as part of a city-wide drainage study.

17. Firm Experience: Identify the team's project experience **most relevant** to the scope in the advertisement. **The projects*** should be limited to a total of 20, with no more than 5 projects being represented by the prime consultant and with no more than 3 projects represented by each sub-consultant on the team. If more than 5 projects are identified for the prime consultant, all projects identified after the first 5 will not be evaluated.** If more than 3 projects are identified for a single sub-consultant, all projects identified after the first 3 from that sub-consultant will not be evaluated. Include no more than one page per project. Projects identified shall only include work performed by firms on the team. The projects identified do not necessarily need to have been DOTD projects.

FIRM NAME	Dewberry Engineers Inc.	**DISCIPLINE(S)***	Data Collection, Geotech, Survey
Project name	USGS Lidar Acquisition and Processing for 3DEP, Louisiana	**Firm responsibility (prime or sub?)**	Prime
Project number	140G0223F0255	**Owner's name**	U.S. Geological Survey
Project location	Coastal Louisiana	**Owner's Project Manager**	Walter Kloth
Owner's address, phone, email	1400 Independence Road MS306, Rolla MO 65401, ph-303-202-4334, email- wkloth@usgs.gov		
Services commenced by this firm (mm/yy)	08/23	**Total consultant contract cost ($1,000's)**	1,569
Services completed by this firm (mm/yy)	Ongoing	**Cost of consultant services provided by this firm ($1,000's)**	1176

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

FIRM'S ROLE:

- Topographic Survey – Ground Control
  - Survey planning, field work, QA/QC
- Topographic Mapping – Lidar (Topographic)
  - Flight planning
  - Lidar acquisition
  - Processing
  - Derivative product generation
  - QA/QC

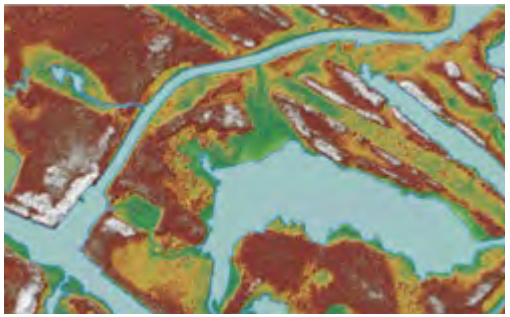
STAFF MEMBERS:

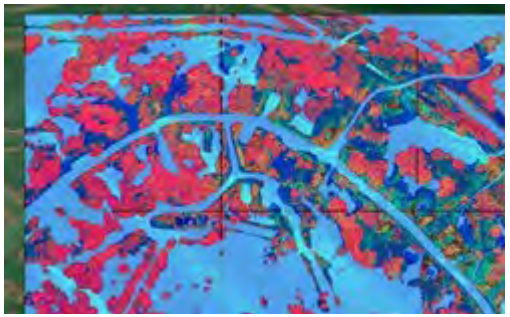
- Ryan Ligon
- Meag an Anderson
- Bryan Deslauriers
- Jason Dolf
- Andrew Peters

Dewberry was contracted by the USGS to provide Lidar acquisition and processing services in support of the 3-Dimensional Elevation Program for topographic mapping of approximately 5,155 square miles of coastal Louisiana. This task order was issued in partnership with the Louisiana Department of Transportation and Development (DOTD) under the 3D National Topography Model (3DNTM) Data Collaboration Announcement (DCA), formally the 3DEP Broad Agency Announcement (BAA). The entire area that Dewberry collected was tidally coordinated and produced Quality Level 1 (QL1) Lidar data within the state of Louisiana.

Dewberry oversaw the establishment of all ground control surveys. Independent checkpoints for validation and control points for calibration were acquired by the Dewberry team to make sure accuracy with NVA and VVA accuracy reported with delivered products.

We prepared the final Lidar products to meet the task order requirements based on the USGS/NGP Lidar Base Specification 2022, Rev A. We designed, oversaw, and performed quality control on the Lidar acquisition and production for this project. Dewberry performed all Lidar processing, including hydro flattening and delivered raw, unclassified Lidar data, classified to LAS, 0.5m DEMs in raster format, as well as Lidar intensity ortho rasters and all ancillary data.





FIRM NAME	Dewberry Engineers Inc.	DISCIPLINE(S)*	Data Collection, Geotech
Project name	USGS Topobathymetric Lidar, Breton Island	**Firm responsibility (prime or sub?)**	Prime
Project number	140G0224F0239	**Owner's name**	U.S. Geological Survey
Project location	Nearshore Louisiana and Mississippi	**Owner's Project Manager**	Walter Kloth
Owner's address, phone, email	1400 Independence Road MS306, Rolla MO 65401, ph-303-202-4334, email- wkloth@usgs.gov		
Services commenced by this firm (mm/yy)	08/22	**Total consultant contract cost ($1,000's)**	210
Services completed by this firm (mm/yy)	08/24	**Cost of consultant services provided by this firm ($1,000's)**	134

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

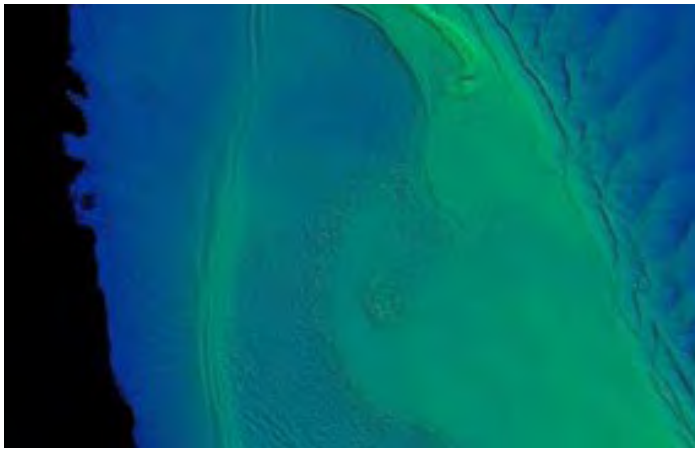
FIRM'S ROLE:

- Topographic Survey – Ground Control
  - Survey planning, field work, QA/QC
- Topographic Mapping – Lidar (Topobathymetric)
  - Flight planning,
  - Lidar acquisition
  - Processing
  - Derivative product generation
  - QA/QC

STAFF MEMBERS:

- Ryan Ligon
- Jason Dolf
- Stephanie Padilla

Dewberry was contracted by the USGS to complete all planning, acquisition, and processing to deliver topobathymetric Lidar and derivative products. This work is being done for two contiguous areas totaling approximately 123 square miles along the Gulf of Mexico coast covering the Breton and Crurlew Islands (~64 mi²) and the Northern Chandeleur Islands (~59 mi²) to include the surrounding waters until point of extinction.



The Lidar data was classified for vegetation, water column and bathymetry. Vegetation, water-column noise, and any other above-ground structures were initially separated and classified using an automated classification process. An intensive manual cleanup was also required for obtaining reliable bathymetric returns. Dewberry developed new classification macros to limit the amount of manual cleanup. QA/QC procedures were continuously implemented through all iterations of the data processing cycle. Data passed through an automated set of macros for initial cleaning, a first edit by a trained technician, and a second review and edit by an advanced processor, and finally exported to a final product. All final products were reviewed for completeness and correctness before delivery. Final products included unclassified Lidar data, classified LAS, topobathy seamless DEM at 1 meter res., Lidar intensity orthos, confidence rasters, ground control report, Lidar data processing report, QC report, FGDC- compliant Metadata, and ESRI shapefile containing the edge of water breaklines used in classification.

This project will support the USGS Wetland and Aquatic Research Center mission. Additionally, this Lidar survey will be used for modeling, predicting coastal landscape change, restoration of ecosystems, and mitigating risks associated with anthropomorphic and natural hazards.

FIRM NAME	Dewberry Engineers Inc.	DISCIPLINE(S)*	Data Collection, Geotech, Survey
Project name	USACE Galveston District- Orange County Coastal Storm Risk Management	**Firm responsibility (prime or sub?)**	Sub
Project number	W912HY22R2274	**Owner's name**	United States Army Corps of Engineers, Galveston District
Project location	Orange County, Texas (Sabine Pass to Galveston Bay)	**Owner's Project Manager**	Maria Rodriguez
Owner's address, phone, email	US Army Engineer District, Galveston, A-E Services Attn: Maria Rodriguez, PO Box 1229, Galveston, TX 77553, ph- 409-765-4656, email- Maria.e.rodriguez@usace.army.mil		
Services commenced by this firm (mm/yy)	08/22	**Total consultant contract cost ($1,000's)**	155
Services completed by this firm (mm/yy)	03/23	**Cost of consultant services provided by this firm ($1,000's)**	117

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

FIRM'S ROLE:

- Topographic Survey – Ground Control
  - Survey planning, field work, QA/QC
- Topographic Mapping – Imagery
  - Flight planning,
  - Imagery acquisition
  - Aerotriangulation
  - Orthophoto generation
  - QA/QC
- Topographic Mapping – Lidar (Topographic)
  - Flight planning
  - Lidar Acquisition
  - Processing
  - Derivative product generation
  - QA/QC

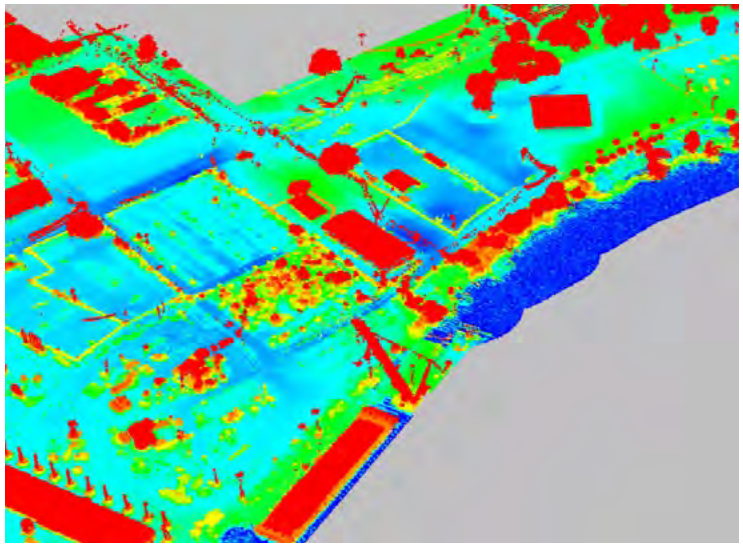
STAFF MEMBERS:

- Meagan Anderson
- Jason Dolf
- Ryan Ligon
- Stephanie Padilla

Dewberry was contracted by EMC Survey as prime contractor on a task order from the USACE-St Louis District to complete all planning, acquisition, and processing for delivery of topobathymetric Lidar with co-acquired orthophotography and derivative products. This work was done for approximately 5 square miles (20 linear miles) along the coastal Orange County, Texas from approximately Sabine Pass west to Galveston Bay.

Ground survey was coordinated by Dewberry to meet the needs of the calibration, aerotriangulation, and accuracy check steps of the task order. All identified ground survey points were collected by EMC and QC'd by Dewberry for use in Lidar and orthophotography workflows.

This project is in support of the USACE coastal storm risk management efforts. Additionally, this Lidar survey will be used for modeling, predicting coastal landscape change, restoration of ecosystems, and mitigating risks associated with anthropomorphic and natural hazards.



FIRM NAME	Dewberry Engineers Inc.	DISCIPLINE(S)*	Data Collection, Geotech, Survey
Project name	Leon County QL0 Topographic Lidar, Aerial Imagery and Planimetric Mapping	**Firm responsibility (prime or sub?)**	Prime
Project number	B-23-238A	**Owner's name**	Leon County Government
Project location	Leon County, Florida	**Owner's Project Manager**	Scott Weisman, Technical Services Manager
Owner's address, phone, email	301 Monroe Street: P3 Tallahassee, FL 32301 | 850.606.5504 | weisman@leoncountyfl.gov		
Services commenced by this firm (mm/yy)	10/28	**Total consultant contract cost ($1,000's)**	298,500.00
Services completed by this firm (mm/yy)	Ongoing	**Cost of consultant services provided by this firm ($1,000's)**	$1.8M

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

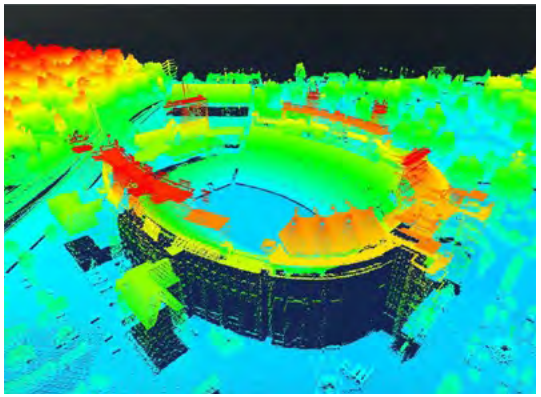
FIRM'S ROLE:

- Topographic Survey – Ground Control
  - Survey planning
  - Field work
- Topographic Mapping – Imagery
  - Flight planning,
  - Imagery acquisition
  - Aerotriangulation
  - Orthophoto generation
  - QA/QC
- Topographic Mapping – Lidar (Topographic)
  - Flight planning
  - Lidar Acquisition
  - Processing
  - Derivative product generation
  - QA/QC

STAFF MEMBERS:

- Meagan Anderson
- Jason Dolf
- Chad Lopez
- Ray Miller
- Andrew Peters

Under a five-year contract with Leon County, Dewberry acquired and processed high- resolution topographic Lidar and 4-band aerial imagery and performed robust ground surveys to support updates to the Tallahassee-Leon County Geographic Information Systems (TLCGIS) Land Base Map. Dewberry used the Lidar and imagery data to update the TLCGIS planimetric base map that includes impervious surfaces and hydrography.



The Lidar produced for this contract in 2018 represents the first-ever USGS QL0 county-wide Lidar dataset in the nation co-funded by the USGS' 3D Elevation Program to demonstrate the production of QL0 Lidar data over 783 square miles. Dewberry managed the Lidar acquisition, performed the ground survey of 230 checkpoints used to control and test the positional accuracy of the Lidar, and performed all Lidar data processing and product generation including a seamless DEM of Leon County.

In 2020, Dewberry was tasked by the USGS to produce QL1 topographic Lidar for the Florida panhandle in response to Hurricane Michael. This project included full coverage of Leon County who elected to upgrade the Lidar within the county to achieve their full specification. In addition to the standard bare ground Lidar point cloud classification, Dewberry classified buildings and vegetation.These features were reviewed to make sure a classification accuracy threshold of at least ninety percent.

The TLCGIS program also tasked Dewberry to acquire 4-band aerial imagery again in 2019, 2021, and 2022 that was used to produce a highly accurate, seamless orthoimagery mosaic of the county. Using the Lidar and multiple orthoimage mosaics, we updated multiple elements of the TLCGIS Land Base Map including building footprints, impervious surfaces, tree canopy and vegetation maps, and topographic contours and spot elevations.

Currently, Dewberry is executing the second GIS base map update contract for Leon County. We are actively producing topographic Lidar and aerial imagery that was collected in January 2024. The aerial imagery was recently accepted, and the topographic Lidar will be completed by December 2025.

FIRM NAME	Dewberry Engineers Inc.	DISCIPLINE(S)*	Data Collection, Geotech, Survey
Project name	Amite Watershed Topographic Lidar Acquisition & Processing	**Firm responsibility (prime or sub?)**	Prime
Project number	4400008293 TO#6	**Owner's name**	Louisiana Department of Transportation
Project location	Amite River Watershed, Louisiana	**Owner's Project Manager**	Edward Knight, PE
Owner's address, phone, email	1201 Capitol Access Road, Baton Rouge, LA 70804-9245 | 225.279.3007 | edward.knight@la.gov		
Services commenced by this firm (mm/yy)	07/17	**Total consultant contract cost ($1,000's)**	672
Services completed by this firm (mm/yy)	08/18	**Cost of consultant services provided by this firm ($1,000's)**	369

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

FIRM'S ROLE:

- Topographic Survey – Ground Control
  - Survey planning
  - Field work
  - QA/QC
- Topographic Mapping – Lidar (Topographic)
  - Flight planning
  - Lidar acquisition
  - Processing
  - Derivative product generation
  - QA/QC

STAFF MEMBERS:

- Meagan Anderson
- Ryan Ligon
- Jen Novac
- Andrew Peters

Dewberry was tasked under their Cooperative Technical Partnership (CTP) contract with DOTD to perform acquisition and all Lidar derived products for the HUC-8 Amite River Basin Watershed consisting of 1,884 square miles of Quality Level 1 (QL1) Lidar to meet all USGS 3DEP required specifications. Dewberry was responsible for coordinating the Lidar acquisition and the collection of necessary primary and secondary survey points from designated acquisition and survey partners. The flight plan for the acquisition was prepared by Dewberry to collect the Lidar data with a 30% swath overlap resulting in an average of 9 points-per-square-meter. The ground control points for calibration and check points for validation (125 in all) were devised by the survey team from Forte & Tablada and approved by Dewberry. All Lidar data were calibrated for further classification and derivative product creation. We processed and classified the data to meet the USGS/NGP Lidar Base Specificationv1.2 requirements. Dewberry generated the breaklines, including bridge polygons, required for hydro-flattening using a semi-automated approach that focused on extracting the geometry of the hydrographic features using a combination of point cloudand intensity imagery. The process was then followed with a 100% manual review of the breaklines. We worked closely with USGS to make sure the data was approved by USGS for publication. DOTD used this dataset to create hydrographic models of the Amite River watershed that will be used in determining where intense flooding may take place for historic level rains. These models will be used for future development efforts to minimize impacts that will affect the way the river flows while in a flood stage. Deliverable products included: raw, unclassified Lidar data; classified LAS files; 2-foot resolution DEMs (hydro flattened bare earth); intensity ortho rasters; ground survey report; supplemental Ground Control Report including a statistical report summarizing the results of the airborne GPS adjustment and IMU data, Lidar processing report, QC report containing procedures and results, FGDC compliant metadata, and ESRI file geodatabase feature class containing the breakline data.

FIRM NAME	Keystone Aerial Surveys, Inc.	DISCIPLINE(S)*	Data Collection
Project name	Digital Imagery and Lidar Acquisition for 3 Corridors in Tennessee and Alabama	**Firm responsibility (prime or sub?)**	Sub
Project number	N/A	**Owner's name**	Louisiana Department of Transportation
Project location	Decatur, AL; Hanceville, AL; Nashville, TN	**Owner's Project Manager**	Wilson and Company, Inc.
Owner's address, phone, email	990 South Broadway, Suite 220 | Denver, CO 80209 | 816-701-3181 | Danny.Roark@wilsonco.com		
Services commenced by this firm (mm/yy)	04/25	**Total consultant contract cost ($1,000's)**	Unknown
Services completed by this firm (mm/yy)	04/25	**Cost of consultant services provided by this firm ($1,000's)**	$54,425.00

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

FIRM'S ROLE:

- Topographic Mapping - Imagery

STAFF MEMBERS:

- John Schmitt
- Brian Jennings
- Andrew Martinez

Keystone Aerial Surveys, Inc. was contracted by Wilson and Company, Inc. to acquire aerial digital imagery and Lidar data for three corridors across Tennessee and Alabama. Acquisition occurred in April 2025.

Project specifications included 60 imagery flight lines, 1,623 total exposures at 7 cm GSD and 20 ppsm Lidar data acquisition.

The imagery and Lidar data were acquired using Keystone's Leica CityMapper H2 Hybrid sensor. The project was flown with: Gyro-stabilized camera mount, Northrop Grumman LCI-100C Inertial Measurement Unit (IMU), Leica Flightpro Navigation Software, Post- processing completed using Waypoint Inertial Explorer and HxMap Processing Suite 2.7.0, Leica MissionPro Flight Planning Software

The final deliverables for the client included: Digital Imagery, 4-band RGBi, 8-bit imagery, ABGPS/IMU data , EO files, Calibrated LAS Files to GCP, SOL Trajectory, and Flight Reports / Logs.

FIRM NAME	Keystone Aerial Surveys, Inc.	DISCIPLINE(S)*	Data Collection
Project name	Lidar Acquisition for the North Central Texas Council of Governments	**Firm responsibility (prime or sub?)**	Sub
Project number	N/A	**Owner's name**	Woolpert, Inc.
Project location	Dallas, TX	**Owner's Project Manager**	Sam Moffat, GISP
Owner's address, phone, email	11486 Corporate Boulevard, Suite 190, Orlando, FL 32817 | 407-591-5010 | Sam.Moffat@Woolpert.com		
Services commenced by this firm (mm/yy)	02/25	**Total consultant contract cost ($1,000's)**	Unknown
Services completed by this firm (mm/yy)	03/25	**Cost of consultant services provided by this firm ($1,000's)**	$14,925

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

FIRM'S ROLE:

- Topographic Mapping - Imagery

STAFF MEMBERS:

- John Schmitt
- Brian Jennings
- Andrew Martinez

Keystone Aerial Surveys, Inc. has been contracted by Woolpert, Inc. for over seven years to acquire aerial data for several counties in Texas for the North Central Texas Council of Governments (NCTCOG) contract. Keystone acquired Lidar data for this project in February 2025. This was a challenging project in that the area of interest was located in the Dallas Fort Worth International Airport airspace.

Project Specifications included: 485 flight lines, 1500m AGL, and eight points per square meter Lidar data acquisition.

The imagery and Lidar data were acquired using Keystone's Leica CityMapper H2 Hybrid sensor. The project was flown with: Gyro-stabilized camera mount, Northrop Grumman LCI-100C Inertial Measurement Unit (IMU), Leica Flightpro Navigation Software, Post- processing completed using Waypoint Inertial Explorer and HxMap Processing Suite 2.7.0, Leica MissionPro Flight Planning Software.

The final deliverables for the client included: Raw Lidar Data, Calibrated LAS files, ABGPS/IMU data , EO files, SOL Trajectory, and Flight Reports / Logs.

FIRM NAME	Keystone Aerial Surveys, Inc.	DISCIPLINE(S)*	Data Collection
Project name	Digital Imagery and Lidar Data Acquisition for Interstate-10 Analysis	**Firm responsibility (prime or sub?)**	Sub
Project number	N/A	**Owner's name**	Dallas Aerial Surveys, Inc. DBA DAS Geospatial
Project location	Waller, Fort Bend & Harris Counties, TX	**Owner's Project Manager**	Andy Longoria
Owner's address, phone, email	16415 Addison Road, Suite 100, Addison, TX 75001 | 214-349-2200 | alongoria@dasmaps.com		
Services commenced by this firm (mm/yy)	03/24	**Total consultant contract cost ($1,000's)**	Unknown
Services completed by this firm (mm/yy)	04/24	**Cost of consultant services provided by this firm ($1,000's)**	$12,990

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

FIRM'S ROLE:

- Topographic Mapping - Imagery

STAFF MEMBERS:

- John Schmitt
- Brian Jennings
- Andrew Martinez

Keystone Aerial Surveys, Inc. was contracted by Dallas Aerial Surveys to acquire aerial digital imagery and Lidar data for a linear AOI through Waller, Fort Bend & Harris Counties, TX. This project will assist in the analysis of Interstate-10. Acquisition occurred in March 2024.

Project Specifications included: 19 imagery flight lines, 582 total exposures, GSD: 5 cm, 30 ppsm.

Acquisition details: The imagery and Lidar data were acquired using Keystone's Leica CityMapper H2 Hybrid sensor. The project was flown with: Gyro-stabilized camera mount, Northrop Grumman LCI-100C Inertial Measurement Unit (IMU), Leica Flightpro Navigation Software, Post- processing completed using Waypoint Inertial Explorer and HxMap Processing Suite 2.7.0, Leica MissionPro Flight Planning Software

The final deliverables for the client included: Digital Imagery, 4-band RGBi, 8-bit imagery, ABGPS/IMU data , EO files, Calibrated LAS Files to GCP, SOL Trajectory, and Flight Reports / Logs.

FIRM NAME	Forte and Tablada	DISCIPLINE(S)*	Survey
Project name	Amite River Basin Model-Hydrographic Survey	**Firm responsibility (prime or sub?)**	Sub
Project number	4400008293 TO#6	**Owner's name**	Louisiana Department of Transportation
Project location	Amite River Watershed, Louisiana	**Owner's Project Manager**	Edward Knight, PE
Owner's address, phone, email	1201 Capitol Access Road, Baton Rouge, LA 70804-9245 | 225.279.3007 | edward.knight@la.gov		
Services commenced by this firm (mm/yy)	06/17	**Total consultant contract cost ($1,000's)**	$349
Services completed by this firm (mm/yy)	02/19	**Cost of consultant services provided by this firm ($1,000's)**	$349

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

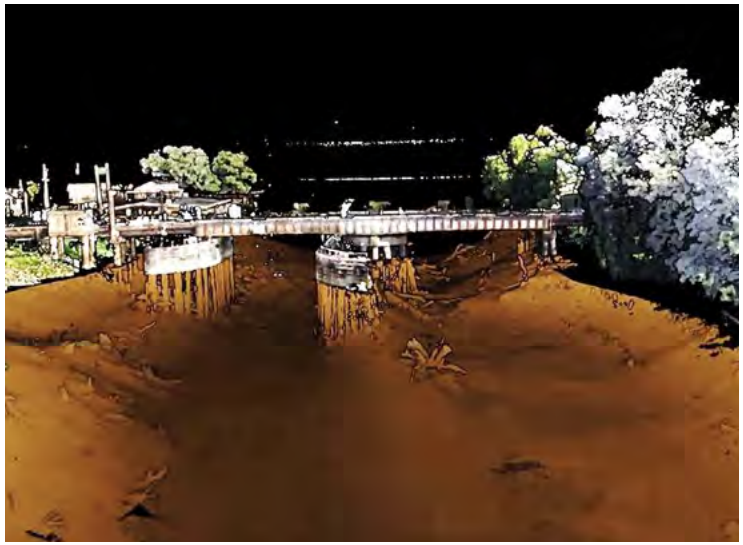
FIRM'S ROLE:

- Topographic cross-sections
  - Bathymetric and hydrographic surveys
  - Survey control
- Topographic surveys (Lidar)

STAFF MEMBERS:

- Joey Coco, Jr.
- Brent Campbell

Forte and Tablada, Inc. worked with LA DOTD and Dewberry to provide hydrographic surveying of the Amite River and Comite River. Task orders included typical cross-sections of these rivers, as well as detailed 3-D bathymetric data collected with sonar equipment. Forte and Tablada also provided ground control for Lidar of the Amite River Basin. Notably, Forte and Tablada provided a high-resolution survey of the Amite River Diversion Weir utilizing a variety of techniques including multibeam sonar and traditional survey methods. The largest challenge for this project was the varying water depths of the Amite and Comite River, which prevented the use of a single type of data collection system. Forte and Tablada was able to overcome this challenge through the multiple types of data collection systems within its inventory. A wide swath multi-beam sonar unit was used to collect data remotely into shallow water areas, single-beam sonar equipment was used to confirm the results of the multi-beam areas as well as collect bathymetry data in water less than two feet deep. Lidar laser scanners were used on bridge structures to give a seamless representation of the underwater conditions as well as above water conditions for a precise bridge opening area. The image depicts the seamless merging of these two data sets collected utilizing two different types of data collection systems.



FIRM NAME	Forte and Tablada	DISCIPLINE(S)*	Survey
Project name	IDIQ Contract for Louisiana Watershed Initiative (LWI) Modeling Region 7	**Firm responsibility (prime or sub?)**	Sub
Project number	4400017093	**Owner's name**	Louisiana Department of Transportation
Project location	LWI Region 7	**Owner's Project Manager**	Edward Knight, PE
Owner's address, phone, email	1201 Capitol Access Road, Baton Rouge, LA 70804-9245 | 225.279.3007 | edward.knight@la.gov		
Services commenced by this firm (mm/yy)	10/18	**Total consultant contract cost ($1,000's)**	Unknown
Services completed by this firm (mm/yy)	09/21	**Cost of consultant services provided by this firm ($1,000's)**	$1,478

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

FIRM'S ROLE:

- Records research
- Topographic and hydrographic cross-sections
- Data collection
- Topographic surveys (Lidar)
  - Drainage structure survey,

STAFF MEMBERS:

- Joey Coco, Jr.
- Brent Campbell
- Brad Holleman

Forte and Tablada, Inc. worked with LA DOTD and Dewberry to provide surveying of critical waterway features throughout Region 7 which contains 13 parishes. The three primary components of the survey consist of 1) obtaining records of previous surveys 2) cross section surveys of strategic waterways and 3) surveying culvert and bridge crossings. The purpose of the surveys performed by Forte and Tablada is for regional watershed modeling performed by Dewberry.

Forte and Tablada performed the surveys using GPS survey equipment as well as advanced 3D modeling equipment. Above the water line, a 3D Lidar laser scanner was utilized while under the water line multi-beam and single-beam hydrographic equipment was utilized. Two notable advancements to data collection procedures took place on this project. Forte and Tablada, along with Dewberry, were able to create a procedure to capture 3D models of bridge crossing to precisely determine the bridge opening areas. Another notable solution was the Forte and Tablada Research and Development Team's fabrication of an unmanned, remote controlled single beam hydrographic surveying device to access waterways, too shallow for a manned vessel yet too deep for personnel in hip boots.

FIRM NAME	Forte and Tablada	DISCIPLINE(S)*	Survey
Project name	Mid-Barataria Sediment Diversion Survey QC Program	**Firm responsibility (prime or sub?)**	Sub
Project number	CPRA Project No. BA-153	**Owner's name**	HNTB
Project location	Plaquemines Parish, Louisiana	**Owner's Project Manager**	Avis Gaines
Owner's address, phone, email	601 Poydras St., Ste. 1530, New Orleans, LA 70130 | 504-872-3011 | againes@hntb.com		
Services commenced by this firm (mm/yy)	07/23	**Total consultant contract cost ($1,000's)**	$2,920
Services completed by this firm (mm/yy)	Ongoing	**Cost of consultant services provided by this firm ($1,000's)**	$842.1

Describe the project including the firm's role and members involved. (Highlight staff to be used in this proposal.)

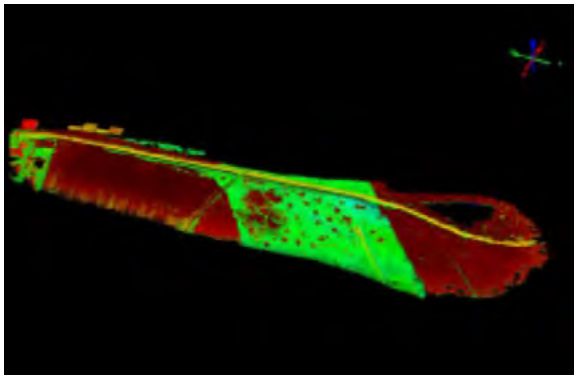
FIRM'S ROLE:

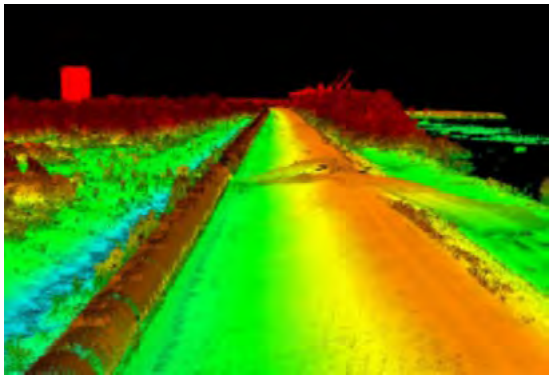
- Topographic Surveys (conventional)
- Topographic Surveys (Lidar/Photo)
- Bathymetric and hydrographic surveys
  - Magnetometer Surveys
  - Geophysical Surveys
  - Benchmarks
  - Maps

STAFF MEMBERS:

- Brent Campbell
- Brad Holleman

Forte and Tablada, Inc is the professional land surveying subconsultant under HNTB for the Quality Assurance of the Mid Barataria Sediment Diversion project. The goal of the scope of work is to provide quality assurance on 10% of the project elements. The professional land surveying aspect of the quality assurance scope is described in two sections; UAV data collection and conventional surveying. The UAV data collection component comprises of bi-weekly UAV flights to collect Lidar data and monthly fights to collect orthomosiacs aerial imagery. The data will be provided to HNTB for review and comparison to design. Elements found to be greater than the positional tolerance as compared to the design will be verified under the conventional surveying scope component. The conventional surveying scope component includes RTK GPS observations, total station observations and hydrographic surveying observations of those elements needing positional verification as determined by the UAV data collection comparison or the QA inspectors.





18. Approach and Methodology: Provide a description of how the work will be performed and provide the proposed project schedule. Include any additional information or description of unique resources that are planned to be used to produce the deliverables. Include any proprietary technologies, methods or approaches that will be used on this project to improve quality or efficiency. If the proposal is for an IDIQ contract, the consultant should review the scope of services in Attachment A to the advertisement to obtain a general understanding of what a typical task order would entail. Based upon that understanding, the consultant should provide a sample schedule that identifies the major milestones, deliverables, tasks, etc., to demonstrate sufficient understanding of a typical task order. The duration of the task order is not required. This section shall be limited to four pages. **If more than four pages are included, all pages after the fourth page will not be evaluated.**

If the consultant has information it believes is proprietary, label it accordingly.

Introduction

Dewberry understands that the DOTD mission for this indefinite delivery indefinite quantity (IDIQ) is to supplement your capabilities to collect, process, manage, distribute, and leverage Lidar and imagery data that supports and enhances the Statewide Topographic Mapping Program. Dewberry has more than a decade of direct, hands-on experience from working on multiple DOTD CTP Lidar and GIS support contracts. DOTD will benefit from our combination of on-site experience, local knowledge, and deep understanding of program requirements. Dewberry will build on our partnership with DOTD, developing innovative solutions, and delivering tailored technical solutions that will bring lasting value to the program.

For this new IDIQ contract, Dewberry has partnered with both local and regional subcontractors who will provide DOTD with a team that offers the full spectrum of equipment resources and staffing capacity to successfully execute multi-service, concurrent task orders (TOs) of various magnitudes issued during this contract. Dewberry will lead the team and will be responsible for both contract and project management as well as executing all topographic and bathymetric Lidar acquisition and processing. Our team is additionally supported by **Forte & Tablada (F&T),** who will provide ground-control services, and **Keystone Aerial Surveys (Keystone)**, who will provide Lidar and aerial imagery collection services.

Dewberry will adhere to the following approach to acquire, process, and deliver quality data to DOTD for every TO throughout the duration of our contract. A Dewberry project is one of **NO SURPRISES!** We use disciplined project controls and risk registers, including Microsoft Project and PowerBI, so that our projects are delivered on time and within budget. **Figure 1** outlines the proposed workflow for a typical TO awarded under this contract. The following pages outline the Dewberry team's approach and methodology to complete a TO from initial planning through final data delivery for each service as outlined in Attachment A of the RFP.

FIGURE 1. Simplified workflow for a typical TO issued under this IDIQ.

Topographic Survey – Ground Control

F&T will lead the ground control efforts providing GPS base station establishment, GNSS survey, and leveling across all awarded TO area of interest (AOIs). F&T is locally-based in Baton Rouge, Louisiana and has worked extensively with Dewberry on projects in Louisiana, including the Amite Watershed Topographic Lidar Acquisition & Processing project with DOTD (this project is included in Section 17). Their extensive knowledge of Louisiana's terrain and infrastructure adds efficiency and reliability to the Dewberry team.

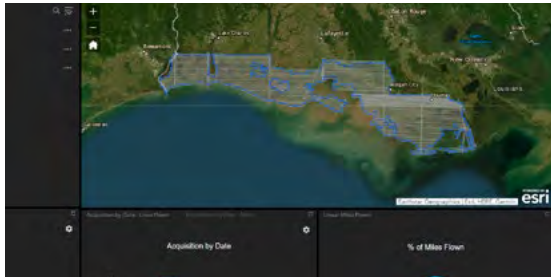
During initial project planning, Dewberry and F&T will coordinate with DOTD to determine the acquisition plan and control layout, timing of field work, and the type of survey technique based on the project specifications, location, and size. The survey plan will be provided to DOTD for approval prior to the start of fieldwork. Depending on the TO AOI, a combination of Real-Time Kinematics (RTK), Rapid-Static (GPS), and/or VRS networks will be used so that all survey points are collected, observed, and calculated to meet ASPRS Position Accuracy Standards for Digital Geospatial Data, Edition 2, Version 2 (2024) guidelines. This includes ground control points (GCPs), Non-Vegetated Vertical Accuracy (NVA), Vegetated Vertical Accuracy (VVA), and Bathy checkpoints. All ground control will be completed under the guidance of Bradley Holleman, PE, PLS (LA PLS #5082) of F&T. After fieldwork is complete, the F&T team will compile the survey data and prepare a survey report that will be delivered to Dewberry and DOTD upon project completion.

Topographic Mapping – Imagery

Keystone will be supporting the Dewberry team with imagery collection for all TOs where this service is requested. Keystone owns multiple large-format frame-based digital mapping cameras, including the Vexcel UltraCam Falcon M2, and two Vexcel UltraCam Eagles M3/M1, which can collect 4-band (RGB/NIR) imagery at 3" GSD, meeting minimum contract requirements. Each camera system is maintained and operated to manufacturer recommendations with regular calibration of the system for optimal data quality. These camera systems are mounted in gyro-stabilized mounts (GSMs) with internal IMU/GNSSs to compensate for role, pitch, and crab during flight. For camera systems, this helps to reduce image misalignments and distortions.

Depending on the specifications of a TO, aerial imagery collection will be performed in conjunction with Lidar acquisition for temporal alignment across the data and cost efficiency to DOTD. Flight plans will be submitted to DOTD for approval prior to flight crew mobilization. Imagery will be collected utilizing an UltraCam or similar wide-format frame-based digital mapping camera at optimal sun angle conditions (30-degree minimum), when ground conditions are ideal to meet TO specifications. Dewberry will perform the aerotriangulation, orthorectification, and finalization of the imagery to meet or exceed the meet ASPRS Position Accuracy Standards for Digital Geospatial Data, Edition 2, Version 2 (2024) for the specified GSD as outlined in the awarded TO.

Topographic Mapping – Lidar (Topographic and Topobathymetric)



The Dewberry team owns and operates the RIEGL VQ-1560 II-S for high resolution topographic Lidar mapping, capable of dual-channel operation and multiple pulse returns, and a pulse repetition rate up to 4 MHz. This system has been deployed on over 550,000 mi^2 across multiple states, including Louisiana for the USGS Coastal Parishes 3DEP Lidar task order (refer to Section 17 to read more about this project). For coastal and inland water environments, Dewberry will deploy either the Teledyne CZMIL SuperNova or RIEGL VQ-880-G II. Dewberry was the first private U.S. firm to operate the CZMIL SuperNova. This sensor was successfully used on the Louisiana Breton Island Topobathymetric task order with the USGS. You can read more about this project in Section 17. Additional Lidar sensors can be deployed depending on DOTD needs to support contract requirements.

Together, these complementary Lidar sensors allow Dewberry to adapt depending on the TO AOI, and DOTD needs. The RIEGL VQ-1560-II S will be flown in accordance with USGS Lidar Base Specification (LBS) 2025, Revision A, Quality Level 1 (QL1), while bathymetric missions will use either the CZMIL SuperNova or RIEGL VQ-880-G meeting LBS QL1b specifications. Careful consideration will be given to water clarity, tidal cycles, and seasonal windows to optimize data outputs for Lidar TOs. This flexible acquisition strategy provides Dewberry with the ability to capture accurate elevation data across Louisiana's diverse terrain.

Regardless of whether topographic or bathymetric Lidar is acquired, Dewberry will perform routine reviews of the data via quick look rasters throughout acquisition to confirm that data collected achieves project requirements. Dewberry's DimensionalView portal will be utilized throughout data acquisition to show real-time collection statistics, plane locations, and progress throughout TO duration. Raw Lidar data will be processed by Dewberry which begins with data calibration. After data is calibrated, Dewberry's proprietary Automated Tool Suite (ATS), will be used to support processing routines to streamline Lidar editing and point classification. ATS was developed and finetuned for Lidar processing efficiency over the last 15+ years. Depending on TO specifications, Dewberry's deep learning model (DLM) will be used to generate breaklines. The model was used successfully on the USGS Louisiana Coastal Parishes project. For bathymetric data, after data calibration additional QA steps will be taken to address turbidity, refraction, and water column efforts. All final Lidar data (topographic and topobathymetric) will be reviewed by an independent team within Dewberry to confirm compliance with TO specifications.

Final Deliverables

All deliverables will meet TO guidelines and specifications. For a QL1/QL1b topographic and Bathymetric Lidar and 3" orthoimagery TO, deliverables may include the following.

- Raw Point Cloud
- Classified Point Cloud (LAS or LAZ) in both ellipsoid and orthometric heights
- Bare Earth Surface (Raster DEM)
- Bathymetric DEM
- Hydrographic Breaklines
- Bridge and Saddle Breaklines
- Intensity Imagery (GeoTIFF
- Tile Index
- Low Confidence 2D Polygons
- Ground Control Points
- Checkpoints
- Metadata
- Project Report
- Acquisition Reports
- Digital Orthoimagery (GeoTIFF)
- Pilot Area

Quality Control

Dewberry's Quality Management System is certified by National Quality Assurance (an ANAB accredited organization) and in full compliance with the ISO 9001:2015 standard. Our quality assurance/quality control (QA/QC) system has proven protocols, automated checks, and independent audits across every project. For DOTD TOs, final data will go through a thorough review to confirm compliance with project specifications and USGS/ASPRS standards.

Risk Mitigation

To reduce the likelihood and impact of risks, Dewberry will apply proactive monitoring, contingency planning, and adaptive workflows across all phases of a TO. During acquisition planning, Dewberry accounts for vegetation, water/turbidity, flooding, and major storm events (e.g., Hurricanes), to minimize disruption to schedules and the impacts to data quality. Additionally, for TOs with restricted access locations, engagement with local stakeholders, military contacts, and/or tribal authorities begins early and alternative flight lines and ground survey plans can be prepared quickly to avoid mobilization delays. During initial data processing, automated QA scripts are run to detect density gaps and data voids to verify that collected data met TO requirements and reduce downstream rework.

Additionally, embedded within our production workflow processes are risk mitigation measures to reduce, identify, and address risks before they cascade into significant issues on a TO. These include incremental, independent data reviews, risk registrars, and requirements checklists.

TO Management/Communication Plan

Dewberry's management team will maintain open and consistent communication with DOTD throughout each TO, providing timely updates on progress and quickly addressing any technical issues. This includes developing detailed work plans, monitoring TO milestones, and managing resources to maintain schedule and budget expectations. Internal coordination of a TO includes regular production meetings and stand-ups across line leads to keep downstream workflows on track. Ongoing coordination will include regular check-ins with our DOTD Client Manager, **Ryan Ligon**, Project Manager, **Bryan Deslauriers, CP, PMP, GISP** and Principal-in-Charge, **Jason Dolf, CP, CMS** as necessary, to support smooth execution from mobilization through final delivery. Dewberry places emphasis on collaboration and responsiveness to client needs. Questions, concerns, or technical issues raised by DOTD will be addressed promptly by Ryan and Bryan with input from our technical experts and escalated to senior leadership as needed for prompt resolution.

Sample TO Schedule

To illustrate a typical TO execution for DOTD, Dewberry has developed a project schedule (Table below) outlining tasks, major milestones, and deliverables assuming a ~2,500 mi2 Lidar and imagery project. For emergency response TOs, Dewberry will leverage both our in-house and subcontractor pool of resources for rapid-deployment and TO execution to reduce project duration while still meeting DOTD specifications.

TASK	MILESTONE	DELIVERABLES	ESTIMATED DURATION (MONTHS)
TASK 1	Project Kickoff including Survey Plan and Flight Plan Approval	Meeting minutes, Flight Line Layout, Ground Survey Layout, Monthly TO Progress Reports	**10 days** from NTP
TASK 2	Ground Control Survey and Check Points	Ground Control Status Reports, Monthly TO Progress Reports	**60 days**
TASK 3	Data Acquisition (Imagery & Lidar)	Acquisition Status Reports, Monthly TO Progress Reports	**60 days**
TASK 4	Project Pilot	Pilot Dataset, Monthly TO Progress Reports	**30 days** after acquisition
TASK 5	Initial Data Submission to DOTD	Preliminary TO Data, Monthly TO Progress Reports	**6 MONTHS** after NTP
TASK 6	Receipt of Data Feedback (Calls) or Data Approval	Corrections to Data as requested by DOTD	**30 DAYS** after receipt of Task 5
TASK 7	Final Deliverables	Finalized Data, Final Acquisition Report, Final Survey Report, Final Project Report	**60 DAYS** after receipt of Task 6

19. Workload: For all contracts where a firm on the team is a prime consultant or sub-consultant and where a) the consultant selection was made by DOTD, and b) a contract was executed by the consultant and the contracting entity by the date the advertisement for this proposal was posted, list all work meeting the following criteria:

1. one of the team's firms is responsible for the performance of the work;
2. authorization to perform the work has been provided, as provided in the contract between the consultant and the contracting entity;
3. the work has not yet been performed and invoiced; and
4. the work is not currently suspended for an indefinite period of time.

For indefinite delivery/indefinite quantity (IDIQ) contracts, list open Task Orders individually. List only the portion of the fees attributable to firms on the team.

FIRM(S) **ALL FIRMS** MUST BE REPRESENTED IN THIS TABLE	DISCIPLINE(S)*	CONTRACT NUMBER AND STATE PROJECT NUMBER	PROJECT NAME	REMAINING UNPAID BALANCE**
Dewberry Engineers Inc. (sub to Atkins)	Other (H&H)	440001067 (Unknown to Dewberry)	LWI Region 1, Task Order 4	$70,131
Dewberry Engineers Inc. (sub to Michael Baker)	Other (H&H)	4400017092 (Unknown to Dewberry)	LWI Region 6, Task Order 4	$19,364
Dewberry Engineers Inc. (sub to Freese and Nichols)	Planning	4400027092 H.016254.1	LA DOTD Transportation Resilience Improvement Plan (January 2025)	$ 546,516
Forte and Tablada, Inc.	Bridge, Survey	4400021594 H.011965.6	Task Order No. 2 - IWGO Bridge Rehabilitation (Drone Flyover)	$51,603
Forte and Tablada, Inc.	Bridge, Survey	4400021594 H.000303.6	Task Order No. 3 - Danziger Bridge Rehabilitation	$4,017
Forte and Tablada, Inc.	Bridge	4400021594 H.009730.5	Task Order No. 4 - In Depth Bridge Inspection T-1 Steel Weld Assessment	$562
Forte and Tablada, Inc.	Bridge	4400021594 H.015228.5	Task Order No. 5 - LA 70: Sunshine Bridge Emer Truss Repair	$123
Forte and Tablada, Inc.	Bridge	4400021594 H.009859.5	Task Order No. 6 - Load Rate Selected Statewide Bridges	$1,408,396
Forte and Tablada, Inc.	Bridge	4400021594 H.009730.5	Task Order No. 7 - In-Depth Bridge Inspections	$68,942
Forte and Tablada, Inc.	Bridge	4400021594 H.009730.5	Task Order No. 8 - In-Depth Bridge Inspections	$158,517
Forte and Tablada, Inc.	Bridge	4400021594 H.015546.6	Task Order No. 9 - Caplis Sligo Road Over Red Chute Bayou	$5,244

19. Workload:

FIRM(S) ALL FIRMS MUST BE REPRESENTED IN THIS TABLE	DISCIPLINE(S)*	CONTRACT NUMBER AND STATE PROJECT NUMBER	PROJECT NAME	REMAINING UNPAID BALANCE**
Forte and Tablada, Inc.	Bridge	4400024589 H.014990.5	OSBR S. Tiger Bend Rd & East Achord Rd Bridges	$7,428
Forte and Tablada, Inc.	Bridge/Survey	4400013387 H.013137.5	OSBR Ouachita	$23,249
Forte and Tablada, Inc.	Bridge/Survey	4400019864 H.014318.5	OSBR Gurney Road Bridges	$4,708
Forte and Tablada, Inc.	Bridge	4400025037 H.014994.5	OSBR Bonne Idee Rd over Bonne Bayou	$3,487
Forte and Tablada, Inc.	CE&I/OV	4400023837 H.013090.6	Gretna Downtown Pedestrian Improvements	$10,577
Forte and Tablada, Inc.	CE&I/OV	4400023837 H.009290.6	LSU Laboratory School SRTS Project	$7,263
Forte and Tablada, Inc.	Survey	4400021532 H.012068.5	LA 1026: Creek Bridge	$10,719
Forte and Tablada, Inc.	Survey	4400021532 H.010116.5	LA 1088: Soult & Trinity Roundabouts	$23,987
Forte and Tablada, Inc.	Survey	4400021532 H.005734.5	LA 447 Corridor Study	$119,475
Forte and Tablada, Inc.	Survey	4400021532 H.012563.5	LA 73: Bayou Manchac Bridge (HBI)	$461
Forte and Tablada, Inc.	Survey	4400021974 H.002186.5	UP (Plaquemine)	$73,559
Forte and Tablada, Inc.	Survey	4400021974 H.012449.5	H.012449.5 KCS Xings Gayosa St. & Louise	$17,107
Forte and Tablada, Inc.	Survey	4400021974 H.016748.5	US 167: Median Improvements	$134,057
Forte and Tablada, Inc.	Survey	4400021974 H.012449.5	KCS X'ings Between Gayosa St. & Louise (BTR)	$15,829

19. Workload:

FIRM(S) **ALL FIRMS** MUST BE REPRESENTED IN THIS TABLE	DISCIPLINE(S)*	CONTRACT NUMBER AND STATE PROJECT NUMBER	PROJECT NAME	REMAINING UNPAID BALANCE**
Forte and Tablada, Inc.	Survey	4400025029 H.015341	D61(EBR) IIJA Off-System Bridge	$69,054
Forte and Tablada, Inc.	Survey	4400025029 H.015341	D61(EBR) IIJA Off-System Bridge - SA 3	$41,123
Forte and Tablada, Inc.	Survey	4400004128 H.004273.5	I-49 Connector Additional ROW	$55,766
Forte and Tablada, Inc.	Survey	4400027919 H.012072	LA 60: Drain Bridge (Map Rev)	$337
Keystone	N/A	N/A	N/A	N/A

20. Certifications/Licenses: If the advertisement requires submission of licenses and/or certificates, include them here. **Otherwise, leave this section blank.**

Dewberry Engineers Inc. SOS

State of Louisiana Secretary of State

COMMERCIAL DIVISION
225.925.4704

Fax Numbers
225.932.5317 (Admin. Services)
225.932.5314 (Corporations)
225.932.5318 (UCC)

Name	Type	City	Status
DEWBERRY ENGINEERS INC.	Business Corporation (Non-Louisiana)	ALBANY	Active

Previous Names

DEWBERRY-GOODKIND, INC. (Changed: 3/5/2012)

Business: DEWBERRY ENGINEERS INC.
Charter Number: 40662916F
Registration Date: 11/10/2011
Domicile Address
80 STATE STREET
ALBANY, NY 122072543
Mailing Address
8401 ARLINGTON BOULEVARD, SUITE 1
FAIRFAX, VA 22031
Principal Business Office
8401 ARLINGTON BOULEVARD, SUITE 1
FAIRFAX, VA 22031
Registered Office in Louisiana
450 LAUREL STREET, 8TH FLOOR
BATON ROUGE, LA 70801
Principal Business Establishment in Louisiana
9026 JEFFERSON HIGHWAY, SUITE 302
BATON ROUGE, LA 70809

Status

Status: Active
Annual Report Status: In Good Standing
Qualified: 11/10/2011
Last Report Filed: 10/16/2024
Type: Business Corporation (Non-Louisiana)

Registered Agent(s)

Agent:	CORPORATION SERVICE COMPANY
Address 1:	450 LAUREL STREET, 8TH FLOOR
City, State, Zip:	BATON ROUGE, LA 70801
Appointment Date:	11/10/2011

Dewberry Engineers Inc. MSA for Lease Agreement

MASTER SERVICES AGREEMENT

This Master Services Agreement ("Agreement") is made and entered into as of the 1st day of November 2024 and ending the 31st day of October 2026, by and between Dewberry Engineers Inc., a New York corporation having its principal place of business in Fairfax, VA ("Dewberry"), and Revolution Flight, LLC, an Alabama limited liability company, having its principal place of business in Huntsville, AL ("Revolution"). Dewberry and Revolution are hereinafter sometimes referred to individually as a "Party" or collectively as the "Parties".

WITNESSETH:

WHEREAS, Dewberry has entered into various services agreements (each, a **"**Prime Agreement**"**) with clients for geospatial mapping projects (singularly or collectively, the "Client"); and

WHEREAS, Dewberry desires to engage Revolution to provide certain services as described herein in order to facilitate Dewberry's performance under each Prime Agreement; and

WHEREAS, Revolution has agreed to furnish the Services (as hereafter defined) in accordance with the terms and conditions set forth in this Agreement and all project specific authorizations (each, a "Purchase Order").

NOW, THEREFORE, for and in consideration of the premises and the mutual covenants contained herein, the Parties hereto agree as follows:

ARTICLE 1 - OBLIGATIONS OF REVOLUTION

1.1 **General Scope of Services**. Dewberry hereby engages Revolution, and Revolution hereby agrees to perform, the services in accordance with this Agreement and each Purchase Order (the "Services"). Revolution shall perform such other services as may be requested by Dewberry from time to time, all as an independent contractor and otherwise in accordance with the provisions of this Agreement. The term of this Agreement shall be two (2) years, with the potential for extending the Agreement upon Dewberry's prior, written notice.

1.2 **Dewberry Owned Sensors**. Dewberry shall furnish the required sensor(s) ("Sensor") to perform the Services and to be installed in Revolution's aircraft. Revolution shall provide a licensed aircraft mechanic at Dewberry's cost to ensure the Sensor is mounted on or dismounted from the aircraft in accordance with Federal Aviation Administration ("FAA") regulations. Dewberry will be responsible for insurance coverage on the Sensor(s), storage within the Revolution hangar, security, maintenance, repair, and calibration of the Sensors.

1.3 **Standard of Performance**. Revolution assumes, as applicable to Revolution's Services, all obligations to Dewberry as Dewberry assumes to its Client under the Prime Agreement. Revolution shall perform the Services in a good and workmanlike manner using reasonable care, due diligence and good faith commensurate with the care ordinarily exercised by practicing professionals performing similar services in the general locality and under similar circumstances and conditions as where the Project is located. Revolution shall cause each of its employees, agents and representatives, at all times during the term of this Agreement, to obey all applicable rules and directives of Dewberry and the Client, including all rules and laws promulgated by the FAA.

1.4 **Commencement and Completion of the Services**. Revolution shall commence the Services upon receipt of a fully executed Purchase Order. Revolution shall complete performance of the Services on a project by project basis in accordance with the Purchase Order, including the agreed upon

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. MSA for Lease (continue)

Services, the schedule, the specifications and the special requirements, if any.

1.5 **Purchase Order Responsibilities**. Performance of the Services by Revolution shall include all of the following:

A. The following aircraft(s) will be used with the following Sensors during the terms of this Agreement unless otherwise agreed upon by both Parties: Cessna 208/208B Caravan. Multiple aircraft may be made available to Dewberry for operation by Revolution."
B. Aircraft will be modified to accommodate the use of the Sensor assigned to it without additional cost to Dewberry, including the mounting plate.
C. Aircraft to be based at Peter O'Knight airport (KTPF) in Tampa, Florida unless otherwise agreed upon in the Purchase Order.
D. Revolution shall provide a skilled survey pilot with adequate hours in aircraft type (1500 hours TT 200 turbine, 100 type), or other pilot that both Dewberry and Revolution mutually agree upon by prior, written approval, unless higher flight times are dictated by the Prime Agreement. In such a case, Revolution will be required to supply a pilot that meets the hour requirements set forth in the Purchase Order or the Prime Agreement.
E. Revolution shall provide to Dewberry upon request or execution of this Agreement, resumes of the available pilots, including periodic updates to the list of pilots and resumes, for review and approval, which shall not be unreasonably withheld. No less than five (5) days prior to a flight under a Purchase Order, Revolution shall present to Dewberry the proposed pilot's resumes for final review and approval, not to be unreasonably withheld.
F. Dewberry reserves the right to request a different pilot if current pilot performance is judged unsatisfactory.
G. Any reflights that result from pilot error or aircraft malfunction (i.e. not intercepting a line, being too far off the line, etc.) will be recollected at the expense of Revolution.

1.6 **Maintenance.** Revolution shall schedule routine aircraft maintenance, when possible, to fall on inclement weather days or after flight windows have closed to minimize impact on the schedules contained in the Purchase Orders. Revolution shall provide a quarterly report on necessary routine maintenance to the aircraft for each quarter upon request. Unscheduled maintenance is to be completed in the most time effective manner as possible to minimize impact on the schedule in the Purchase Order.

1.7 **Storage of Dewberry's Sensors**. Revolution shall provide for the storage of Dewberry Sensors while mounted on the aircraft, dismounted from the aircraft or not being used. Revolution and Dewberry shall locate an appropriate area within Revolution's hanger for storage purposes and Dewberry shall provide the necessary equipment with which to store the Sensors. Revolution shall be responsible for providing a lockable storage location for the Sensors. Any security pertaining to the storage of the Sensors shall belong to Dewberry unless the Sensors are mounted on the aircraft.

1.8 **Licenses and Compliance with Laws.** Revolution shall keep all pilot's licenses in good standing and as required by all FAA regulations. Revolution shall keep all aircraft properly licensed and in good standing as required by all FAA regulations. Revolution shall keep all flight logs in proper order and shall certify its flight times as necessary to comply with FAA regulations, this Agreement and any Prime Agreement. Pilots will maintain necessary FAA currency requirements, if currency flight(s) are required the flight time to perform required activities will be the responsibility of Revolution. During flight operations the aircraft shall at all times be under the exclusive possession, direction and operational control of Revolution and that legal title as well as operational control of the aircraft shall be and remain vested in Revolution.

1.9 **Compliance**. Revolution agrees to perform all of the Services in strict compliance with this Agreement and all plans, specifications and instructions provided by Dewberry and the Client through the Prime Agreement. Revolution, its officers, directors, shareholders, partners, managers, members,

Dewberry Engineers Inc. MSA for Lease (continue)

employees, agents and representatives shall at all times comply with all applicable federal, state and local laws, ordinances, statutes, rules and regulations (including professional licensing requirements) in effect at the time the Services are performed and acquire all permits required to perform its Services.

1.10 **Health and Safety**. Revolution agrees that the prevention of accidents to workers engaged by Revolution is the responsibility of Revolution. Revolution agrees to be bound by, and, at its own cost comply with, all federal, state and local laws, codes, ordinances and regulations applicable to this Agreement and provisions of the Prime Agreement, and the performance of the Services hereunder, including, but not limited to, the Occupational Safety and Health Act of 1970. Revolution warrants that none of its pilots shall be under the influence of drugs, alcohol, or any illegal substances that could affect or impair the pilot's ability to fly while performing the Services.

ARTICLE II - COMMERCIAL TERMS

2.1 **Compensation for the Services**. Compensation to Revolution for the proper performance of the Services shall be according to Exhibit A – Negotiated Rates and Fees Schedule, and as set forth in the Purchase Orders. Amounts paid to Revolution hereunder shall constitute the sole and complete compensation to Revolution for the performance of the Services. Except as provided in Section 2.2, the payment of all applicable taxes and assessments based on the amounts received hereunder shall be the sole responsibility of Revolution.

2.2 **Invoicing and Payment**. Revolution shall submit to Dewberry biweekly invoices, along with supporting documentation (documentation to include reimbursable expenses, flight logs, a cumulative summary of month to date and year to date flight hours for each aircraft) if requested. All invoices should be submitted electronically to Jason Dolf (jdolf@dewberry.com) with a cc: to Andrew Ericson (aericson@dewberry.com). Payments shall be due to Revolution within thirty(30) days after receipt of invoice and documentation if requested from Revolution, but no later than forty-five (45) days. A late fee equal to five percent (5%) of the overdue amount will be applied if not paid within forty-five (45) days of invoice.

2.3 **Books, Records and Invoices**. Revolution shall keep and maintain books, records and invoices relating to the performance of the Services in such form, substance and detail as Dewberry may prescribe from time to time. Revolution shall make such books, records and invoices available for inspection, examination, and auditing by Dewberry at any reasonable time during regular business hours during the term of this Agreement, or within three (3) years after the termination or expiration hereof.

2.4 **Indemnity**. Revolution and Dewberry both agree to release, defend, protect, indemnify and hold harmless the other party and their respective affiliates, directors, officers, shareholders, members, managers, agents and employees from and against any and all claims, liabilities, losses or expenses including, without limitation, attorneys' fees and costs, arising out of the negligent performance of either party, or any negligent act, omission or willful misconduct, or the employees, agents, or representatives of either party.

2.5 **Insurance**. Revolution shall carry and maintain during the performance of Services the following insurance coverages: General Liability - $5,000,000/$5,000,000; Workman's Comp - $500,000; Professional Liability - $1,000,000/$1,000,000; Airplane Liability - $5,000,000. Dewberry shall be responsible for insurance coverage for the Sensors that will be mounted to the aircraft and stored on Revolution's premises under this Agreement and General Liability - $1,000,000/$2,000,000. Revolution shall name Dewberry and the Client as additional insureds. Dewberry shall carry insurance for each Sensor at the replacement value or as other value determined by Dewberry at its sole discretion. Dewberry shall name Revolution as an additional insured on the general liability policy with minimum coverage of $5,000,000 per occurrence and $5,000,000 aggregate.

2.6 **Preferred Business Arrangement**. (a) Under this Agreement, the Parties are committing

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. MSA for Lease (continue)

to a preferred business arrangement to better ensure the availability of Revolution's services and to meet Dewberry's contract obligations to its Clients, including preferred scheduling, aircraft availability, redundancy for reliability, quality, and competitive pricing. Dewberry is committing to Revolution the minimum flight hours and rates as provided in Exhibit B and/or each Purchase Order issued hereunder in aggregate for each aircraft (partial years will be prorated). This is not an exclusive relationship, but a preferred business arrangement.

(b) Flight hours shall be cumulative for each aircraft over a one-year period ("Annual Flight Hours") and reported on a quarterly basis. If Dewberry does not meet the Annual Flight Hours at the end of a one-year term under this Agreement, Dewberry shall pay to Revolution the cost difference between the Annual Flight Hours and the actual flight hours as addressed in Exhibit A and at the rates in Exhibit A, and/or each Purchase Order for the year.

(c) Dewberry shall also comply with a quarterly minimum number of flight hours in the aggregate for each aircraft ("Minimum Flight Hours"). Any failure to meet the Minimum Flight Hours shall cause Dewberry to pay to Revolution the difference between the actual flight hours for that quarter and the Minimum Flight Hours required.

(d) Dewberry shall have access to a licensed aircraft mechanic by Revolution upon notice throughout the term of this Agreement at standard rates charged by Revolution Flight.

ARTICLE III - SUSPENSION, TERMINATION AND DEFAULT

3.1 **Suspension.** Dewberry may, in its sole discretion, suspend the Services in whole or in part upon thirty (30) days prior written notice to Revolution. Upon the receipt of such notice, each Party shall strictly comply with the instructions set forth therein and shall exert due diligence and best efforts to mitigate any suspension costs.

3.2 **Termination for Material Breach**. Either Party shall have the right to terminate this Agreement upon seven (7) days prior written notice and another seven (7) days opportunity to cure in the event of a material breach of the Agreement by the other Party.

3.3 **Force Majeure**. Should either Party be unable, in whole or in part, to perform its obligations under this Agreement by reason of force majeure, such Party shall be excused from performance to the extent they are affected by such force majeure. The Party affected by force majeure shall endeavor to remedy the impediment to its performance with all reasonable dispatch. The term "force majeure" shall mean any cause which is not within the control of the Party claiming force majeure and which is recognized as such under the Prime Agreement.

ARTICLE IV – NON-SOLICITATION AND NON-CIRCUMVENTION

4.1 The Parties covenant not to directly or indirectly circumvent the other party or its affiliates with respect to any relationships introduced or made known to each party as a direct or indirect result of this Agreement, including but not limited to the Clients, contractors, suppliers, and professionals, without the prior consent of the other party. In the event of a breach of this section by either party, each party will have all injunctive and equitable relief available, as well as all other remedies at law or in equity.

ARTICLE V - GOVERNING LAW AND DISPUTES

5.1 **Governing Law**. This Agreement shall be governed by and construed in accordance with the laws of the State of Florida excluding any conflict of laws provision which would refer to the law of another jurisdiction.

Dewberry Engineers Inc. MSA for Lease (continue)

5.2 **Disputes**. Any and all disputes, claims or controversies arising out of or relating to this Agreement, or the breach thereof, and not resolved amicably shall be finally settled in either the state or federal courts of the State of Florida located in Tampa, Hillsborough County, Florida.

ARTICLE VI - GENERAL PROVISIONS

6.1 **Assignments and Transfers**. Revolution shall not in any way assign, subcontract or otherwise transfer, in whole or in part, any of its rights, interests or obligations under this Agreement without the prior written consent of Client, which may be withheld in its sole discretion.

6.2 **Amendments and Integration**. This Agreement and the Exhibits attached hereto shall constitute the complete and entire agreement between the Parties with respect to the subject matter hereof. No prior or contemporaneous statement or agreement, oral or written, with respect to the subject matter hereof, shall vary or modify the written terms hereof. This Agreement may be amended only by a written document signed by both Parties.

6.3 **Notices**. All notices, requests, demands and other communications required or permitted to be given by either Dewberry or Revolution hereunder shall be in writing and shall be deemed to have been given if delivered in person or by telex or facsimile or by first class certified mail, postage and fees prepaid, to the address of the intended recipient as set forth below. All such notices, requests, demands and other communications shall be deemed to have been received by the addressee, if by mail, three (3) days following mailing; if by facsimile, twenty-four (24) hours following transmission; or if by personal delivery, upon such delivery. All such notices, requests, demands and other communications shall be sent to the following addresses:

Revolution Flight LLC.	Dewberry Engineers Inc.
2002 Houston Goodson Way	1000 N Ashley Dr., Ste 801
Hunstville, AL 35824	Tampa FL 33602
Telephone: 256.476.8822	Telephone: 813.327.5069
Attention: Paul Rossouw	Attention: Jason Dolf
Title: President	Title: Associate Vice President

The foregoing addresses may be changed by either Party by giving notice to the other as provided above.

6.4 **Exercise of Rights and Waiver**. The failure of either Party to exercise any right under this Agreement shall not, unless otherwise provided or agreed to in writing, be deemed a waiver thereof. No waiver by either Party of any provisions hereof shall be deemed a waiver of any future compliance therewith, and such provisions shall remain in full force and effect.

6.5 **Severability**. In the event that any clause or provision in this Agreement shall for any reason be deemed invalid or unenforceable, the remaining provisions and clauses shall not be affected, impaired or invalidated and shall remain in full force and effect.

6.6 **Headings; Exhibits**. The headings contained in this Agreement are for ease of reference only and shall not limit or otherwise affect the meaning hereof. The Exhibits referred to herein are attached hereto and by this reference made a part hereof.

6.7 **Digital Copy**. This Agreement may be digitally copied and stored (the "Imaged

Dewberry Engineers Inc. MSA for Lease (continue)

Agreement"). The Imaged Agreement (once digitally regenerated to paper form), and any facsimile, and all computer records of the foregoing, if introduced as evidence in any judicial, arbitration, mediation or administrative proceedings, will be admissible as between the Parties to the Client extent and under the Client conditions as other business records originated and maintained in documentary form and neither Party shall object on the basis that such business records were not originated or maintained in documentary form under any rule of evidence.

6.8 **Confidential Information.** For purposes of this Agreement, "Confidential Information" shall mean all ideas, concepts, data and other information of a confidential, proprietary, technical, financial, pricing, strategic, marketing, operational or business-related nature, including, without limitation, all proposals, reports, correspondence, processes, themes, concepts, and approaches, disclosed to Revolution by Dewberry or the Client, or developed or acquired by or others in connection with the Services. All Confidential Information is and shall remain the property of Dewberry or the Client, and may not be copied or otherwise reproduced or used in any way except in connection with the Services, or disclosed to third parties, or used in any manner detrimental to the interests of Dewberry or the Client. This article shall remain in effect for a period of five (5) years from the date of termination or expiration of this Agreement, whichever is later.

This provision does not apply to information that:

.1 Was in the public domain at the time it was disclosed, or known to the receiving Party at the time of disclosure, or which becomes known to the receiving Party independent of disclosures hereunder, or which is independently developed by the receiving Party;

.2 Was published by others after receipt thereof by the receiving Party or otherwise becomes part of the public domain through no fault of the receiving Party;

.3 The receiving Party can demonstrate was already in its possession at the time of receipt thereof and was not acquired directly or indirectly from Dewberry or other team members; or

.4 The receiving Party can demonstrate was received by it from a third party that did not require the receiving Party to hold it in confidence.

Neither Party shall be liable for the disclosure of Confidential Information pursuant to judicial or governmental compulsion. Under such circumstances, however, the compelled Party shall promptly advise the disclosing Party of the compulsion so that the disclosing Party may take steps to protect its interests. Dewberry may in its discretion disclose the terms and conditions of this Agreement to the Client.

6.9 **Ownership of Materials, Equipment and Other Items**. Revolution shall purchase and utilize its own materials, equipment and other items necessary to perform the Services hereunder. Materials, equipment and other items, if any, furnished to Revolution by Dewberry or purchased by Revolution with funds supplied or reimbursed by Dewberry shall be and remain the property of Dewberry and shall be marked and regarded as such by Revolution. Upon the completion or termination of the Services, Revolution shall furnish to Dewberry a complete inventory of any remaining materials, equipment and other items of Dewberry property.

6.10 **Transfer and Ownership Of Documents.** Unless otherwise agreed to by Dewberry in writing, all materials resulting from Revolution's efforts in connection with this Agreement, including drawings, specifications, calculations, maps, reports, photographs, samples and other documents shall be deemed the property of Dewberry and shall be furnished to Dewberry upon its request (all part of "Deliverables"). Dewberry and Revolution will develop a process and procedure for protection and transfer of Deliverables in a secure environment, with considerations for data integrity and security. Revolution may be permitted to retain reproducible copies of such materials for its files, if agreed to in the Purchase

Dewberry Engineers Inc. MSA for Lease (continue)

Order by Dewberry.

6.11 **Lease of Dewberry's Sensors**. From time to time, Dewberry may deem it necessary or desirable to lease the Sensor. Upon prior written notice, the lessee of the Sensor may pick up the Sensor from Revolution's premises or request the Sensor to be used in one of the aircraft identified in Exhibit A. In those instances, Revolution shall work with the lessee for a smooth transition of the Sensor or for flights with Revolution's aircraft. Aircraft and pilot service feed provided to the lessee of the Sensor are the responsibility of the lessee and not be billed to Dewberry.

6.12 **Order of Precedence.** If there is any conflict between the terms of this Agreement, its Exhibits, or a Purchase Order, the order of precedence shall be as follows:

1. Purchase Order;
2. Each Exhibit; then
3. This Agreement.

In Witness Whereof, the Parties hereto have caused this Agreement to be executed by their duly authorized representatives as of the date first written above.

REVOLUTION FLIGHT, LLC

By:_____
Printed Name: Paul Rossouw
Title: CEO

DEWBERRY ENGINEERS INC.

By:_____
Printed Name: Jason Dolf
Title: Associate Vice President

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. MSA for Lease (continue)

EXHIBIT A

General

The rates and fees in this Exhibit A are effective upon execution of the Master Service Agreement. Additional rates and fees may be required, negotiated, and added to this Exhibit for services or items not covered.

A. Purchase Orders

A Purchase Order will be issued with a not to exceed amount, as well as the specific scope of work for each project.

B. Preferred Business Arrangement

1. For a one-year period starting with the execution of the first Purchase Order after the Effective Date of this Agreement, Dewberry is committing to Revolution the following minimum flight hours for all aircraft provided under this agreement:

AIRCRAFT	QUARTERLY MINIMUM (FLIGHT HOURS)	ANNUAL MINIMUM (FLIGHT HOURS)
Cessna 208/208B Caravan	75	2600

   a. If Dewberry fails to meet the minimum flight hours, Dewberry shall pay 100% of the hourly rate for the aircraft for the difference between the actual flight hours and the minimum flight hours commitment.
   b. The minimum flight hours commitment is based on having adequate weather for transit and data acquisition. If weather conditions do not allow for completion of the minimum flight hour requirement, an extension of time will be negotiated at no added cost to Dewberry.
   c. Once the annual minimum flight hours are achieved additional quarterly minimum fees will no longer be assessed to Dewberry for the contract period.
   d. Quarterly minimum flight hour payments will be credited towards future Dewberry flight hours once annual minimum flight hours are met.

C. Pilot and Flight Rates

The following unit rates will be applied for the work performed under the Agreement, and as

[redacted]

Dewberry

MASTER SERVICE AGREEMENT: EXHIBIT A 8

Dewberry Engineers Inc. MSA for Lease (continue)

[redacted]

Dewberry [redacted]

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment

Title: **System Calibration *RIEGL* VQ-1560II-S S2224894**

Author: Markus Nowotny, DI Peter Rieger

Customer: RIEGL USA, INC.
Doc. No.: Na
Date: 24.10.2022
Pages: 24
Issue: 07
Distribution:

RIEGL LASER MEASUREMENT SYSTEMS

Dewberry Engineers Inc. Equipment (continue)

Contents

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

1 Introduction

The system calibration has been performed using the associated software tools for airborne - laser scanning developed by *RIEGL* LMS GmbH:

RiPROCESS, version V.1.9.2.4

RiUNITE, version V.1.0.3.3

Calibration parameter values are derived from a process called “scan data adjustment”. Chapter 2 describes the essential parameters given in the protocol associated with scan data adjustment.

The process of system calibration is highly automated; the final “RiPROCESS Scan Data Adjustment Protocol” given in chapter 3 “RiPROCESS Scan Data Adjustment Protocol” includes the automatically generated summary of relevant parameters and results provided by the iterative calculation performed by RiPROCESS.

A visual verification of the quality of the system calibration has been performed by plotting the height difference of two overlapping scan stripes.

The results of the calibration and a calibration protocol confirming the systems specified accuracy are included in this document.

Dewberry Engineers Inc. Equipment (continue)

2 Explanations to the protocol

Calculation parameters

Information regarding the configuration and the status of the scan data adjustment algorithm are given in this category.

Calculation mode

In case “least square fitting” is chosen the sum of the squares of the residues is minimized (least squares method).

The “robust fitting”-method minimizes the absolute values of the residues.

Calculation time

States the actual computation time of the algorithm.

Min. change of error [m]

The iterative calculation ends when the minimum changes of the residual error are smaller than the chosen value.

Search radius [m]

Asks for the maximum distance of the centre of gravity of a terrestrially surveyed control surface (a so called “tie object”) to the centre of gravity of a corresponding surface found in the scan data (point cloud).

Angle tolerance [deg]

The terrestrially surveyed tie objects and the surface in the scan data is found to be correspondent if the normal vectors of both surfaces include an angle smaller than *Angle tolerance*.

Max. normal dist. [m]

The terrestrially surveyed tie objects and the surface in the scan data is found to be correspondent if the mean distance of both surfaces is smaller than *Max. normal distance.*

Calculation results

Number of free parameters

States the amount of parameters to be optimized by the scan data adjustment algorithm.

Number of observations

States the amount of actually used observations by the scan data adjustment algorithm.

Error (Std. deviation) [m]

States the resulting standard deviation of the residual errors.

Dewberry Engineers Inc. Equipment (continue)

Laser Data

The table gives the optimized angular differences [deg] and translations [m] with respect to the system calibration.

Laser devices

The exact boresight angles of the laser scanner's coordinate system with respect to the IMU-sensors coordinate system is a result of the scan data adjustment. The boresight calibration and also the optimized angular differences and translations between scan stripes are taken into account with the data processing of all scan stripes separately.

Navigation Devices

The global shifts with respect to the directions east and north as also to the local normal vector to the ellipsoid in meters are given in this category.

Additionally, the parameter "Time" is taken into account when combining the scan data and the trajectory.

Observations

The spreadsheets give the absolute residual errors of single observations. The best and the worst 15 observations are listed separately with their residual error which is the mean normal distance [m]. The coordinates of each single observation enable a fast search.

A statement regarding the quality of the attitude and position of single scan stripes is given in the tables "best 15 Scans" and "worst 15 Scans". The standard deviation of all observations within a single scan stripe with respect to all other overlapping stripes is stated.

Histogram of residues

The histogram shows the distribution of the observations according to their residual error. Generally, it is a nearly Gaussian distribution with a mean value of 0.

Orientation chart

The orientation of the observations has an influence on the results of the scan data adjustment algorithm. If the observations are oriented in various directions the result can be expected to be stable and accurate. In case all the corresponding surfaces are aligned similar, e.g., north-south, or in case that only horizontally oriented surfaces are available the algorithm may diverge and a stable result is unlikely, at the same time the residual errors will be low.

The orientation chart shows the distribution of all surfaces with respect to all directions of the compass.

Dewberry Engineers Inc. Equipment (continue)

3 RiPROCESS Scan Data Adjustment Protocol

Project:	20221019100001 63_VQ-1560II-S_S2224894
Protocol date:	2022-10-24 08:02
Operator:	MN
Comments:	VQ-1560II-S S2224894
Program version:	RiPROCESS v1.9.2.1081 (2022-10-07)
Computer:	RUBBERDUCK
Physical units:	m, deg, s

3.1 Calculation parameters

Calculation mode:	Analyze
Calculation time:	6 mins, 44 secs
Calculation mode:	Least Square Fit
Tolerance:	0.000100
Use Manual Tie Objects:	True
Search corresp. planes:	False
Search radius [m]:	1.000
Angular tolerance [deg]:	5.000
Max. normal dist. [m]:	1.000
Observations active:	True
Observations count:	120000

3.2 Calculation results

Number of free parameters:	0
Number of observations:	120000
Error (Std. deviation) [m]:	0.0201
Median abs. dev. [m]:	0.0150

3.3 Laser data

Name	Roll [deg]	Pitch [deg]	Yaw [deg]	East [m]	North [m]	Height [m]	Time [s]
220005_142609_Channel_1	0.001	0.001	0.003	0.019	0.011	-0.011	0.0000
220005_142609_Channel_2	0.001	0.001	0.003	0.019	0.011	-0.011	0.0000
220005_143232_Channel_1	-0.006	0.002	-0.006	0.000	0.000	0.000	0.0000
220005_143232_Channel_2	-0.006	0.002	-0.006	0.000	0.000	0.000	0.0000
220005_143608_Channel_1	0.002	-0.001	-0.007	0.029	-0.023	-0.007	0.0000
220005_143608_Channel_2	0.002	-0.001	-0.007	0.029	-0.023	-0.007	0.0000
220005_144252_Channel_1	-0.005	-0.010	-0.008	-0.015	-0.019	-0.006	0.0000
220005_144252_Channel_2	-0.005	-0.010	-0.008	-0.015	-0.019	-0.006	0.0000
220005_144700_Channel_1	-0.003	-0.001	-0.005	0.062	0.016	-0.039	0.0000
220005_144700_Channel_2	-0.003	-0.001	-0.005	0.062	0.016	-0.039	0.0000
220005_145050_Channel_1	-0.003	-0.006	-0.003	0.001	-0.012	0.011	0.0000
220005_145050_Channel_2	-0.003	-0.006	-0.003	0.001	-0.012	0.011	0.0000
220005_145507_Channel_1	-0.003	0.002	0.002	0.035	0.019	-0.063	0.0000
220005_145508_Channel_2	-0.003	0.002	0.002	0.035	0.019	-0.063	0.0000
220005_150024_Channel_1	-0.007	-0.002	-0.006	-0.004	0.019	0.001	0.0000
220005_150024_Channel_2	-0.007	-0.002	-0.006	-0.004	0.019	0.001	0.0000
220005_150419_Channel_1	0.001	-0.002	-0.001	0.026	-0.006	-0.020	0.0000
220005_150419_Channel_2	0.001	-0.002	-0.001	0.026	-0.006	-0.020	0.0000
220005_150929_Channel_1	-0.007	0.002	-0.005	0.011	0.002	0.014	0.0000
220005_150929_Channel_2	-0.007	0.002	-0.005	0.011	0.002	0.014	0.0000
220005_152217_Channel_1	0.000	-0.004	-0.002	-0.005	-0.006	0.001	0.0000
220005_152217_Channel_2	0.000	-0.004	-0.002	-0.005	-0.006	0.001	0.0000
220005_152651_Channel_1	0.001	0.002	0.001	0.079	-0.013	0.004	0.0000
220005_152651_Channel_2	0.001	0.002	0.001	0.079	-0.013	0.004	0.0000
220005_153243_Channel_1	0.005	-0.002	-0.003	0.006	-0.067	0.007	0.0000
220005_153243_Channel_2	0.005	-0.002	-0.003	0.006	-0.067	0.007	0.0000
220005_153926_Channel_1	-0.002	-0.002	-0.005	0.022	0.100	0.025	0.0000
220005_153926_Channel_2	-0.002	-0.002	-0.005	0.022	0.100	0.025	0.0000

3.4 Laser devices

Name	Roll [deg]	Pitch [deg]	Yaw [deg]	X [m]	Y [m]	Z [m]
Channel 1 (VQ-1560II-S, S2224894)	-0.11410	0.02154	0.17214	0.034	0.010	0.148
Channel 2 (VQ-1560II-S, S2224894)	0.00000	0.00000	0.00000	0.000	0.000	0.000

3.5 Navigation devices

Name	Roll [deg]	Pitch [deg]	Yaw [deg]	East [m]	North [m]	Height [m]	Time [s]
INS-GPS 1 (Applanix POS AV/LV/MV, 12299)	0.00000	0.00000	0.00000	0.000	0.000	0.000	-0.0007

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

3.6 Observations

Best 15 observations

#	Object 1	Object 2	Deviation [m]	Description
1	Record004_Line1 - 221005_142609_Channel_2	Record005_Line2 - 221005_143232_Channel_2	0.000	
2	Record006_Line3 - 221005_143608_Channel_2	Record011_Line10 - 221005_150024_Channel_1	0.000	
3	Record006_Line3 - 221005_143608_Channel_2	Record016_Line12 - 221005_153243_Channel_1	0.000	
4	Record012_Line9 - 221005_150419_Channel_1	Record012_Line9 - 221005_150419_Channel_2	0.000	
5	Record014_Line14 - 221005_152217_Channel_2	Record016_Line12 - 221005_153243_Channel_2	0.000	
6	Record011_Line10 - 221005_150024_Channel_2	Record012_Line9 - 221005_150419_Channel_1	0.000	
7	Record005_Line2 - 221005_143232_Channel_1	Record012_Line9 - 221005_150419_Channel_1	0.000	
8	Record005_Line2 - 221005_143232_Channel_1	Record011_Line10 - 221005_150024_Channel_1	0.000	
9	Record008 - 221005_144700_Channel_1	Record008 - 221005_144700_Channel_2	0.000	
10	Record006_Line3 - 221005_143608_Channel_1	Record012_Line9 - 221005_150419_Channel_1	0.000	
11	Record007_Line4 - 221005_144252_Channel_1	Record014_Line14 - 221005_152217_Channel_2	0.000	
12	Record011_Line10 - 221005_150024_Channel_1	Record012_Line9 - 221005_150419_Channel_2	0.000	
13	Record006_Line3 - 221005_143608_Channel_1	Record011_Line10 - 221005_150024_Channel_2	0.000	
14	Record004_Line1 - 221005_142609_Channel_1	Record012_Line9 - 221005_150419_Channel_1	0.000	
15	Record009_Line6 - 221005_145050_Channel_1	Record009_Line6 - 221005_145050_Channel_2	0.000	

Worst 15 observations

#	Object 1	Object 2	Deviation [m]	Description
1	Record005_Line2 - 221005_143232_Channel_2	Record017_Line11 - 221005_153926_Channel_1	-0.222	
2	Record013_Line8 - 221005_150929_Channel_1	Record017_Line11 - 221005_153926_Channel_1	0.205	
3	Record005_Line2 - 221005_143232_Channel_2	Record016_Line12 - 221005_153243_Channel_1	-0.202	
4	Record004_Line1 - 221005_142609_Channel_1	Record005_Line2 - 221005_143232_Channel_1	0.195	
5	Record010_Line7 - 221005_145507_Channel_1	Record010_Line7 - 221005_145508_Channel_2	-0.194	
6	Record008 - 221005_144700_Channel_1	Record012_Line9 - 221005_150419_Channel_1	-0.192	
7	Record005_Line2 - 221005_143232_Channel_1	Record010_Line7 - 221005_145507_Channel_1	0.191	
8	Record009_Line6 - 221005_145050_Channel_2	Record010_Line7 - 221005_145507_Channel_1	0.189	
9	Record008 - 221005_144700_Channel_2	Record014_Line14 - 221005_152217_Channel_2	0.189	
10	Record005_Line2 - 221005_143232_Channel_2	Record012_Line9 - 221005_150419_Channel_2	-0.188	
11	Record009_Line6 - 221005_145050_Channel_1	Record010_Line7 - 221005_145507_Channel_1	0.186	
12	Record005_Line2 - 221005_143232_Channel_1	Record012_Line9 - 221005_150419_Channel_2	-0.186	
13	Record005_Line2 - 221005_143232_Channel_1	Record013_Line8 - 221005_150929_Channel_2	0.184	
14	Record008 - 221005_144700_Channel_2	Record017_Line11 - 221005_153926_Channel_1	-0.182	
15	Record005_Line2 - 221005_143232_Channel_2	Record012_Line9 - 221005_150419_Channel_1	0.180	

Best 15 scans

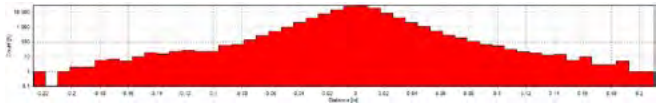
Name	Objects	Std. dev. [m]
221005_144252_Channel_1	7943	0.017
221005_145507_Channel_1	8586	0.017
221005_142609_Channel_1	9604	0.017
221005_145508_Channel_2	7934	0.017
221005_145050_Channel_2	8093	0.017
221005_145050_Channel_1	7483	0.017
221005_144252_Channel_2	7428	0.018
221005_144708_Channel_2	9057	0.018
221005_142609_Channel_2	9564	0.018
221005_143232_Channel_1	10529	0.018
221005_143232_Channel_2	10046	0.018
221005_143608_Channel_2	10225	0.018
221005_143608_Channel_1	10292	0.018
221005_144708_Channel_1	8552	0.019
221005_150419_Channel_2	12970	0.020

Worst 15 scans

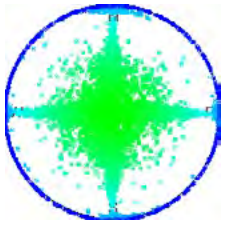
Name	Objects	Std. dev. [m]
221005_153926_Channel_1	6739	0.029
221005_153926_Channel_2	7157	0.027
221005_153243_Channel_1	6569	0.025
221005_153243_Channel_2	6676	0.023
221005_152631_Channel_1	5276	0.023
221005_152631_Channel_2	5882	0.023
221005_150929_Channel_1	8949	0.023
221005_152217_Channel_2	4010	0.022
221005_152217_Channel_1	4477	0.022
221005_150929_Channel_2	10076	0.021
221005_150024_Channel_1	10851	0.020
221005_150419_Channel_1	13073	0.020
221005_150024_Channel_2	11159	0.020
221005_150419_Channel_2	12970	0.020
221005_144700_Channel_1	8552	0.019

Dewberry Engineers Inc. Equipment (continue)

3.7 Histogram of residuals



3.8 Orientation chart



20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

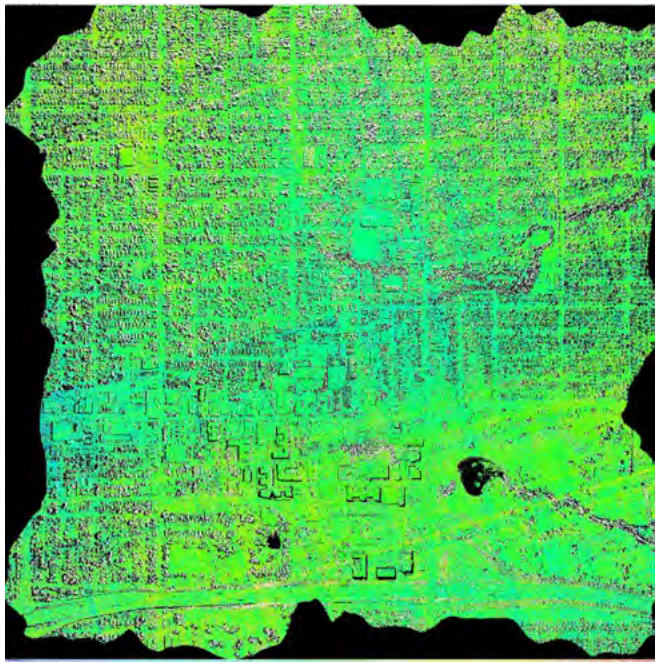
4 Visual accuracy assessment

For the visual assessment of the data quality achieved by applying the results of the scan data adjustment algorithm, a few plots chosen at random, showing the height difference of two overlapping scan lines in each case, are given. The height difference is calculated by already determined surfaces in the overlap of two scan stripes. The distance of the centre of gravity of two corresponding surfaces is colour coded according to the colours of the rainbow with a range of +/- 10 cm. If no surfaces have been determined because of e.g., vegetation and trees or missing data like for example lakes and rivers, no valuable information is available which is indicated by black or white coloured pixels.

Dewberry Engineers Inc. Equipment (continue)

4.1 Height difference plots

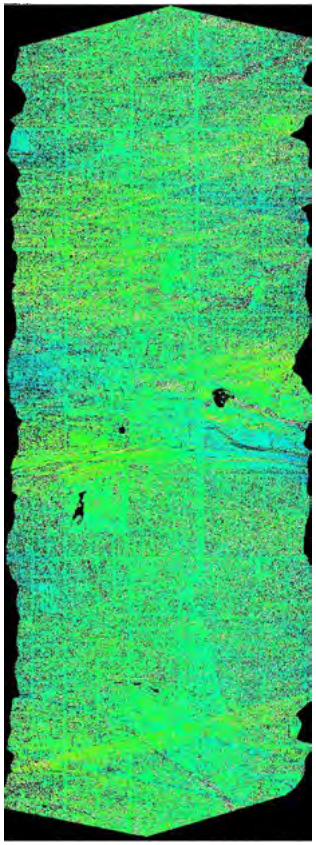
Scan 221005_152651_2 vs. 221005_153243_2



20 Certifications/Licenses: (Continued)

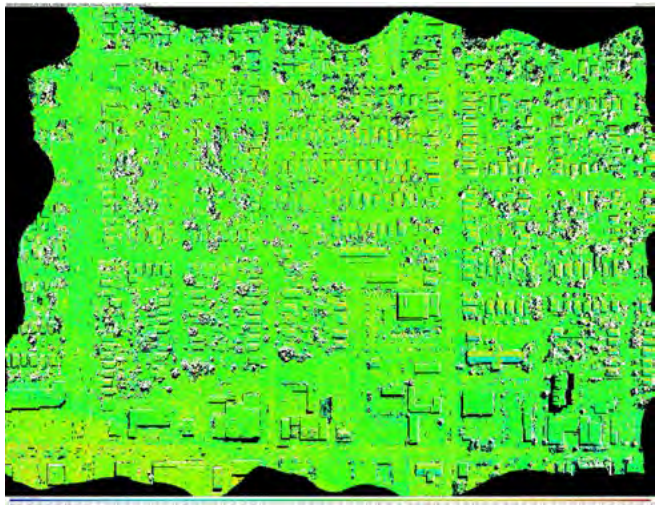
Dewberry Engineers Inc. Equipment (continue)

Scan 221005_153243_1 vs. 221005_153243_2



Dewberry Engineers Inc. Equipment (continue)

Scan 221005_144252_1 vs. 221005_150929_1



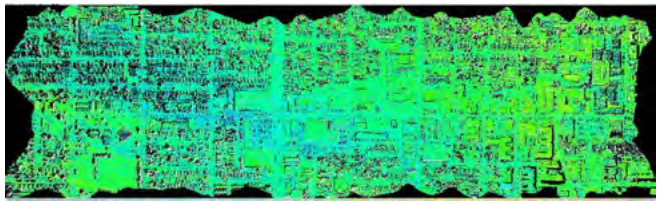
20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

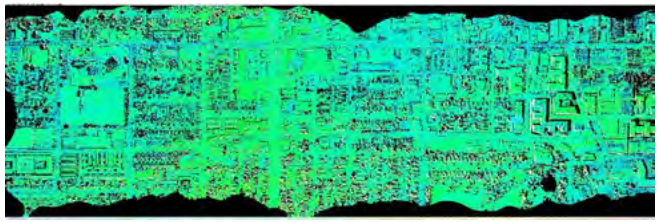
Scan 221005_143608_1 vs. 221005_153243_2

Dewberry Engineers Inc. Equipment (continue)

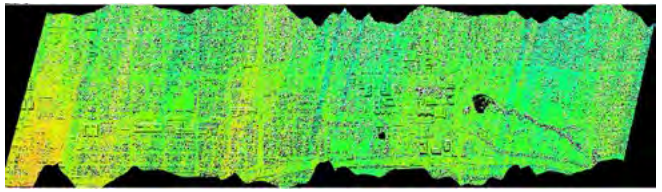
Scan 221005_144700_2 vs. 221005_153926_1



Scan 221005_145050_2 vs. 221005_153926_1



Scan 221005_152217_1 vs. 221005_152651_1



20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

Scan 221005_142609_1 vs. 221005_145508_2

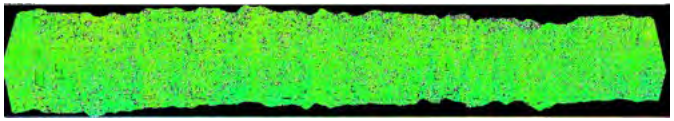
Dewberry Engineers Inc. Equipment (continue)

Scan 221005_143608_2 vs. 221005_152651_2

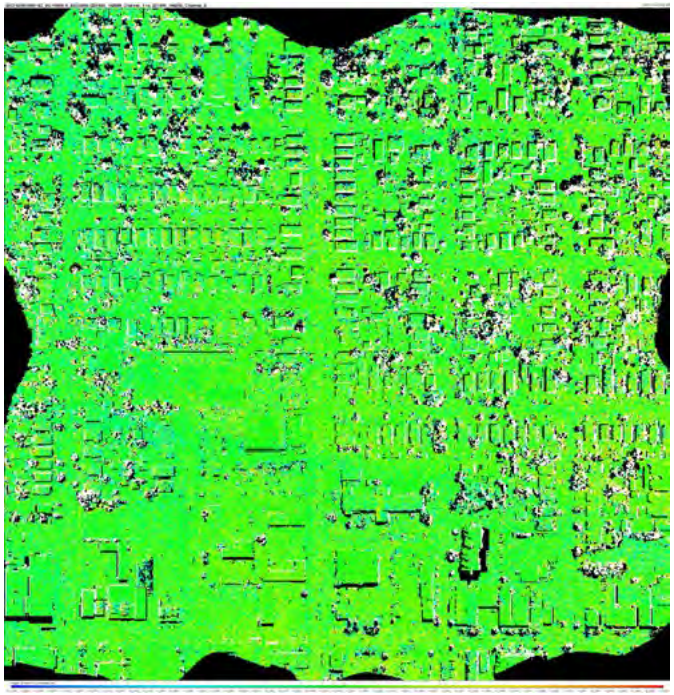
20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

Scan 221005_144252_1 vs. 221005_144252_2



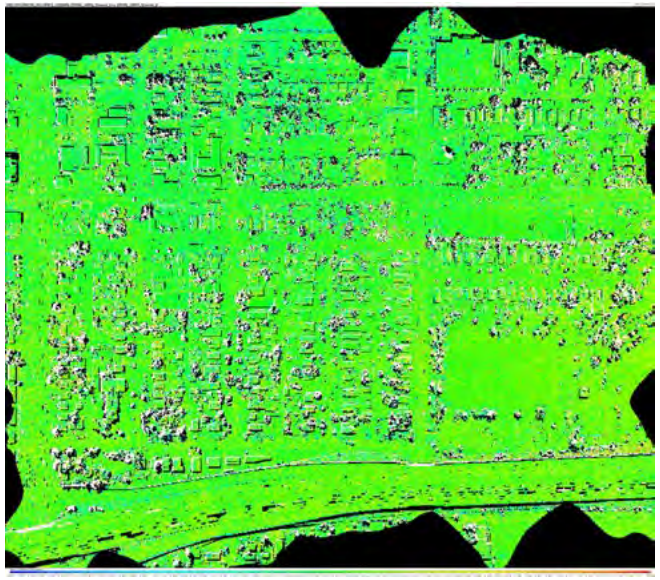
Scan 221005_142609_1 vs. 221005_144252_2



Dewberry Engineers Inc. Equipment (continue)

Scan 221005_144700_2 vs. 221005_145050_2

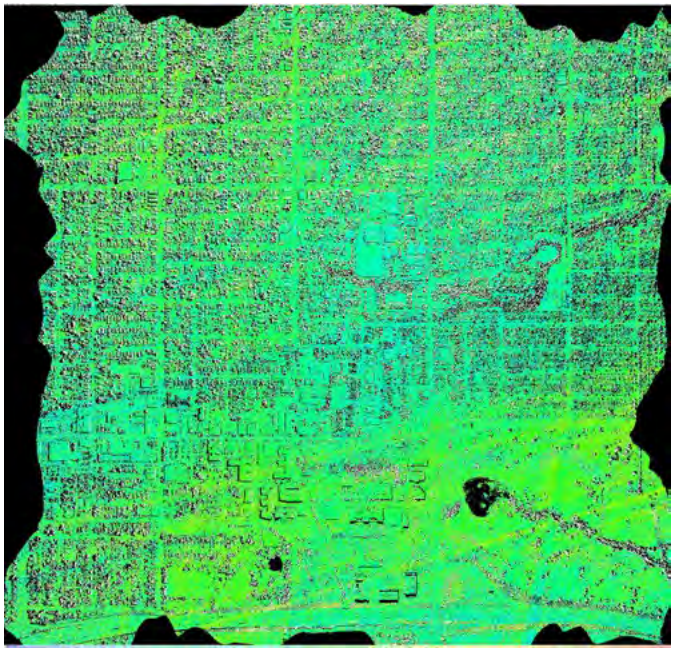
Scan 221005_145508_2 vs. 221005_150929_2



20 Certifications/Licenses: (Continued)

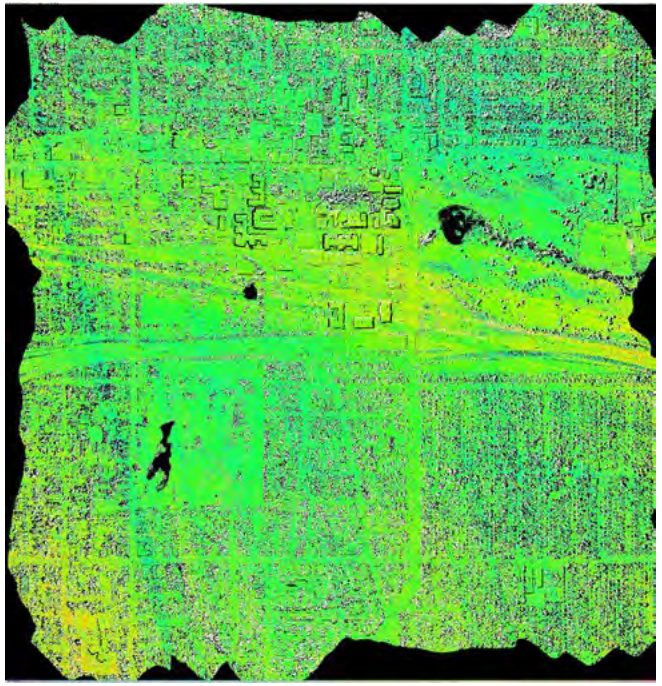
Dewberry Engineers Inc. Equipment (continue)

Scan 221005_152651_2 vs. 221005_153243_2



Dewberry Engineers Inc. Equipment (continue)

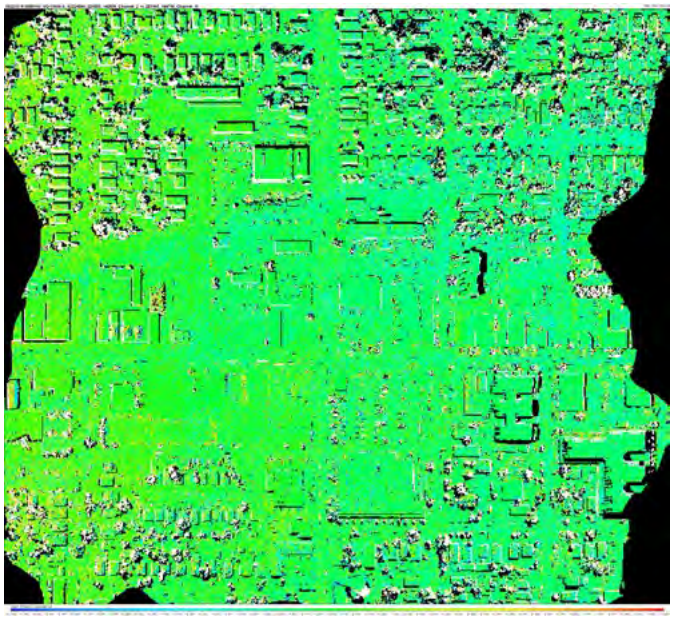
Scan 221005_152217_1 vs. 221005_152343_2



20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

Scan 221005_142609_2 vs. 221005_144700_1



Dewberry Engineers Inc. Equipment (continue)

5 Calibration Result

In the following the boresight angles for laser scanner are specified. The results are an output of the iterative scan data adjustment algorithm and are also given in chapter 3 “RiPROCESS Scan Data Adjustment Protocol”.

Applying the automated scan data adjustment algorithm, the following values of boresighting angles Scanner-IMU, according to the axis and their chirality of the aircraft defined in the ARINC 705 aviation standard (see chapter 5.2 “Excerpt of the ARINC 705 aviation standard:”), have been determined to be:

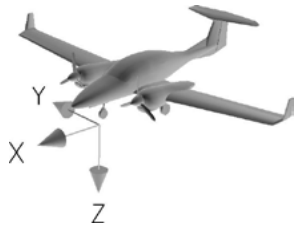
5.1 Boresight angles Scanner S2224894 - IMU

Axis	notation	angle [deg]
x - Roll	ν_c	-0.11410
y - Pitch	ρ_c	0.02154
z - Yaw	κ_c	0.17214

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

5.2 Excerpt of the ARINC 705 aviation standard:



Definition of the axis of the aircraft-own coordinate system

Positive values of roll angles mean a right handed rotation of the aircraft around the roll-axis (x) with respect to the local horizon

Positive values of pitch angles mean a right-handed rotation around the pitch-axis (y) with respect to the local horizon.

Positive values of yaw angles mean a right-handed rotation around the yaw-axis (z) with respect to Heading North.

The ARINC 705 Standard – definition of roll-, pitch- and yaw angles with respect to the aircraft own coordinate system.

5.3 Residues after System Calibration

The standard deviation of all residual errors determined by taking 120000 observations into account calculates to 0.0201 Meters (2.01 cm).

Dewberry Engineers Inc. Equipment (continue)

RIEGL LASER MEASUREMENT SYSTEMS

Calibration Protocol
CAL-1022-S2224894

Customer:	RIEGL USA, INC.		
System:			
Laser Scanner:	RIEGL VQ-1560II-S	**Serial No:**	S2224894
IMU/GPS-System:	APPLANIX AV610	**Serial No:**	20035
IMU-Sensor	APPLANIX IMU57-Ri	**Serial No:**	12299

Calibration Results Scanner S2224894:

Boresight Misalignment (System Installation):		
	optimum alignment angles [deg]	
Roll	-0.11410	
Pitch	0.02154	
Yaw	0.17214	

Time offset	-0.0007 [s]	

Important note:
The accuracy of the present calibration is subject to, and only as reliable as, the quality of the sample data-set acquired and provided to *RIEGL* by the customer. *RIEGL* does not assume and expressly disclaims hereby, any liability arising from or in connection with the quality, correctness and accuracy of the present calibration to the extent that this could directly or indirectly be affected by the quality of the sample data-set.

Standard deviation of residuals derived from 120000 observations = 0.0201 m

Calibration performed: 24.10.2022, Date, Sign

Supervising engineer: 24.10.2022, Date, Sign

Approved: 24.10.2022, Date, Sign

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

Boresight and Calibration Report:

Sensor: Teledyne Optech CZMIL SuperNova CZ11

Mission Date: June – July 2025

Prepared By:

Dewberry
8401 Arlington Blvd
Fairfax, VA 22031

Prepared For:

NOAA NGS
1315 East West Highway
Silver Spring, MD 20910

1. Operations

The calibration flights were conducted between June 23rd and July 24th, 2025, Table 1. These flights were collected with the flight parameters in Table 2. The Stennis International

Dewberry Engineers Inc. Equipment (continue)

Version 1.0.3, August 2025

Airport flights were conducted July 23rd (Figure 1). The Ft Lauderdale bathymetric test site flights were conducted on June 23rd and 24th (Figure 2).

The flights over Stennis were used for the computation of geometric and system calibration and validation. The flights over the Ft Lauderdale test area were used to compute and validate bathymetric depth bias parameters and to further ensure the system performance is meeting expectations and matches previously acquired data. This system (CZMIL SuperNova CZ11) was installed into a Cessna Caravan 208B (N119RF).

Date	Location	Purpose
July 23rd, 2025_F1	Stennis Airport	Topographic Validation
July 23rd, 2025_F2	Stennis Airport	Topographic Calibration
July 23rd, 2025_F3	Stennis Airport	Topographic Validation
June 23rd, 2025_F1	Fort Lauderdale, FL	Bathymetric Calibration
June 23rd, 2025_F2	Fort Lauderdale, FL	Bathymetric Validation
June 24th, 2025	Fort Lauderdale, FL	Bathymetric Validation

Table 1. Calibration & Validation Flights of CZMIL SuperNova CZ11

Subsystem	Parameter	Configuration
Aircraft	Altitude AGL	400m
	Speed	140kts
Lidar	Swath Width	72% of AGL
	Pulse Repetition Rate	10-30kHz
	Circular Scan Rate	27Hz
	Line Overlap	50%

Table 2. CZMIL SuperNova system operating configuration

Dewberry Engineers Inc. Equipment (continue)

Figure 1. Stennis Airport boresight pattern

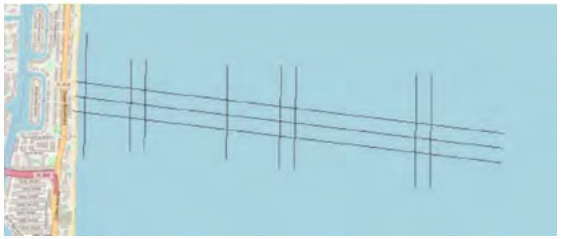


Figure 2. Bathymetric boresight flight pattern near Fort Lauderdale, FL

2. Equipment

Dewberry Engineers Inc. Equipment (continue)

Version 1.0.3, August 2025

Instrument	Manufacturer	Model
CZMIL Lidar Sensor Head	Optech	CZ12
Power Distribution Unit	Optech	cPDU
Thermal Management System	Optech	CZM-0062
EDAK 1	Optech	AM09.4802.5127
Laser	Optech	CDL-OPT-03
POS System	Applanix	AP60
IMU	Applanix	AIMU IMU-57
RGB Camera	PhaseOne	iXM-RS150F, 50mm Lens
GPS Antenna	Trimble	AV39

Table 3. List of installed equipment

3. System Offsets

Lever Arm (meters) offsets for the GNSS/IMU system as calculated by POSPac MMS.

Lever Arm Offsets	X(m)	Y(m)	Z(m)
Reference to IMU Lever Arm*	0	0	0
Reference to Primary GNSS Lever Arm	0.024	0.245	-1.178

Table 4. Lever arm values

4. Trajectory Processing

Trajectory processing was done using Applanix Pospac MMS 9.2 using Applanix PP-RTX. This processing was also used to determine the installation reference to GNSS antenna lever arms.

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

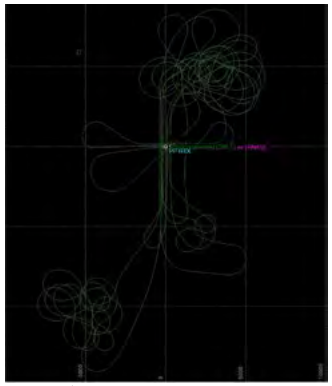


Figure 3. July 23rd_F1 Stennis Airport topographic calibration flight trajectory in PosPac

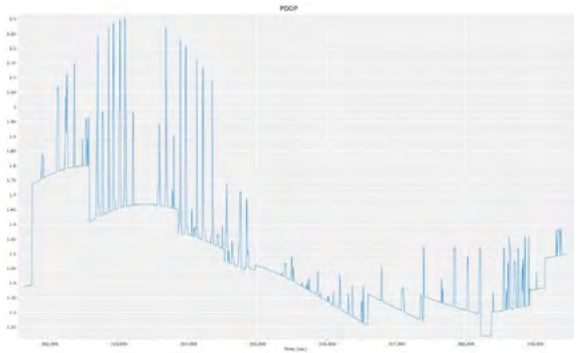


Figure 4. July 23rd_F1 Stennis Airport calibration flight PDOP

Dewberry Engineers Inc. Equipment (continue)

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Figure 5. POSPac MMS plot of North, East and Vertical position error in the airborne trajectory

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

5. Calibration Determination

Topographic calibration values were calculated using the calibration flights over Stennis Airport. These flights were used to compute misalignment angles and range offsets for each scanner channel individually, as well as to center the scanner angle of origin. Calibration flight(s) of CZMIL SuperNova are used to geometrically calibrate the system. The geometric calibration, using Lidar Mapping Suite (LMS), was performed using a standardized Optech procedure. The geometric calibration parameters that are automatically derived are listed in the Tables 5 - 7 below. These parameters are stored in a parameters file (.lcp) and are used in standard data processing, using the CARIS BASE Editor CZMIL module.

Sensor Corrections									
	SH1	SH2	SH3	SH4	SH5	SH6	SH7	IR	Deep
Beam roll correction (deg)	0.047382717	0.041049472	0.058927979	0.066341011	0.055513371	0.044974353	0.037017858	-0.048387572	0.054529294
Beam pitch correction (deg)	0.083183770	-0.118456572	0.091754894	0.287163304	0.279039075	0.065527683	-0.131737906	0.040561305	0.057965444
Range offset (m)	-0.852692	-0.893068	-0.771878	-0.751231	-0.812553	-0.757616	-0.831779	-1.859220	-0.689470
Range scale [-]	0.999958142484067900	0.999946437402975100	0.999907292904638500	0.999922735900850000	0.999942376590821400	0.999946243614813900	1.000000789 94146700	0.999892876900000000	1.000000003000996600
Range scale intensity [-]	0.000061936909274359	0.000056475845520985	0.000045886489186047	0.000041692029655894	0.000039085561914601	0.000027097333820820	0.000041491262727371	-0.000009172509191000	0.000000018923331500

Table 5. Sensor Correction values for each shallow channels 1-7, the IR channel, and the Deep channel.

Prism misalignments	
Prism roll correction (deg)	-0.000000681
Prism pitch correction (deg)	0.000229040
Prism yaw correction (deg)	139.983196609

Table 6. Prism Misalignments

Boresight corrections

Boresight angle eX (deg)	
Boresight angle eY (deg)	-0.000163324
Boresight angle eZ (deg)	0.001102799
Eccentricity dX (deg)	0.110681
Eccentricity dY (deg)	0.211249
Eccentricity dZ (deg)	0.169167

Table 7: Boresight Corrections

Dewberry Engineers Inc. Equipment (continue)

6. Quality Control

CZMIL SuperNova system accuracy is defined vertically and horizontally for topographic and bathymetric surfaces, Table 8. SuperNova seafloor elevations are compared to a seafloor ground truth surface and the mean difference and standard deviation between the two surfaces provides the real-world result to demonstrate the accuracy standard.

CZMIL Bathymetric Accuracy		
Shallow Channels		
Depth Measurement Accuracy	√ (0.252+(0.0075 d)2) m, 2 σ	Where d = depth
Horizontal Accuracy	(0.40 + 0.075d) m, 2 σ	Where d = depth
Deep Channel		
Depth Measurement Accuracy	√ (0.32+(0.013 d)2) m, 2 σ	Where d = depth
Horizontal Accuracy	(2.0 + 0.075d) m, 2 σ	Where d = depth
CZMIL Topographic Accuracy		
Horizontal Accuracy	±0.40 m, 2 σ	
Vertical Accuracy	±10 cm, 2 σ	

Table 8. CZMIL SuperNova system data accuracy specification

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

6.a Delta Z Plots

Topographic accuracy

Once the calibration coefficients are computed, data can be processed using the coefficients and compared to the mobile lidar ground control surface. Figure 6 shows CZMIL SuperNova data points compared to the ground truth of the Stennis runway. Figures 7 and 8 show the histogram of the data difference distribution. This plots and reports show no systematic offset in the data and data meets the vertical accuracy requirement.

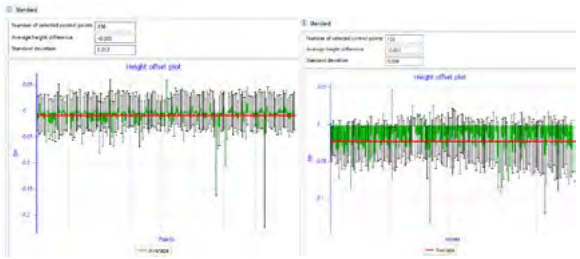

Figure 6. Elevation difference between flights 1 & 3 SuperNova data and mobile lidar control surface

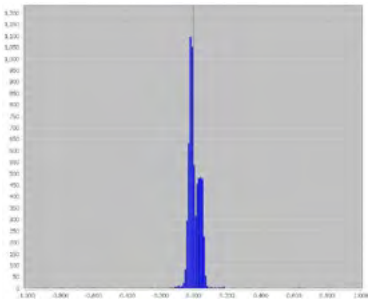

Figure 7. Histogram distribution of elevation difference between Flight 1 SuperNova data and mobile lidar control surface

Dewberry Engineers Inc. Equipment (continue)

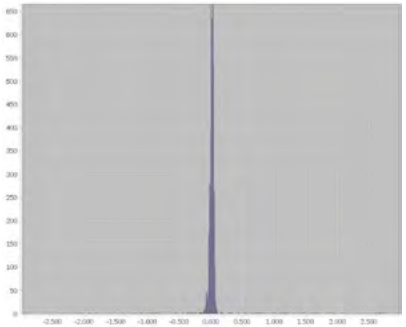

Figure 8. Histogram distribution of elevation difference between Flight 3 SuperNova data and mobile lidar control surface

6.b Control Report

No control report of individual control points for all channels is available because topographic control consists of a mobile lidar surface that was established at Stennis Airport in the Spring of 2019, Figure 9. The bathymetric surface offshore of Fort Lauderdale was collected with SHOALS bathymetric lidar in 2005; note this surface has been checked for change against a second SHOALS dataset from 2011. Also note the SHOALS bathymetric surface has been edited to remove sand bottom (which can change over time) and retained the hard bottom surface (which does not change), Figure 10.

Figure 9. SuperNova calibration pattern over Stennis Airport and mobile lidar data used for topographic ground control

Dewberry Engineers Inc. Equipment (continue)

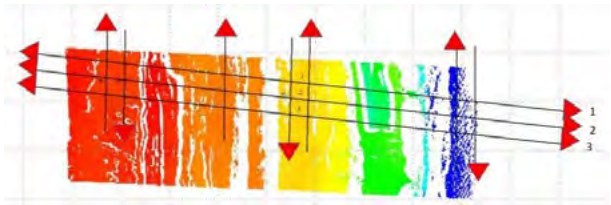

Figure 10. Bathymetric ground control data and SuperNova calibration flight lines, Fort Lauderdale.

6.c Summary Table

Control data consists of precisely surveyed topographic and bathymetric surfaces. Control data are accurate at the centimeter level, horizontally and vertically. Control data are compared to CZMIL SuperNova data and CZMIL SuperNova system accuracy is reported as the mean vertical error, vertical error range, and standard deviation of the control data comparison. The difference between the mobile lidar ground truth and CZMIL SuperNova elevations is reported in Table 9. The accuracy requirement is less than 10 cm at 2 sigma.

	Date of Flight	Vertical Accuracy (m)	
Flight 1	July 23rd, 2025_1	Mean (m)	-0.005
		Standard Deviation (m), 2σ	0.024
Flight 3	July 23rd, 2025_3	Mean (m)	-0.021
		Standard Deviation (m), 2σ	0.026

Table 9. Shallow & IR channels topographic validation results of Stennis Airport flights 1 & 3

Note: Other measures of vertical accuracy not reported, nor required, by the sensor manufacturer.

Dewberry Engineers Inc. Equipment (continue)

Version 1.0.3, August 2025

Bathymetric accuracy

CZMIL SuperNova vertical bathymetric accuracy is reported as a function of depth and reported relative to CZMIL SuperNova specification. We generate plots that show the comparison as a function of depth, with error envelopes on the plot representing the CZMIL SuperNova requirement. For the system to meet each accuracy requirement, 95% of the depth difference (between Shallow channels and ground control depths) should be inside of the CZMIL SuperNova error curve (red curve, Figures 11-14). For the June 23rd_F2 flight 1 data, 98.7% of Shallow channels *depth difference* points & 99.1 % of Deep channel *depth difference* points were within the red curve. For the June 24th flight data, 98.6% of Shallow channels *depth difference* points & 98.7 % of Deep channel *depth difference* points were within the red curve.

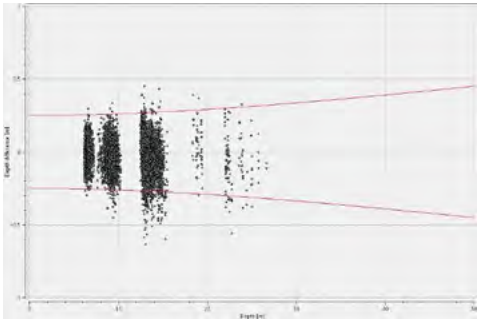

Figure 11. Shallow channel bathymetric vertical accuracy standards plotted as a function of depth, June 23rd_F2, 2025. CZMIL vertical bathymetric accuracy requirement: √ (0.252+(0.0075 d)2) m, represented by the red curves in the above figure.

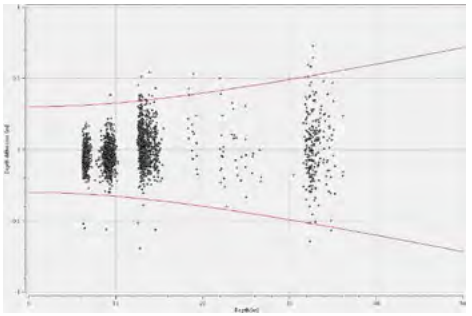

Figure 12. Deep channel bathymetric vertical accuracy standards plotted as a function of depth June 23rd_F2, 2025. CZMIL vertical bathymetric accuracy requirement: √ (0.32+(0.013 d)2) m, represented by the red curves in the above figure.

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

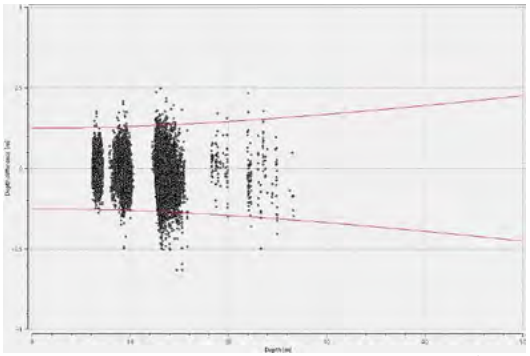

Figure 13. Shallow channel bathymetric vertical accuracy standards plotted as a function of depth June 24th_F1, 2025. CZMIL vertical bathymetric accuracy requirement: √ (0.252+(0.0075 d)2) m, represented by the red curves in the above figure.

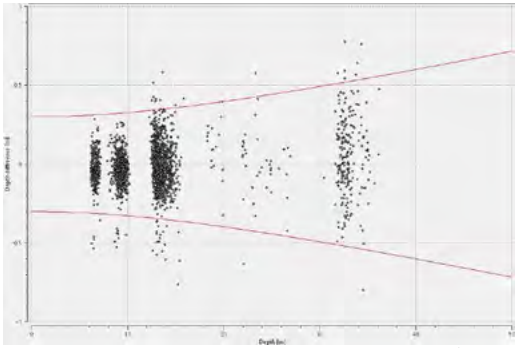

Figure 14. Deep channel bathymetric vertical accuracy standards plotted as a function of depth, June 24th_F1, 2025. CZMIL vertical bathymetric accuracy requirement: √ (0.32+(0.013 d)2) m, represented by the red curves in the above figure

Dewberry Engineers Inc. Equipment (continue)

7. Depth Bias Calibration

7.a Depth Performance

Maximum detected depths were observed and noted for the Shallow and Deep channels. We list the maximum depth in Table 10 along with the observed Kd values. Bathymetric performance coefficient (Kd●Dmax) specification for both Shallow and Deep channels are met for the June 23rd data listed in the table. It is to be noted that when calculating Kd ●Dmax, bottom reflectance is assumed to be ≥ 15%. For the June 23rd-24th, 2025 datasets, both the Shallow and Deep channels meet the required Kd ●Dmax, specification of 2.9 and 4.4.

Date of Flight	Maximum depth detected (Dmax), m		K_d (532nm), m^{-1}	K_d · Dmax
June 23rd, Flight 1	Shallow Channels	24.5	0.12-0.14	≥2.9
	Deep Channel	45.9	0.10-0.13	≥4.4

Table 10. Depth performance of CZMIL SuperNova shallow and deep channels

7.b Depth Bias Calibration Values

Bathymetric calibration was done in the Teledyne Optech LMS processing software using the two test flights over the Ft Lauderdale test site. In addition to verifying the alignment angles determined from the topographic calibration, depth bias values were determined using the variety of depths acquired over the test lines. The depth bias calibration values are generated in LMS as a combination of Range Water Offsets and Range Water Scale. This replaces previous methodologies which provided Look Up Table (LUT) coefficients. The current Range in Water values are shown in Table 11 below.

Rangewater offset [-]	-0.232286	-0.245235	-0.244296	-0.245090	-0.241846	-0.272881	-0.275439	-	-0.298325
Rangewater scale [-]	0.989263367855900000	0.991284382437800000	0.989698770199630000	0.987706489982299900	0.986928614186690100	0.989769612727300000	0.992406551086700000	-	0.986658078964800000

Table 11. Range in Water parameters derived for all channels

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

Boresight and Calibration Report:

Sensor: Teledyne Optech CZMIL SuperNova CZ12

Mission Date: June – July 2024

Prepared By:

Dewberry
8401 Arlington Blvd
Fairfax, VA 22031

Prepared For:

NOAA NGS
Stephen White
1315 East West Highway
Silver Spring, MD 20910

Dewberry Engineers Inc. Equipment (continue)

Version 1.0, July 2024

1. Operations

The calibration flights were conducted on June 14th and July 8th, 2024, Table 1. These flights were collected with the flight parameters in Table 2. The Stennis International Airport flights were conducted June 13th- 14th (Figure 1). The Ft Lauderdale bathymetric test site flights were conducted on June 8th (Figure 2).
The flights over Stennis were used for the computation of geometric and system calibration and validation. The flights over the Ft Lauderdale test area were used to compute and validate bathymetric depth bias parameters and to further ensure the system performance is meeting expectations and matches previously acquired data. This system (CZMIL SuperNova CZ12) was installed into a Cessna Caravan 208B (N126RF).

Date	Location	Purpose
June 14th, 2024_1	Stennis Airport	Topo Calibration/Validation
June 14h, 2024_2	Stennis Airport	Bathy Calibration/Validation
July 8th, 2024_1	Fort Lauderdale, FL	Bathy Calibration/Validation
July 8th, 2024_2	Fort Lauderdale, FL	Bathy Calibration/Validation

Table 1. Calibration & Validation Flights of CZMIL SuperNova CZ11

Subsystem	Parameter	Configuration
Aircraft	Altitude AGL	400m
	Speed	140kts
Lidar	Swath Width	72% of AGL
	Pulse Repetition Rate	10-30kHz
	Circular Scan Rate	27Hz
	Line Overlap	50%

Table 2. CZMIL SuperNova system operating configuration

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

Version 1.0, July 2024

Figure 1. Stennis Airport boresight pattern

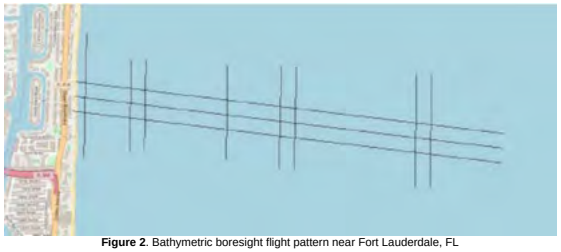

Figure 2. Bathymetric boresight flight pattern near Fort Lauderdale, FL

Dewberry Engineers Inc. Equipment (continue)

Version 1.0, July 2024

2. Equipment

Instrument	Manufacturer	Model
CZMIL Lidar Sensor Head	Optech	CZ12
Power Distribution Unit	Optech	cPDU
Thermal Management System	Optech	CZM-0062
EDAK 1	Optech	AM09.4802.5127
Laser	Optech	CDL-OPT-03
POS System	Applanix	AP60
IMU	Applanix	AIMU IMU-57
RGB Camera	PhaseOne	iiXM-RS150F, 50mm Lens
GPS Antenna	Trimble	AV39

Table 3. List of installed equipment

3. System Offsets

Lever Arm (meters) offsets for the GNSS/IMU system as calculated by POSPac MMS

Lever Arm Offsets	X(m)	Y(m)	Z(m)
Reference to IMU Lever Arm*	0	0	0
Reference to Primary GNSS Lever Arm	0.065	0.003	-1.186

Table 4. Lever arm values

4. Trajectory Processing

Trajectory processing was done using Applanix Pospac MMS 8.7 using Applanix PP-RTX. This processing was also used to determine the installation reference to GNSS antenna lever arms.

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

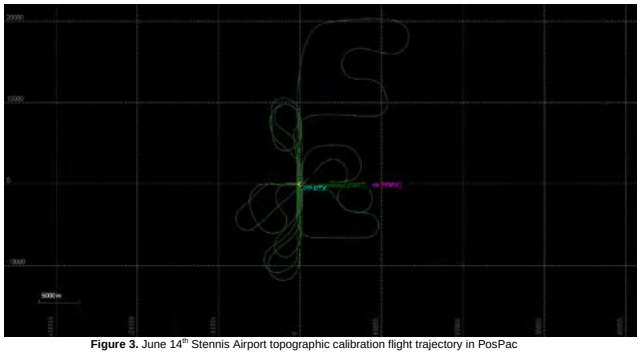

Figure 3. June 14th Stennis Airport topographic calibration flight trajectory in PosPac

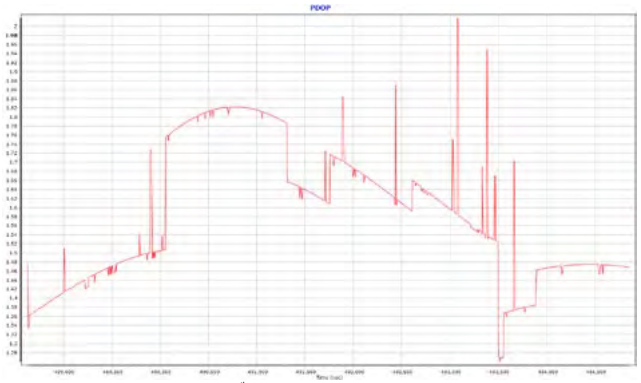

Figure 4. June 14th Stennis Airport calibration flight PDOP

Dewberry Engineers Inc. Equipment (continue)

Figure 5. POSPac MMS plot of North, East and Vertical position error in the airborne trajectory

5. Calibration Determination

Topographic calibration values were calculated using the calibration flights over Stennis Airport. These flights were used to compute misalignment angles and range offsets for each scanner channel individually, as well as to center the scanner angle of origin. Calibration flight(s) of CZMIL SuperNova are used to geometrically calibrate the system. The geometric calibration, using Lidar Mapping Suite (LMS), was performed using a standardized Optech procedure. The geometric calibration parameters that are automatically derived are listed in the Sensor Corrections table below. These parameters are stored in a parameters file (.lcp) and are used in standard data processing, using the CARIS BASE Editor CZMIL module.

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

Sensor Corrections									
	SH1	**SH2**	**SH3**	**SH4**	**SH5**	**SH6**	**SH7**	**IR**	**Deep**
Beam roll correction (deg)	0.012775708	-0.002289435	0.022453926	0.033845976	0.020100435	-0.002745336	-0.014333163	-0.062457103	0.025888146
Beam pitch correction (deg)	-0.206051900	-0.402239487	-0.191432891	0.007160166	-0.016187516	-0.231215618	-0.421463607	-0.197541006	-0.209748413
Range offset (m)	-0.674678	-0.676018	-0.680901	-0.747778	-0.696944	-0.661105	-0.741768	-1.174760	-0.412437
Range scale[-]	0.999958142792847800	0.999946437529016000	0.999907293381182400	0.999922735807977300	0.999942376916965500	0.999946243798459900	1.000000777969342300	0.999892877100000000	1.000000003009528800
Range scale intensity[-]	0.000070464789880558	0.000042638154225682	0.000036685132903808	0.000053389542623655	0.000049053019536141	0.000046205658510760	0.000055342370428797	-0.000128152397900000	0.000000019023726093

Table 5. Sensor Correction values for each shallow channels 1-7, the IR channel, and the Deep channel.

Prism misalignments	
Prism roll correction (deg)	-0.000000700
Prism pitch correction (deg)	0.000225763
Prism yaw correction (deg)	-76.30873009

Table 6. Prism Misalignments

Boresight corrections	
Boresight angle eX (deg)	-0.000135266
Boresight angle eY (deg)	0.001153909
Boresight angle eZ (deg)	-0.000019610
Eccentricity dX (deg)	0.110950
Eccentricity dY (deg)	0.211738
Eccentricity dZ (deg)	0.169378

Table 7: Boresight Corrections

Dewberry Engineers Inc. Equipment (continue)

6. Quality Control

CZMIL SuperNova system accuracy is defined vertically and horizontally for topographic and bathymetric surfaces, Table 8. SuperNova seafloor elevations are compared to a seafloor ground truth surface and the mean difference and standard deviation between the two surfaces provides the real world result to demonstrate the accuracy standard.

CZMIL Bathymetric Accuracy		
Shallow Channels		
Depth Measurement Accuracy	√(0.252+(0.0075 d)2) m, 2 σ	Where d = depth
Horizontal Accuracy	(0.40 + 0.075d) m, 2 σ	Where d = depth
Deep Channel		
Depth Measurement Accuracy	√(0.32+(0.013 d)2) m, 2 σ	Where d = depth
Horizontal Accuracy	(2.0 + 0.075d) m, 2 σ	Where d = depth
CZMIL Topographic Accuracy		
Horizontal Accuracy	±0.40 m, 2 σ	
Vertical Accuracy	±10 cm, 2 σ	

Table 8. CZMIL SuperNova system data accuracy specification

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

6.a Delta Z Plots

Topographic accuracy

Once the calibration coefficients are computed, data can be processed using the coefficients and compared to the mobile lidar ground control surface. Figure 6 shows CZMIL SuperNova data points compared to the ground truth of the Stennis runway. Figures 7 and 8 show the histogram of the data difference distribution. This plots and reports show no systematic offset in the data and data meets the vertical accuracy requirement.

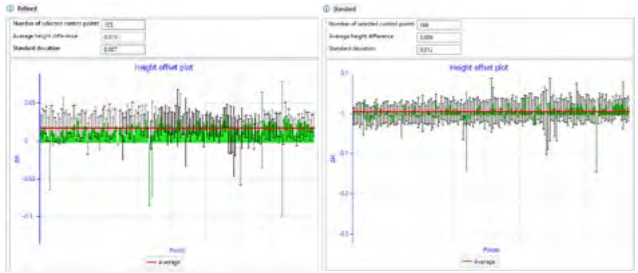

Figure 6. Elevation difference between flights 1 &2 SuperNova data and mobile lidar control surface

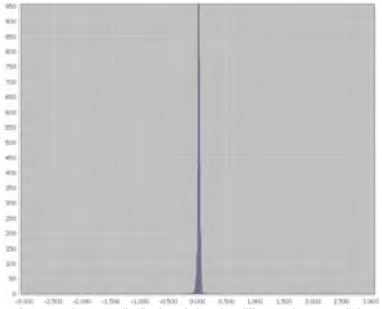

Figure 7. Histogram distribution of elevation difference between Flight 1 SuperNova data and mobile lidar control surface

Dewberry Engineers Inc. Equipment (continue)

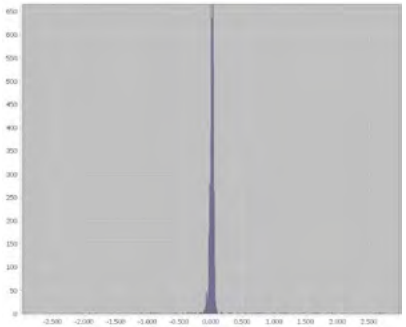

Figure 8. Histogram distribution of elevation difference between Flight 2 SuperNova data and mobile lidar control surface

6.b Control Report

No control report of individual control points for all channels is available because topographic control consists of a mobile lidar surface that was established at Stennis Airport in the Spring of 2019, Figure 9. The bathymetric surface offshore of Fort Lauderdale was collected with SHOALS bathymetric lidar in 2005; note this surface has been checked for change against a second SHOALS dataset from 2011. Also note the SHOALS bathymetric surface has been edited to remove sand bottom (which can change over time) and retained the hard bottom surface (which does not change), Figure 10.

Figure 9. SuperNova calibration pattern over Stennis Airport and mobile lidar data used for topographic ground control

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

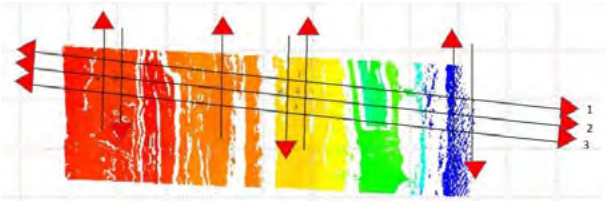

Figure 10. Bathymetric ground control data and SuperNova calibration flight lines, Fort Lauderdale.

6.c Summary Table

Control data consists of precisely surveyed topographic and bathymetric surfaces. Control data are accurate at the centimeter level, horizontally and vertically. Control data are compared to CZMIL SuperNova data and CZMIL SuperNova system accuracy is reported as the mean vertical error, vertical error range, and standard deviation of the control data comparison. The difference between the mobile lidar ground truth and CZMIL SuperNova elevations is reported in table 9. The accuracy requirement is less than 10 cm at 2 sigma.

	Date of Flight	Vertical Accuracy (m)	
Flight 1	June 14th, 2024_1	Mean (m)	0.019
		Standard Deviation (m), 2σ	0.014
Flight 2	June 14th, 2024_2	Mean (m)	0.009
		Standard Deviation (m), 2σ	0.024

Table 9. Shallow & IR channels topographic validation results of Stennis Airport flights 1 & 2

Note: Other measures of vertical accuracy not reported, nor required, by the sensor manufacturer.

Dewberry Engineers Inc. Equipment (continue)

Version 1.0, July 2024

Bathymetric accuracy

CZMIL SuperNova vertical bathymetric accuracy is reported as a function of depth and reported relative to CZMIL SuperNova specification. We generate plots that show the comparison as a function of depth, with error envelopes on the plot representing the CZMIL SuperNova requirement. For the system to meet each accuracy requirement, 95% of the depth difference (between Shallow channels and ground control depths) should be inside of the CZMIL SuperNova error curve (red curve, Figures 11-14). For the July 8th, 2024 flight 1 data, 99.1% of Shallow channels *depth difference* points & 99.5 % of Deep channel *depth difference* points were within the red curve. For the July 8th flight 2 data, 98.5% of Shallow channels *depth difference* points & 99.1 % of Deep channel *depth difference* points were within the red curve.

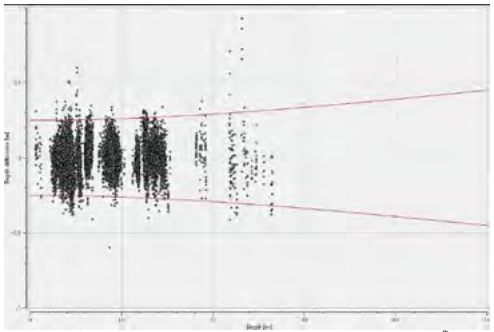

Figure 11. Shallow channel bathymetric vertical accuracy standards plotted as a function of depth, July 8th_1, 2024. CZMIL vertical bathymetric accuracy requirement: √(0.252+(0.0075 d)2) m, represented by the red curves in the above figure.

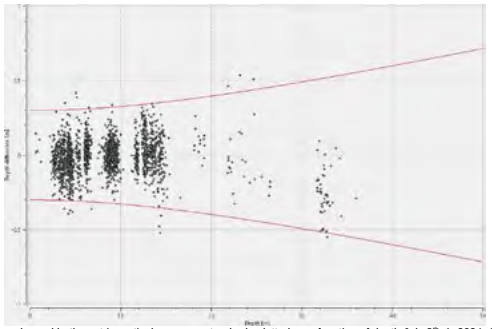

Figure 12. Deep channel bathymetric vertical accuracy standards plotted as a function of depth July 8th_1, 2024. CZMIL vertical bathymetric accuracy requirement: √(0.32+(0.013 d)2) m, represented by the red curves in the above figure.

20 Certifications/Licenses: (Continued)

Dewberry Engineers Inc. Equipment (continue)

Version 1.0, July 2024

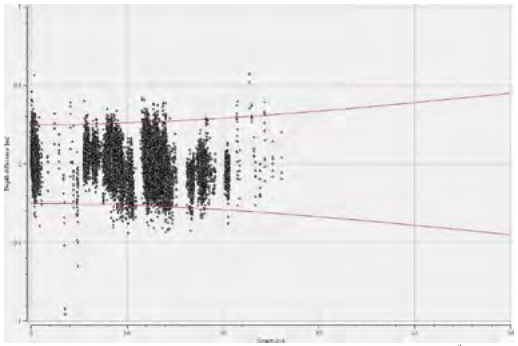

Figure 13. Shallow channel bathymetric vertical accuracy standards plotted as a function of depth July 8th_2, 2024. CZMIL vertical bathymetric accuracy requirement: √(0.252+(0.0075 d)2) m, represented by the red curves in the above figure.

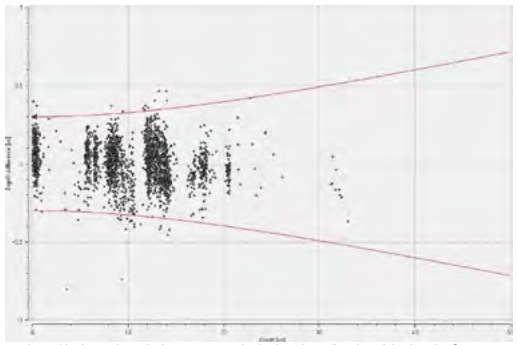

Figure 14. Deep channel bathymetric vertical accuracy standards plotted as a function of depth, July 8th_2, 2024. CZMIL vertical bathymetric accuracy requirement: √(0.32+(0.013 d)2) m, represented by the red curves in the above figure

Dewberry Engineers Inc. Equipment

Version 1.0, July 2024

7. Depth Bias Calibration

7.a Depth Performance

Maximum detected depths were observed and noted for the Shallow and Deep channels. We list the maximum depth in Table 10 along with the observed Kd values. Bathymetric performance coefficient (Kd●Dmax) specification for both Shallow and Deep channels are met for the July 8th data listed in the table. It is to be noted that when calculating Kd ●Dmax, bottom reflectance is assumed to be ≥ 15%. For the July 8th, 2024 datasets, both the Shallow and Deep channels meet the required Kd ●Dmax, specification of 2.9 and 4.4.

Date of Flight	Maximum depth detected (Dmax), m		K_d (532nm), m^{-1}	K_d · Dmax
July 8th, 2024 Flight 1	Shallow Channels	32.8	0.095-0.11	≥2.9
	Deep Channel	47.1	0.95-0.11	≥4.4

Table 10. Depth performance of CZMIL SuperNova shallow and deep channels

7.b Depth Bias Calibration Values

Bathymetric calibration was done in the Teledyne Optech LMS processing software using the two test flights over the Ft Lauderdale test site. In addition to verifying the alignment angles determined from the topographic calibration, depth bias values were determined using the variety of depths acquired over the test lines. The depth bias calibration values are generated in LMS as a combination of Range Water Offsets and Range Water Scale. This replaces previous methodologies which provided Look Up Table (LUT) coefficients. The current Range in Water values are shown in Table 11 below.

Range-water offset[-]	-0.148836	-0.200323	-0.204725	-0.170964	-0.182960	-0.202104	-0.171618	-	-0.142681
Range-water scale[-]	0.984633740171970000	0.985313121269600000	0.986593261315150000	0.986294219461260100	0.986553019654590000	0.986526763029300000	0.984787834937780000	-	0.975083607359400000

Table 11. Range in Water parameters derived for all channels

20 Certifications/Licenses: (Continued)

Forte and Tablada, Inc. SOS

State of Louisiana Secretary of State

COMMERCIAL DIVISION
225.925.4704

Fax Numbers
225.932.5317 (Admin. Services)
225.932.5314 (Corporations)
225.932.5318 (UCC)

Name	Type	City	Status
FORTE AND TABLADA, INC.	Business Corporation	BATON ROUGE	Active

Previous Names

Business: FORTE AND TABLADA, INC.
Charter Number: 25306090D
Registration Date: 2/8/1961
Domicile Address
9107 INTERLINE AVE.
BATON ROUGE, LA 70809
Mailing Address
9107 INTERLINE AVE.
BATON ROUGE, LA 70809
Principal Office Address
9107 INTERLINE AVE.
BATON ROUGE, LA 70809

Status

Status: **Active**
Annual Report Status: **In Good Standing**
File Date: 2/8/1961
Last Report Filed: 1/9/2025
Type: Business Corporation

Registered Agent(s)

Agent: JUSTIN T. MANNINO
Address 1: TAYLOR, PORTER, BROOKS & PHILLIPS, L.L.P.
Address 2: 450 LAUREL STREET, 8TH FLOOR
City, State, Zip: BATON ROUGE, LA 70801
Appointment Date: 8/21/2020

Officer(s)

Additional Officers: No

Officer: RUSSELL JOSEPH COCO, JR.
Title: Director, President
Address 1: 9107 INTERLINE AVENUE
City, State, Zip: BATON ROUGE, LA 70809

Forte and Tablada, Inc. Equipment

EQUIPMENT	QUANTITY	PHOTO
Robotic Total Stations		
Trimble S6	2	
Trimble S7	5	
Trimble S9	2	
Trimble VX	1	
Trimble SX12	1	
GPS Receivers		
Trimble R12	11	
Laser Scanners		
Faro Focus	3	
Vehicles		
Heavy Duty Fully Outfitted Survey Trucks	11	
Drones	6	

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Keystone Aerial Surveys (Keystone) Equipment

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CESSNA T210N

ICAO Aircraft Address Code 50334630

KEYSTONE AERIAL SURVEYS INC
PO BOX 21059
PHILADELPHIA PA 19114-0559

Corporation

DATE OF ISSUE September 14, 2019
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Keystone Equipment (continue)

- when it has to be **right** Leica Geosystems

Leica Geosystems
Leica CityMapper
Calibration Certificate

Product	Leica CityMapper
Serial Number	95538
Date	27 June 2022
Inspector	Roberto Clerigo

Document Code: 855923

Leica Geosystems AG
Heinrich-Wild-Strasse
CH-9435 Heerbrugg
Schweiz
www.leica-geosystems.com

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Keystone Equipment (continue)

1. System Components

Component	Type	Serial Number
Pod	CityMapper Pod	95538
GNSS/IMU	Litef LCI-100C 500 Hz	1153
LiDAR Unit	Hyperion II	5537
Camera Head	CH82	82612
Lens	NAT-D 2.8/80	80220
Camera Head	CH81m	81828
Lens	SAT-D 4.0/150	150236
Camera Head	CH81m	81829
Lens	SAT-D 4.0/150	150237
Camera Head	CH81m	81830
Lens	SAT-D 4.0/150	150238
Camera Head	CH81m	81831
Lens	SAT-D 4.0/150	150239

2. Estimation Process

		Passed	Date	Inspector
Image Flight	completed	ok	01.05.2019	Kevin Bless
Image Quality Check	checked	ok	03.05.2019	Rene Heierli
Image Calibration	completed	ok	05.05.2019	Muzaffer Adigüzel
Image Misalignment Update	completed	ok	27.06.2022	Roberto Clerigo
LiDAR Flight	completed	ok	01.05.2019	Kevin Bless
LiDAR Quality Check	checked	ok	03.05.2019	Philip Kurt Benz
LiDAR Calibration and Accuracy	completed	ok	07.05.2019	Xu Wang
LiDAR Misalignment Update	completed	ok	27.06.2022	Roberto Clerigo

3. Inspectors

Name	Bernhard Riedl	27.06.2022	
Position	Production Manager		
Name	Xu Wang	27.06.2022	
Position	Support Engineer		
Name	Michael Vetter	27.06.2022	
Position	Support Engineer		

4. Remarks

Keystone Equipment (continue)

5. LiDAR Calibration Results

The calibration results for the LiDAR Unit are only valid for:

- IMU and Pod as listed in the System Components section

5.1 LiDAR Geometric Calibration Results

IMU Misalignment		**Value**	**Unit**
	ω	-0.017497	degree
	Φ	0.004747	degree
	κ	-0.022907	degree
Boresight		**Value**	**Unit**
	Θ	-0.000871	degree
	Φ	-0.002450	degree
Receiver 1		**Value**	**Unit**
Range	Δ Offset	0.000000	meters
Wedge 0		**Value**	**Unit**
Wedge	Δ Alpha	0.028332	degree
Wedge Position	Δ Offset	0.140803	degree
Position Correction	X	-0.020381	degree
	Y	0.006169	degree
Mount	Roll	0.248296	degree
	Pitch	0.576408	degree
Rotation Axis	Roll	0.077505	degree
	Pitch	0.243510	degree
Wedge 1		**Value**	**Unit**
Wedge	Δ Alpha	-0.022392	degree
Wedge Position	Δ Offset	0.292223	degree
Position Correction	X	0.014140	degree
	Y	0.008778	degree
Mount	Roll	-0.024847	degree
	Pitch	-0.036991	degree
	Speed Pitch	1.50E-06	degree/rps^2
Rotation Axis	Roll	-0.020874	degree
	Pitch	-0.017270	degree

LiDAR Geometric Calibration File

HYPERION_GEOMETRY_LIDARUNIT-5537-C-855570-DATETIME-20220621-190057.XML

	Date	24.06.2022
LiDAR Misalignment Flight	Date	02.06.2022
LiDAR Misalignment Update Completed	Date	21.06.2022

20. Certifications/Licenses: If the advertisement requires submission of licenses and/or certificates, include them here. **Otherwise, leave this section blank.**

Keystone Equipment (continue)

5.2 LiDAR Unit Accuracy Check

Accuracy checks:

- Deviation of two perpendicular lines to GCP's
- Difference of two perpendicular lines
- Difference of forward and backward scan of one line

5.2.1 Multi-line accuracy of two perpendicular lines to ground control points

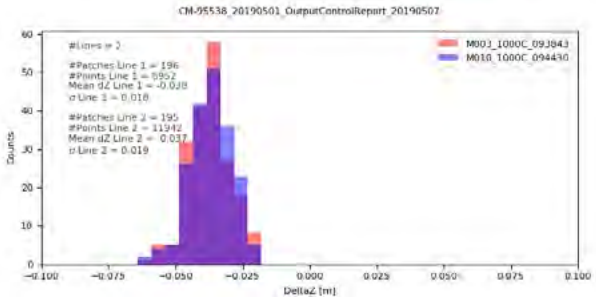

Figure 1 Vertical distance to ground control points at 1000 m AGL.

5.2.2 Difference of forward and backward scan of one line

M010_1000C_094430

344190 valid patches with size of 2 m found. Only patches with standard deviation < 0.05 m and minimum of 5 points are included.

Color	Limits [m]	Number of patches	Proportion of total number of patches [%]
	<=0.04	343418	99.78
	0.04-0.07	722	0.21
	0.07-0.1	45	0.01
	>0.1	5	0.00

Figure 2 Vertical difference betweeen forward and backward scan at 1000 m AGL.

Keystone Equipment (continue)

5.2.3 Multi-line accuracy between two perpendicular lines

M003_1000C_093843_vs_M010_1000C_094430

44531 valid patches with size of 2 m found. Only patches with standard deviation < 0.05 m and minimum of 5 points are included.

Color	Limits [m]	Number of patches	Proportion of total number of patches [%]
	<=0.04	44482	99.88
	0.04-0.07	45	0.09
	0.07-0.1	5	0.01
	>0.1	4	0.01

Figure 3 Vertical difference betweeen two perpendicular lines at 1000 m AGL.

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Keystone Equipment (continue)

6. Imaging Sensors Estimation Results

The estimation results for the camera head and lens combination are only valid for:

- IMU and Pod as listed in the System Components section.
- Camera Head, lens and specified position as listed in the Estimation Results sections.

6.1 Camera Model of distortion free images

All factory calibration results contain fixed nominal focal lengths and zero principal point offsets.
Leica HxMap applies the grid to create distortion-free images of nominal focal length and pixel size.

6.1.1 CH8x Model

			Component
Camera Head			CH82
Lens			NAT-D 2.8/80
Camera Model			
Focal Length			**Distance** [mm]
	c		83.00
Radial Symmetric Distorsion			**Distance** [mm]
	k_0		0.0000
	k_1		0.0000
	k_2		0.0000
Decentering Distortion			**Distance** [mm]
	p_1		0.0000
	p_2		0.0000
Non-Orthogonality Distortion			**Distance** [mm]
	b_1		0.0000
	b_2		0.0000
Pixel Size (Height and Width)			**Distance** [mm]
	RGB		0.0052
	NIR		0.0120
Rows and Columns		**Rows**	**Columns**
	Active RGB	7752	10320
	Raw RGB	7788	10336
	Active NIR	3654	4478
	Raw NIR	3366	4500

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Keystone Equipment (continue)

6.1.2 CH81m Model

			Component
Camera Head			CH81m
Lens			SAT-D 4.0/150
Camera Model			
Focal Length			**Distance** [mm]
	c		156.00
Radial Symmetric Distorsion			**Distance** [mm]
	k_0		0.0000
	k_1		0.0000
	k_2		0.0000
Decentering Distortion			**Distance** [mm]
	p_1		0.0000
	p_2		0.0000
Non-Orthogonality Distortion			**Distance** [mm]
	b_1		0.0000
	b_2		0.0000
Pixel Size (Height and Width)			**Distance** [mm]
	RGB		0.0052
Rows and Columns		**Rows**	**Columns**
	Active RGB	7752	10320
	Raw RGB	7788	10336

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Keystone Equipment (continue)

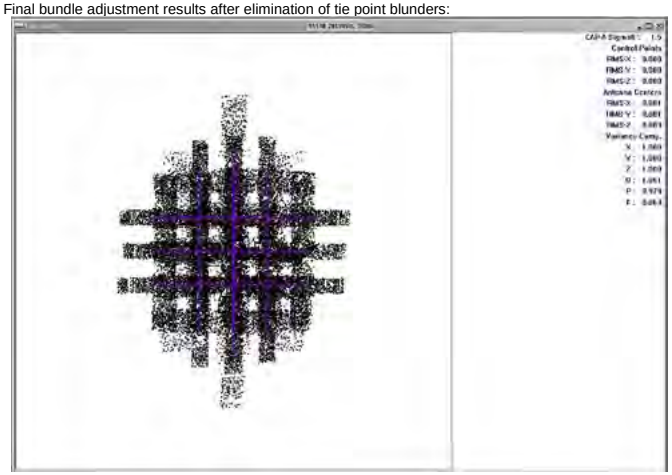
6.2 Results of Geometric Calibration

6.2.1 Calibration method for Green Reference Band

Estimation of additional parameters (focal length, principal point, radial symmetric distortion, correction grid) and IMU misalignment in simultaneous bundle adjustment

Reference band (green)	**Distance** [mm]
Resulting sigma naught of bundle adjustment:	0.0015

Final bundle adjustment results after elimination of tie point blunders:



6.2.2 Calibration method for Other Spectral Bands

Estimation of additional parameters (correction grid), based on the result for green in simultaneous bundle adjustment

Other Spectral Bands	**Distance** [mm]
Co-registration to green better than:	0.002

Leica HxMap applies the grid to create distortion-free images of nominal focal length and fixed pixel size of 0.0052 mm.

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Keystone Equipment (continue)

6.3 Estimation Results for Nadir Camera Head and Lens

		Component	**Serial Number**
Camera Head		CH82	82612
Lens		NAT-D 2.8/80	80220
View Direction in Pod Position		Nadir	
IMU Misalignment		**Angle** [degree]	
	ω	0.070555	
	Φ	-0.016485	
	κ	-0.310159	
Principal Point		**Distance** [mm]	
	x	0.0000	
	y	0.0000	
Focal Length		**Distance** [mm]	
	c	83.00	

Geometric Calibration File

RCD30_GEOMETRY_CAMERAHEAD-82612-E-798528_LENSSYSTEM-80220-B-785423_DATETIME-20220624-120824.XML

Geometric Calibration	Date	04.05.2019
Radiometric Calibration	Date	26.03.2019
Misalignment Flight	Date	02.06.2022
Misalignment Update Completed	Date	24.06.2022

Remaining image space residuals after applying the calibration results

Radius of circles is 0.0015 mm

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Keystone Equipment (continue)

6.4 Estimation Results for Forward Camera Head and Lens

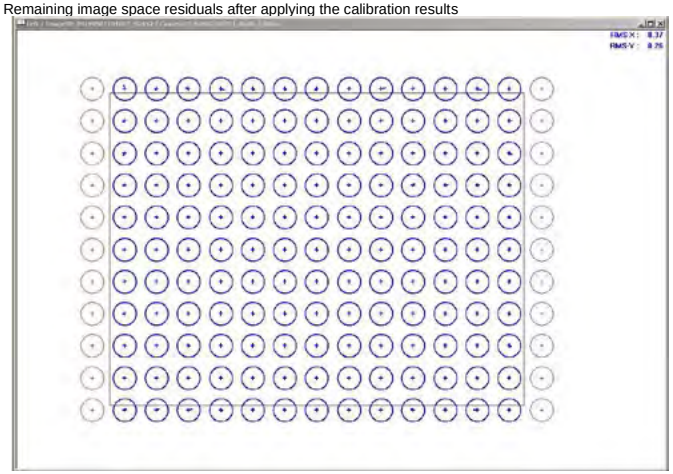
		Component	Serial Number
Camera Head		CH81m	81828
Lens		SAT-D 4.0/150	150236
View Direction in Pod Position		Forward	
IMU Misalignment		**Angle** [degree]	
	ω	-0.151955	
	Φ	0.070247	
	κ	-0.090830	
Principal Point		**Distance** [mm]	
	x	0.0000	
	y	0.0000	
Focal Length		**Distance** [mm]	
		156.00	

Geometric Calibration File

RCD30_GEOMETRY_CAMERAHEAD-81828-D-842157_LENSSYSTEM-150236-B-819435_DATETIME-20220624-120824.XML

Geometric Calibration	Date	05.05.2019
Radiometric Calibration	Date	28.03.2019
Misalignment Flight	Date	02.06.2022
Misalignment Update Completed	Date	24.06.2022

Remaining image space residuals after applying the calibration results



Radius of circles is 0.0015 mm

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Keystone Equipment (continue)

6.5 Estimation Results for Backward Camera Head and Lens

		Component	Serial Number
Camera Head		CH81m	81829
Lens		SAT-D 4.0/150	150237
View Direction in Pod Position		Backward	
IMU Misalignment		**Angle** [degree]	
	ω	0.065843	
	Φ	0.047815	
	κ	-0.081269	
Principal Point		**Distance** [mm]	
	x	0.0000	
	y	0.0000	
Focal Length		**Distance** [mm]	
		156.00	

Geometric Calibration File

RCD30_GEOMETRY_CAMERAHEAD-81829-D-842157_LENSSYSTEM-150237-B-819435_DATETIME-20220624-120824.XML

Geometric Calibration	Date	05.05.2019
Radiometric Calibration	Date	29.03.2019
Misalignment Flight	Date	02.06.2022
Misalignment Update Completed	Date	24.06.2022

Remaining image space residuals after applying the calibration results

Radius of circles is 0.0015 mm

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Keystone Equipment (continue)

6.6 Estimation Results for Left Camera Head and Lens

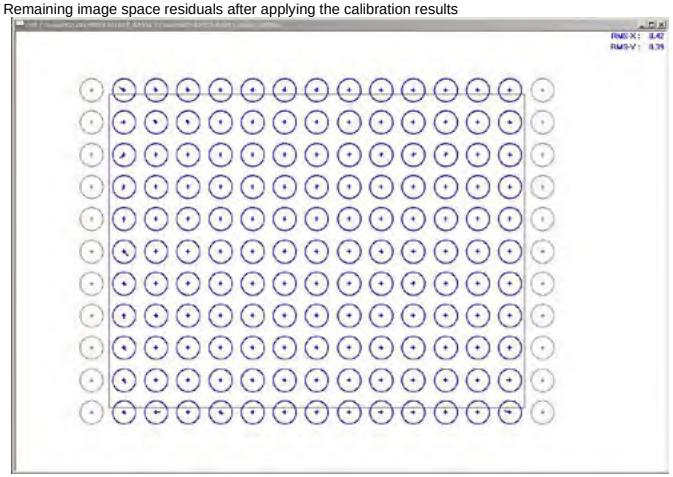
		Component	Serial Number
Camera Head		CH81m	81830
Lens		SAT-D 4.0/150	150238
View Direction in Pod Position		Left	
IMU Misalignment		**Angle** [degree]	
	ω	-0.114792	
	Φ	0.020960	
	κ	-0.092118	
Principal Point		**Distance** [mm]	
	x	0.0000	
	y	0.0000	
Focal Length		**Distance** [mm]	
		156.00	

Geometric Calibration File

RCD30_GEOMETRY_CAMERAHEAD-81830-D-842157_LENSSYSTEM-150238-B-819435_DATETIME-20220624-120824.XML

Geometric Calibration	Date	05.05.2019
Radiometric Calibration	Date	01.04.2019
Misalignment Flight	Date	02.06.2022
Misalignment Update Completed	Date	24.06.2022

Remaining image space residuals after applying the calibration results



Radius of circles is 0.0015 mm

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Keystone Equipment (continue)

6.7 Estimation Results for Right Camera Head and Lens

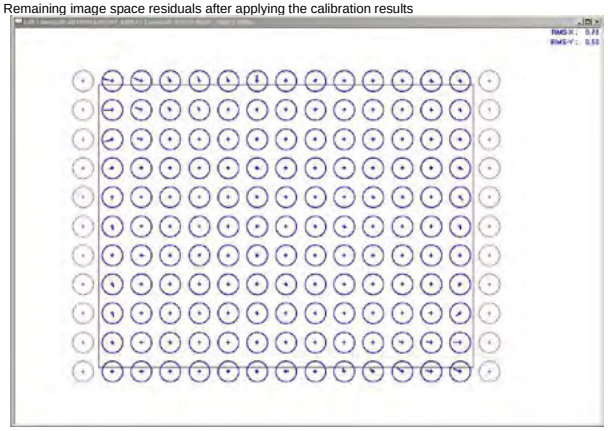
		Component	Serial Number
Camera Head		CH81m	81831
Lens		SAT-D 4.0/150	150239
View Direction in Pod Position		Right	
IMU Misalignment		**Angle** [degree]	
	ω	0.134261	
	Φ	-0.018555	
	κ	-0.176111	
Principal Point		**Distance** [mm]	
	x	0.0000	
	y	0.0000	
Focal Length		**Distance** [mm]	
		156.00	

Geometric Calibration File

RCD30_GEOMETRY_CAMERAHEAD-81831-D-842157_LENSSYSTEM-150239-B-819435_DATETIME-20220624-120824.XML

Geometric Calibration Date	Date	05.05.2019
Radiometric Calibration Date	Date	01.04.2019
Misalignment Flight	Date	02.06.2022
Misalignment Update Completed	Date	24.06.2022

Remaining image space residuals after applying the calibration results



Radius of circles is 0.0015 mm

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Keystone Equipment (continue)

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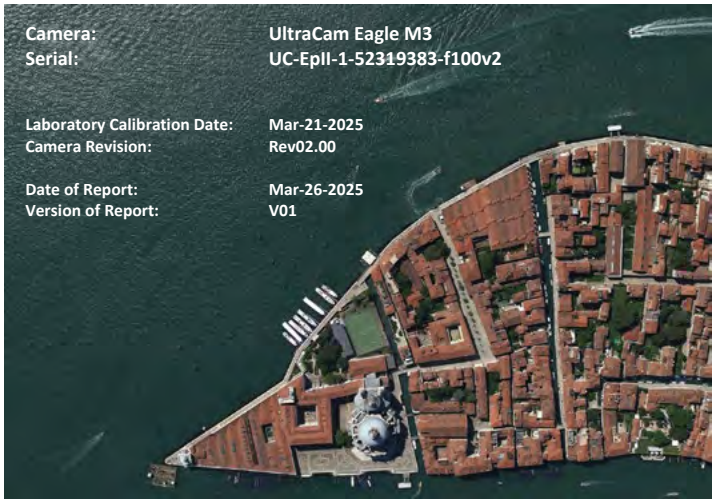
Calibration Report



www.vexcel-imaging.com

Keystone Equipment (continue)

Venice, Italy

Photo on page 1 courtesy of Vexcel Imaging GmbH

www.vexcel-imaging.com

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Keystone Equipment (continue)

ULTRACAM

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Geometric Calibration

Camera:	**UltraCam Eagle M3**
Serial:	**UC-EpII-1-52319383-f100v2**
Panchromatic Camera:	**ck = 101.700 mm**
Multispectral Camera:	**ck = 101.700 mm**
PPA Information:	**X: 0.000mm** **Y: 0.000mm**

SN: UC-EpII-1-52319383-f100v2 3

Keystone Equipment (continue)

ULTRACAM

Panchromatic Camera

Large Format Panchromatic Output Image

Image Format	long track cross track	68.016mm 105.840mm	17004pixel 26460pixel
Image Extent		(-34.008, -52.920)mm	(34.008, 52.920)mm
Pixel Size		4.000µm*4.000µm	
Focal Length	ck	101.700mm	± 0.002mm
Principal Point (Level 2)	X_ppa	0.000mm	± 0.002mm
	Y_ppa	0.000mm	± 0.002mm
Lens Distortion	Remaining Distortion less than 0.002mm		

Multispectral Camera

Medium Format Multispectral Output Image
(Upscaled to panchromatic image format)

Image Format	long track cross track	68.016mm 105.840mm	5668pixel 8820pixel
Image Extent		(-34.008, -52.920)mm	(34.008, 52.920)mm
Pixel Size		12.000µm*12.000µm	
Focal Length	ck	101.700mm	± 0.002mm
Principal Point (Level 2)	X_ppa	0.000mm	± 0.002mm
	Y_ppa	0.000mm	± 0.002mm
Lens Distortion	Remaining Distortion less than 0.002mm		

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Keystone Equipment (continue)

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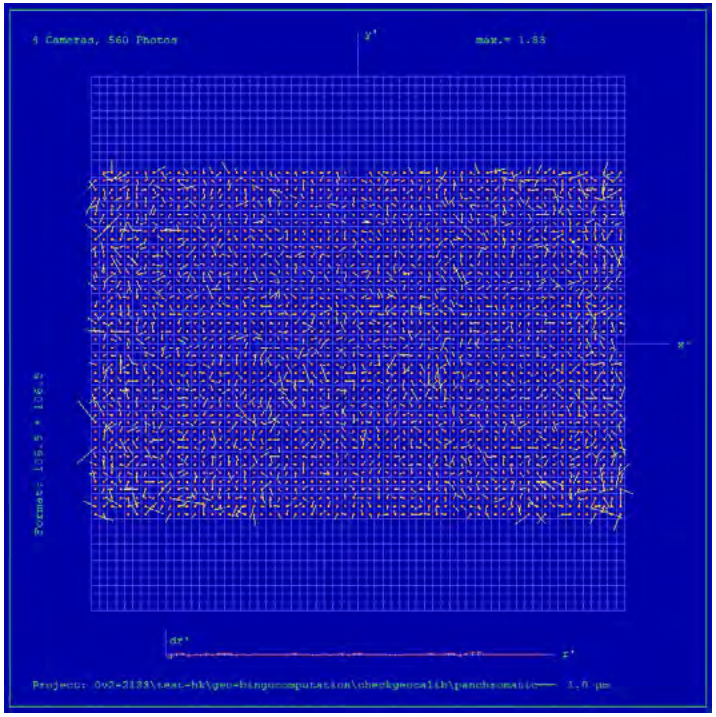
Full Panchromatic Image, Residual Error Diagram



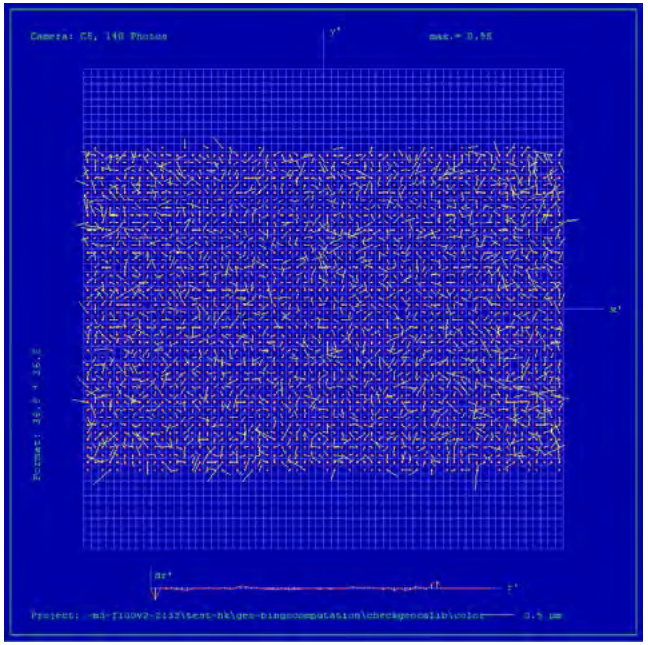
Residual Error (RMS): **0.75 µm**

SN: UC-EpII-1-52319383-f100v2 5

Keystone Equipment (continue)

ULTRACAM

Green Cone (Cone 5), Residual Error Diagram



Residual Error (RMS): **0.48 µm**

SN: UC-EpII-1-52319383-f100v2 6

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Keystone Equipment (continue)

Explanations

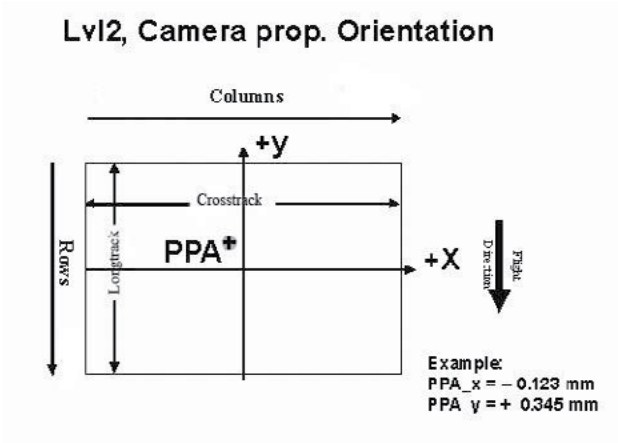
Calibration Method:

The geometric calibration is based on a set of 140 images of a defined geometry target with 394 GCPs.

Number of point measurements for the panchromatic camera : >16000
Number of point measurements for the multispectral camera : >60000

Determination of the image parameters by Least Squares Adjustment.
Software used for the adjustment: BINGO (GIP Eng. Aalen, Germany)

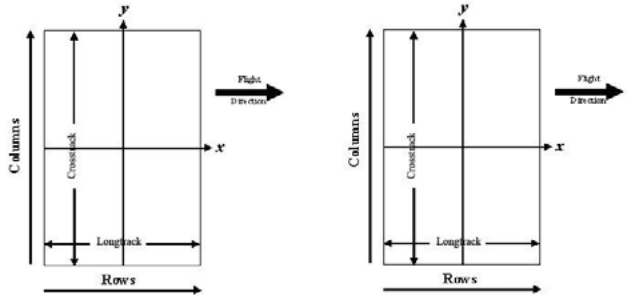
Level 2 Image Coordinate System:



The image coordinate system of the Level 2 images is shown in the above figure. The basic image format and coordinate of the principal point in the level 2 image is given on page 4 of this report. The above figure shows the position of an example principal point at the coordinate (-0.123 / 0.345).

Keystone Equipment (continue)

Level 3 Image Coordinate System:
(after rotation of 270° CW)



Panchromatic Image Format | Multispectral Image Format

Position of Principal Point in Level 3 Image

The position of the principal point in the level 3 image depends on the "rotation" setting used in UltraMap during the pan-sharpening step. The exact position relative to the image center is given in the table below as a function of the rotation setting used in UltraMap. The coordinates are specified for clockwise (CW) rotation in steps of 90 degrees, according to the principal point coordinate given on page 4 for high- and low resolution images.

Image Format	Clockwise Rotation (Degree)	PPA	
		X	Y
Level 2	-	0.000	0.000
Level 3	0	0.000	0.000
Level 3	90	0.000	0.000
Level 3	180	0.000	0.000
Level 3	270	0.000	0.000

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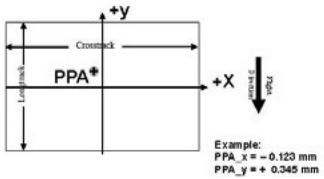
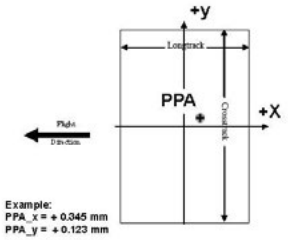
Keystone Equipment (continue)

The coordinates in the figure below are only example values to illustrate the effect of image rotation on the principal point position, and do **not** correspond to the camera described in this report.

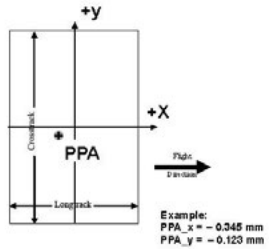
Lvl3, Rotation 0 deg clockwise



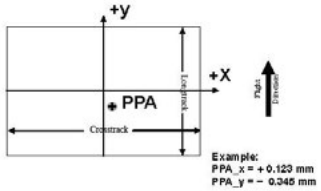
Lvl3, Rotation 90 deg clockwise



Lvl3, Rotation 270 deg clockwise



Lvl3, Rotation 180 deg clockwise



Keystone Equipment (continue)

Lens Resolving Power

The following curves show the development of the modulation transfer function across different image heights of the panchromatic cones.
Please note that these values have been calculated and can vary up to 10% with optics from production (especially at high LP's).

The curves are given for the meridonial (tangential) and sagital (radial) component of signals at frequencies of 12.5, 25, 50 and 100 line pairs per millimeter.

As the MTF is a function of the specific aperture size used, one set of curves is given for each aperture size.

Lens types

Cone	Lens
C0 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/100mm, Qioptic GmbH, Germany
C1 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/100mm, Qioptic GmbH, Germany
C2 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/100mm, Qioptic GmbH, Germany
C3 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/100mm, Qioptic GmbH, Germany
C4 (RED)	Qioptic Vexcel HR Digaron 1:4/33mm, Qioptic GmbH, Germany
C5 (GREEN)	Qioptic Vexcel HR Digaron 1:4/33mm, Qioptic GmbH, Germany
C6 (BLUE)	Qioptic Vexcel HR Digaron 1:4/33mm, Qioptic GmbH, Germany
C7 (NIR)	Qioptic Vexcel HR Digaron 1:4/33mm, Qioptic GmbH, Germany

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Keystone Equipment (continue)

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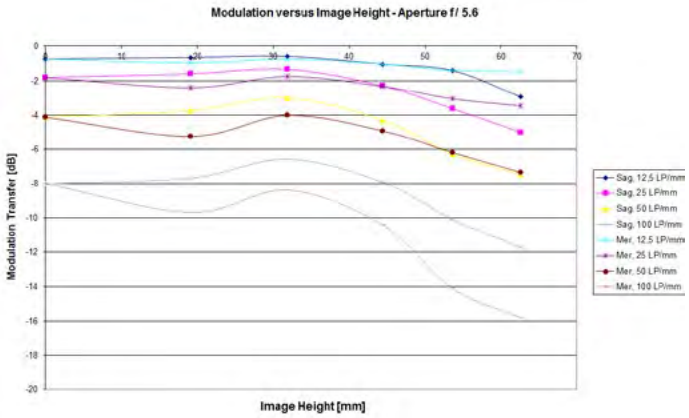
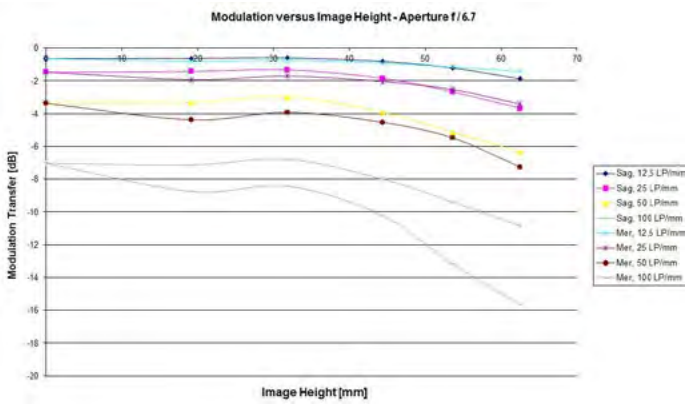
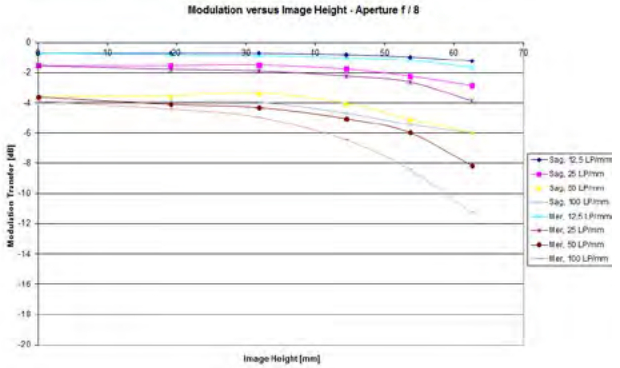


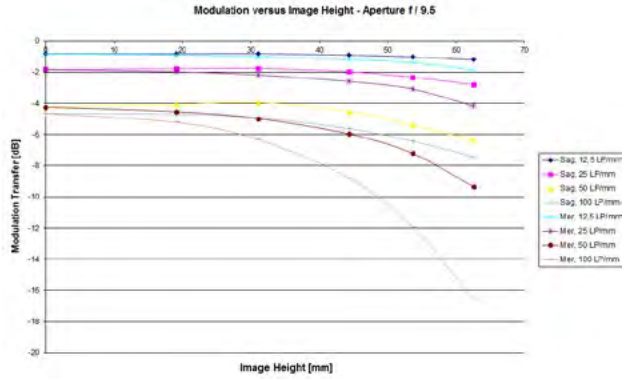


SN: UC-EpII-1-52319383-f100v2 11

Keystone Equipment (continue)

ULTRACAM





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Keystone Equipment (continue)

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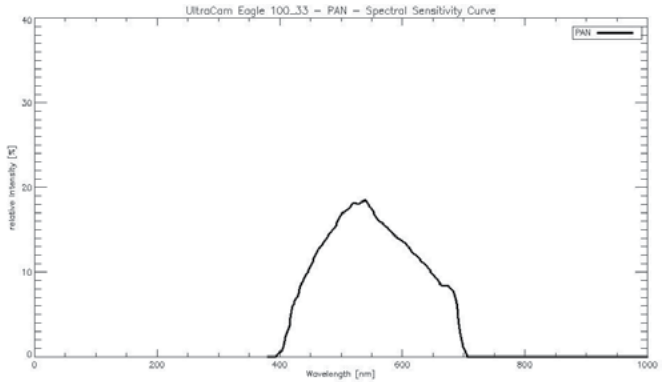
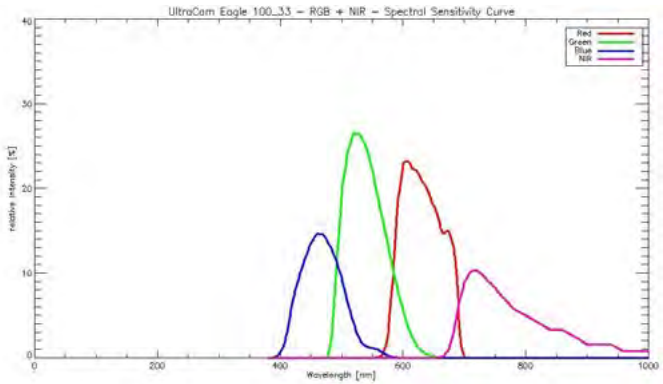
Spectral Sensitivity





Keystone Equipment (continue)

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Radiometric Calibration

Camera: **UltraCam Eagle M3**
Serial: **UC-EpII-1-52319383-f100v2**

	PAN	R, G, NIR	B
Used Apertures	F5.6	F4.8	F4.8
	F6.7	F5.6	F4.8
	F8	F6.7	F4.8
	F9.5	F8	F5.6
	F11	F9.5	F6.7
	F13	F11	F8
	F16	F13	F9.5
	F22	F19	F13

Dead Pixel Report: see Appendix I

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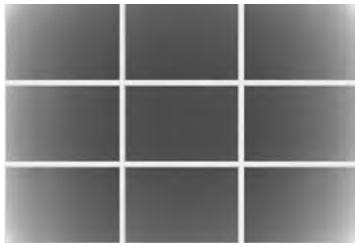
Keystone Equipment (continue)

ULTRACAM

Calibration of Vignetting for working Aperture F6.7

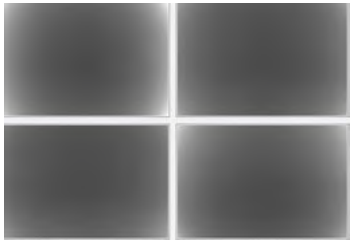
	PAN	R, G, NIR	B
Aperture	F6.7	F5.6	F4.8

Graphical Overview of Pan Sensors:



00_00	01_00	00_01
02_00	03_00	02_01
00_02	01_01	00_03

Graphical Overview of Multispectral Sensors:



04_00 (RED)	06_00 (BLUE)
05_00 (GREEN)	07_00 (NIR)

Keystone Equipment (continue)

ULTRACAM

Explanations

Calibration Method:

The radiometric calibration is based on a series of 50 flat field images for each aperture size and sensor. The flat field is illuminated by eight normal light lamps with known spectral illumination curves.

These images are used to calculate the specific sensitivity of each pixel to compensate local as well as global variations in sensitivity. Sensitivity tables are calculated for each sensor and aperture setting, and applied during post processing from level 0 to level 1.

Outlier Pixels that do not have a linear behavior as described in the CCD specifications are marked as defective during the calibration procedure. These pixels are not used or only partially used during post processing and the information is restored by interpolation between the neighborhood pixels surrounding the defective pixels.

Certain pixels that are named Qmax pixels due to the fact that they can only store and transfer charge up to a certain maximum amount are detected in an additional calibration step. These pixels are treated differently during post processing, since their behavior can affect not only single pixel values but whole columns.

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Keystone Equipment (continue)

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Shutter Calibration

Camera: **UltraCam Eagle M3**
Serial: **UC-EpII-1-52319383-f100v2**

Panchromatic Camera: **4 * Prontor Magnetic 0 HS**
Prontor-Werk Alfred Gauthier GmbH, Germany
Multispectral Camera: **4 * Prontor Magnetic 0 HS**
Prontor-Werk Alfred Gauthier GmbH, Germany

Keystone Equipment (continue)

Calibration of Shutter Release Times:

The shutter release times measured during the calibration describe the time from the moment when the electrical current through the shutter is turned off by the electronics, until the shutter is mechanically closed.

This time is relevant for the exposure control and needs to be known before image recording can take place.

Currently used SRT values (operation values):

Cone Number	Lens Serial Number	SRT F5.6 [ms]	SRT F6.7 [ms]	SRT F8 [ms]	SRT F9.5 [ms]	SRT F11 [ms]	SRT F13 [ms]	SRT F16 [ms]	SRT F22 [ms]	Measurement Tolerance [ms]
C0 (Pan)	12 60 56 34	6.30	6.41	6.66	6.90	7.08	7.22	7.45	7.78	+/- 0.2
C1 (Pan)	12 60 56 46	6.05	6.23	6.54	6.76	6.89	7.07	7.28	7.53	+/- 0.2
C2 (Pan)	12 60 56 37	6.22	6.39	6.67	6.91	7.08	7.24	7.44	7.77	+/- 0.2
C3 (Pan)	12 60 56 33	6.21	6.24	6.40	6.73	7.10	7.29	7.45	7.86	+/- 0.2
C4 (Red)	12 64 45 94	7.63	7.69	7.96	8.07	8.15	8.27	8.50	8.57	+/- 0.2
C5 (Green)	12 60 56 71	7.56	7.68	7.85	8.01	8.13	8.29	8.40	8.63	+/- 0.2
C6 (Blue)	12 64 45 91	7.41	7.41	7.41	7.58	7.72	7.85	8.03	8.32	+/- 0.2
C7 (NIR)	12 64 45 98	6.98	7.05	7.23	7.42	7.54	7.66	7.76	7.98	+/- 0.2

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Keystone Equipment (continue)

ULTRACAM

ULTRACAM

Electronics and Sensor Calibration

Camera:	**UltraCam Eagle M3**
Serial:	**UC-EpII-1-52319383-f100v2**
Panchromatic Camera:	**9 * FTF9060-M Area CCD Sensor by DALSA**
Multispectral Camera:	**4 * FTF9060-M Area CCD Sensor by DALSA**

SN: UC-EpII-1-52319383-f100v2 19

Keystone Equipment (continue)

ULTRACAM

Calibration of Negative Substrate Voltage (VNS):

For optimum performance of the DALSA CCD sensors, the negative substrate voltage is adjusted to a value specified by DALSA.

This voltage value is measured to achieve the best anti-blooming performance possible for each particular sensor.

Currently used VNS and VOG values (operation values):

Cone_Sensor	Sensor Type	Sensor Serial Number	VNS Voltage [V]	VOG Voltage [V]
00_00	FTF9060-M	19 7663/077	22.00	6.55
00_01	FTF9060-M	19 7663/066	22.00	6.44
00_02	FTF9060-M	19 7663/051	21.80	6.42
00_03	FTF9060-M	19 7663/048	21.60	6.25
01_00	FTF9060-M	19 7663/044	22.00	6.18
01_01	FTF9060-M	19 7663/007	21.60	6.09
02_00	FTF9060-M	19 7663/079	22.20	6.06
02_01	FTF9060-M	19 7663/005	21.60	6.13
03_00	FTF9060-M	19 7663/008	22.00	6.30
04_00 (red)	FTF9060-M	19 7663/038	22.00	6.21
05_00 (green)	FTF9060-M	19 7663/069	22.00	6.34
06_00 (blue)	FTF9060-M	19 7663/084	21.80	6.44
07_00 (NIR)	FTF9060-M	19 7663/010	21.60	6.22

SN: UC-EpII-1-52319383-f100v2 20

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Keystone Equipment (continue)

ULTRACAM

Calibration of Intensity Threshold for Exposure Control:

Each CCD sensor and electronics module varies slightly in global sensitivity and intensity scale.

Therefore the maximum possible intensity of each sensor needs to be measured to evaluate the sensitivity behavior of the CCD and electronics.

This value is used as a threshold for the exposure control dialogue shown in the in-flight user interface of the Eagle.

Currently used Threshold values (operation values):

Cone_Sensor	Sensor Type	Sensor Serial Number	Intensity Threshold [DN] Tap 1	Tap2
00_00	FTF9060-M	19 7663/077	12850	12110
00_01	FTF9060-M	19 7663/066	13130	12110
00_02	FTF9060-M	19 7663/051	13230	12430
00_03	FTF9060-M	19 7663/048	13390	12390
01_00	FTF9060-M	19 7663/044	13120	12250
01_01	FTF9060-M	19 7663/007	13470	12630
02_00	FTF9060-M	19 7663/079	12650	12300
02_01	FTF9060-M	19 7663/005	13460	12490
03_00	FTF9060-M	19 7663/008	13140	12490
04_00 (red)	FTF9060-M	19 7663/038	12840	12060
05_00 (green)	FTF9060-M	19 7663/069	13200	12360
06_00 (blue)	FTF9060-M	19 7663/084	13440	12630
07_00 (NIR)	FTF9060-M	19 7663/010	13390	12520

Keystone Equipment (continue)

ULTRACAM

ULTRACAM

Summary

Camera:	**UltraCam Eagle M3**
Serial:	**UC-EpII-1-52319383-f100v2**
Laboratory Calibration Date:	**Mar-21-2025**
Camera Revision:	**Rev02.00**
Date of Report:	**Mar-26-2025**
Version of Report:	**V01**

The following calibrations have been performed for the above mentioned digital aerial mapping camera:

- Geometric Calibration
- Radiometric Calibration
- Shutter Calibration
- Sensor and Electronics Calibration

This equipment is operating fully within specification as defined by Vexcel Imaging GmbH.

Marc Muick MSc.
Head of Applied Photogrammetry - Camera & Calibration
Vexcel Imaging GmbH

Dipl. Ing. (FH) Helmut Jauk
Senior Project Engineer
Vexcel Imaging GmbH

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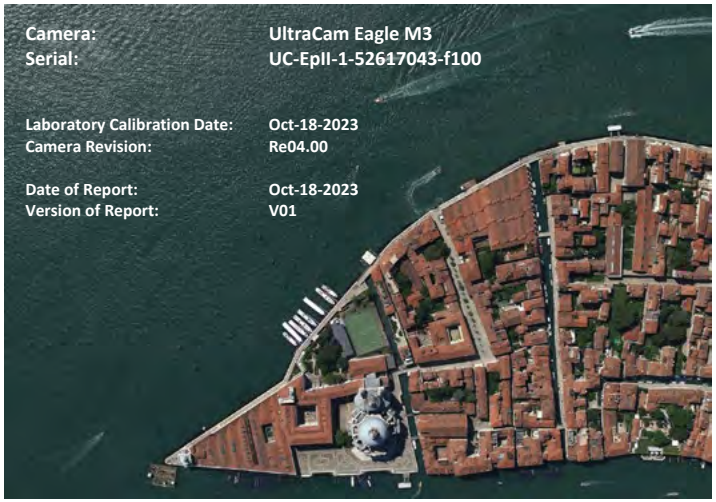
Keystone Equipment (continue)

VEXCEL
IMAGING

ULTRACAM

Calibration Report



www.vexcel-imaging.com

Keystone Equipment (continue)

Venice, Italy

Photo on page 1 courtesy of Vexcel Imaging GmbH

www.vexcel-imaging.com

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Keystone Equipment (continue)

ULTRACAM

ULTRACAM

Geometric Calibration

Camera:	**UltraCam Eagle M3**
Serial:	**UC-EpII-1-52617043-f100**
Panchromatic Camera:	**ck = 100.500 mm**
Multispectral Camera:	**ck = 100.500 mm**
PPA Information:	**X: 0.000mm** **Y: 0.000mm**

SN: UC-EpII-1-52617043-f100 3

Keystone Equipment (continue)

ULTRACAM

Panchromatic Camera

Large Format Panchromatic Output Image

Image Format	long track cross track	68.016mm 105.840mm	17004pixel 26460pixel
Image Extent		(-34.008, -52.920)mm	(34.008, 52.920)mm
Pixel Size		4.000µm*4.000µm	
Focal Length	ck	100.500mm	± 0.002mm
Principal Point (Level 2)	X_ppa	0.000mm	± 0.002mm
	Y_ppa	0.000mm	± 0.002mm
Lens Distortion	Remaining Distortion less than 0.002mm		

Multispectral Camera

Medium Format Multispectral Output Image
(Upscaled to panchromatic image format)

Image Format	long track cross track	68.016mm 105.840mm	5668pixel 8820pixel
Image Extent		(-34.008, -52.920)mm	(34.008, 52.920)mm
Pixel Size		12.000µm*12.000µm	
Focal Length	ck	100.500mm	± 0.002mm
Principal Point (Level 2)	X_ppa	0.000mm	± 0.002mm
	Y_ppa	0.000mm	± 0.002mm
Lens Distortion	Remaining Distortion less than 0.002mm		

SN: UC-EpII-1-52617043-f100 4

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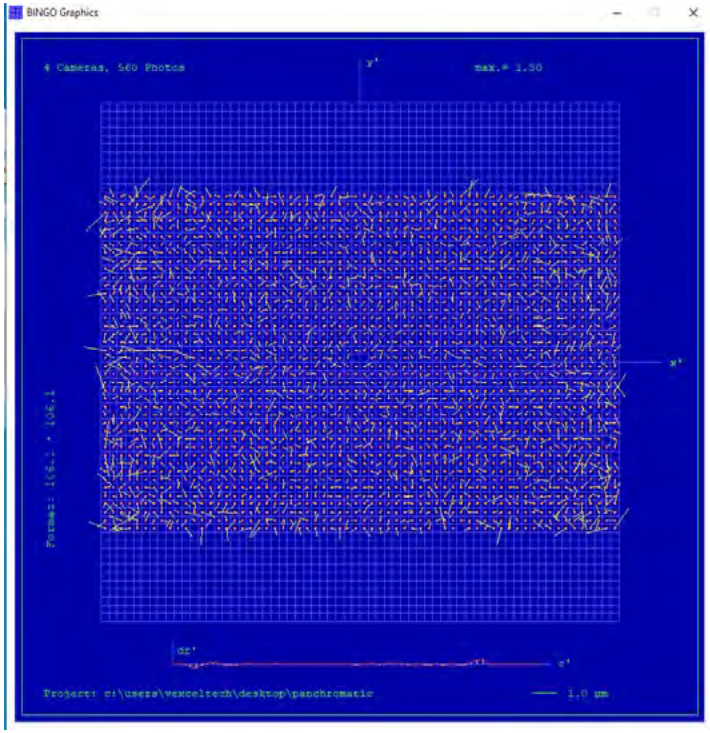
Keystone Equipment (continue)

ULTRACAM

Full Panchromatic Image, Residual Error Diagram



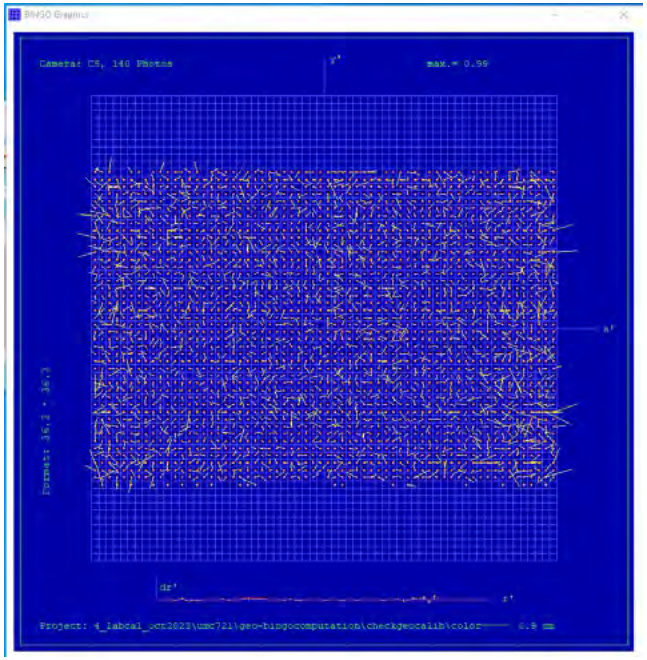
Residual Error (RMS): **0.67 µm**

SN: UC-EpII-1-52617043-f100 5

Keystone Equipment (continue)

ULTRACAM

Green Cone (Cone 5), Residual Error Diagram



Residual Error (RMS): **0.58 µm**

SN: UC-EpII-1-52617043-f100 6

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Keystone Equipment (continue)

Explanations

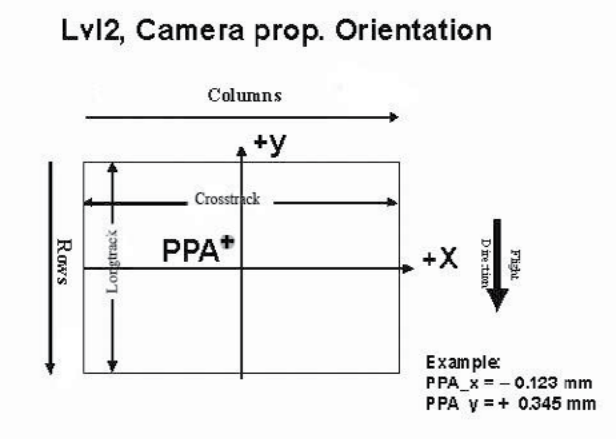
Calibration Method:

The geometric calibration is based on a set of 140 images of a defined geometry target with 394 GCPs.

Number of point measurements for the panchromatic camera : >16000
Number of point measurements for the multispectral camera : >60000

Determination of the image parameters by Least Squares Adjustment.
Software used for the adjustment: BINGO (GIP Eng. Aalen, Germany)

Level 2 Image Coordinate System:



Keystone Equipment (continue)

The image coordinate system of the Level 2 images is shown in the above figure. The basic image format and coordinate of the principal point in the level 2 image is given on page 4 of this report. The above figure shows the position of an example principal point at the coordinate (-0.123 / 0.345).

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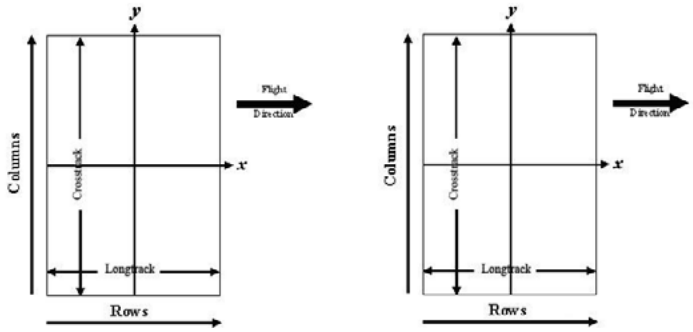
Keystone Equipment (continue)

Level 3 Image Coordinate System:
(after rotation of 270° CW)



Panchromatic Image Format

Multispectral Image Format

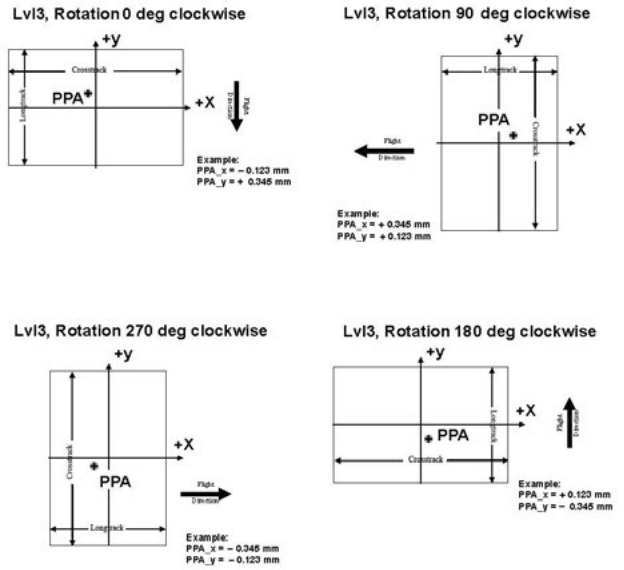
Position of Principal Point in Level 3 Image

The position of the principal point in the level 3 image depends on the "rotation" setting used in UltraMap during the pan-sharpening step. The exact position relative to the image center is given in the table below as a function of the rotation setting used in UltraMap. The coordinates are specified for clockwise (CW) rotation in steps of 90 degrees, according to the principal point coordinate given on page 4 for high- and low resolution images.

Image Format	Clockwise Rotation (Degree)	PPA	
		X	Y
Level 2	-	0.000	0.120
Level 3	0	0.000	0.120
Level 3	90	0.120	0.000
Level 3	180	0.000	-0.120
Level 3	270	-0.120	0.000

Keystone Equipment (continue)

The coordinates in the figure below are only example values to illustrate the effect of image rotation on the principal point position, and do **not** correspond to the camera described in this report.



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Keystone Equipment (continue)

ULTRACAM

Lens Resolving Power

The following curves show the development of the modulation transfer function across different image heights of the panchromatic cones.
Please note that these values have been calculated and can vary up to 10% with optics from production (especially at high LP's).

The curves are given for the meridonial (tangential) and sagital (radial) component of signals at frequencies of 12.5, 25, 50 and 100 line pairs per millimeter.

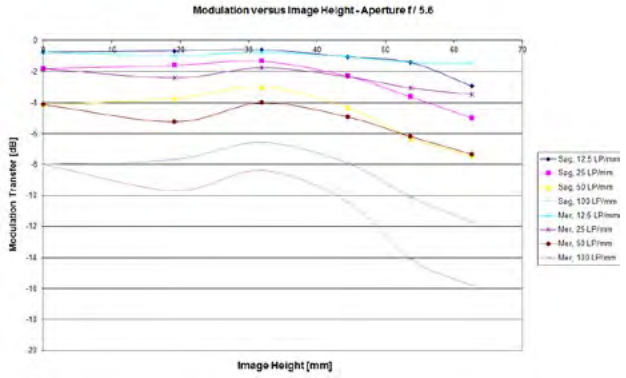
As the MTF is a function of the specific aperture size used, one set of curves is given for each aperture size.

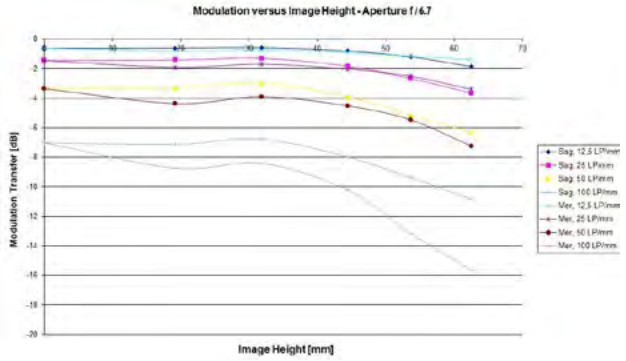
Lens types

Cone	Lens
C0 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/100mm, Qioptic GmbH, Germany
C1 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/100mm, Qioptic GmbH, Germany
C2 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/100mm, Qioptic GmbH, Germany
C3 (PAN)	Qioptic Vexcel HR Digaron 1:5,6/100mm, Qioptic GmbH, Germany
C4 (RED)	Qioptic Vexcel HR Digaron 1:4/33mm, Qioptic GmbH, Germany
C5 (GREEN)	Qioptic Vexcel HR Digaron 1:4/33mm, Qioptic GmbH, Germany
C6 (BLUE)	Qioptic Vexcel HR Digaron 1:4/33mm, Qioptic GmbH, Germany
C7 (NIR)	Qioptic Vexcel HR Digaron 1:4/33mm, Qioptic GmbH, Germany

Keystone Equipment (continue)

ULTRACAM





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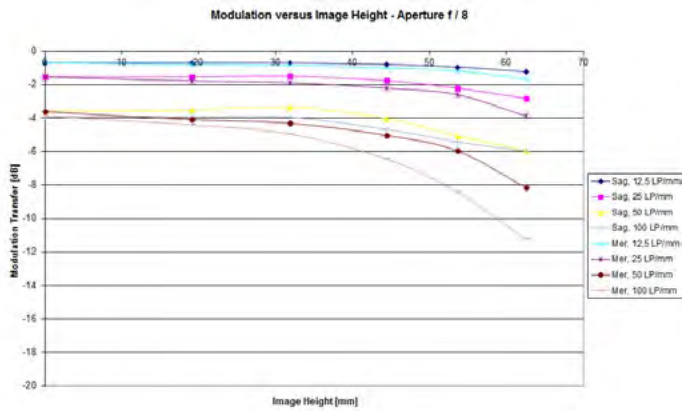
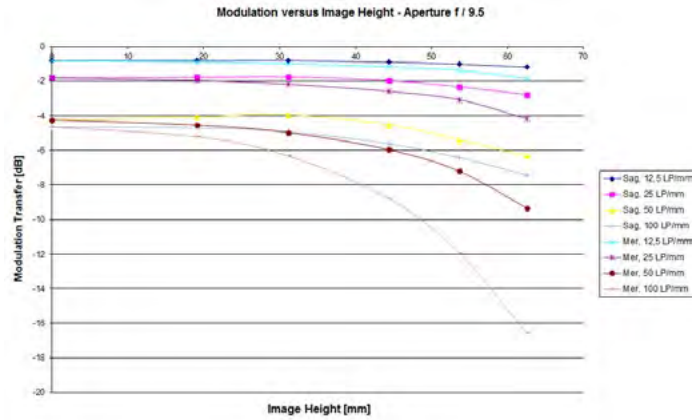
Keystone Equipment (continue)

ULTRACAM

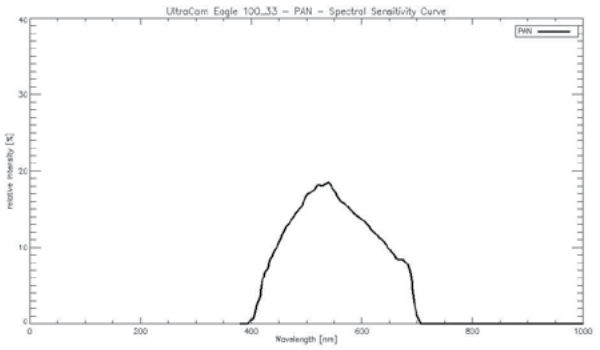


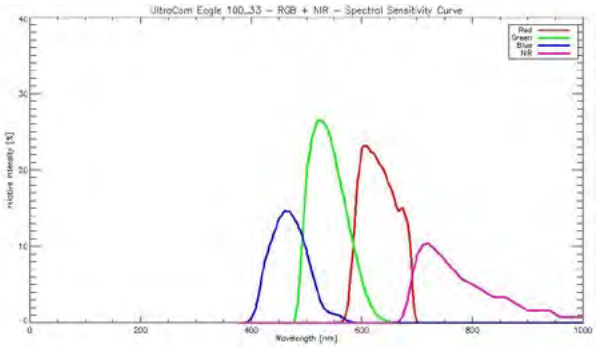


Keystone Equipment (continue)

ULTRACAM

Spectral Sensitivity





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Keystone Equipment (continue)

ULTRACAM

ULTRACAM

Radiometric Calibration

Camera: **UltraCam Eagle M3**
Serial: **UC-EpII-1-52617043-f100**

	PAN	R, G, NIR	B
Used Apertures	F5.6	F4.8	F4.8
	F6.7	F5.6	F4.8
	F8	F6.7	F4.8
	F9.5	F8	F5.6
	F11	F9.5	F6.7
	F13	F11	F8
	F16	F13	F9.5
	F22	F19	F13

Dead Pixel Report: see Appendix I

SN: UC-EpII-1-52617043-f100 15

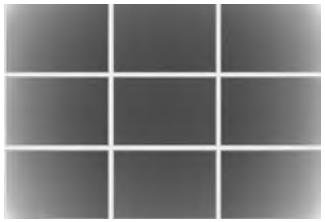
Keystone Equipment (continue)

ULTRACAM

Calibration of Vignetting for working Aperture F6.7

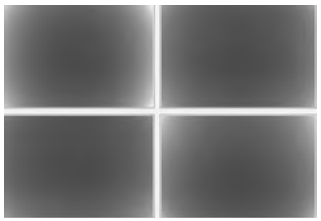
	PAN	R, G, NIR	B
Aperture	F6.7	F5.6	F4.8

Graphical Overview of Pan Sensors:



00_00	01_00	00_01
02_00	03_00	02_01
00_02	01_01	00_03

Graphical Overview of Multispectral Sensors:



04_00 (RED)	06_00 (BLUE)
05_00 (GREEN)	07_00 (NIR)

SN: UC-EpII-1-52617043-f100 16

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Keystone Equipment (continue)

ULTRACAM

Explanations

Calibration Method:

The radiometric calibration is based on a series of 50 flat field images for each aperture size and sensor. The flat field is illuminated by eight normal light lamps with known spectral illumination curves.

These images are used to calculate the specific sensitivity of each pixel to compensate local as well as global variations in sensitivity. Sensitivity tables are calculated for each sensor and aperture setting, and applied during post processing from level 0 to level 1.

Outlier Pixels that do not have a linear behavior as described in the CCD specifications are marked as defective during the calibration procedure. These pixels are not used or only partially used during post processing and the information is restored by interpolation between the neighborhood pixels surrounding the defective pixels.

Certain pixels that are named Qmax pixels due to the fact that they can only store and transfer charge up to a certain maximum amount are detected in an additional calibration step. These pixels are treated differently during post processing, since their behavior can affect not only single pixel values but whole columns.

Keystone Equipment (continue)

ULTRACAM

ULTRACAM

Shutter Calibration

Camera:	**UltraCam Eagle M3**
Serial:	**UC-EpII-1-52617043-f100**
Panchromatic Camera:	**4 * Prontor Magnetic 0 HS Prontor-Werk Alfred Gauthier GmbH, Germany**
Multispectral Camera:	**4 * Prontor Magnetic 0 HS Prontor-Werk Alfred Gauthier GmbH, Germany**

20. Certifications/Licenses: If the advertisement requires submission of licenses and/or certificates, include them here. **Otherwise, leave this section blank.**

Keystone Equipment (continue)

ULTRACAM

Calibration of Shutter Release Times:

The shutter release times measured during the calibration describe the time from the moment when the electrical current through the shutter is turned off by the electronics, until the shutter is mechanically closed.

This time is relevant for the exposure control and needs to be known before image recording can take place.

Currently used SRT values (operation values):

Cone Number	Lens Serial Number	SRT F5.6 [ms]	SRT F6.7 [ms]	SRT F8 [ms]	SRT F9.5 [ms]	SRT F11 [ms]	SRT F13 [ms]	SRT F16 [ms]	SRT F22 [ms]	Measurement Tolerance [ms]
C0 (Pan)	12 57 52 45	7.08	7.19	7.50	7.72	7.90	8.09	8.26	8.60	+/- 0.2
C1 (Pan)	12 57 52 52	6.61	6.79	7.11	7.34	7.53	7.64	7.81	8.13	+/- 0.2
C2 (Pan)	12 57 52 51	6.82	6.99	7.29	7.54	7.73	7.86	8.03	8.35	+/- 0.2
C3 (Pan)	12 57 52 38	5.92	6.19	6.47	6.70	6.83	6.92	7.08	7.29	+/- 0.2
C4 (Red)	12 52 68 67	7.53	7.65	7.79	7.94	8.08	8.24	8.32	8.56	+/- 0.2
C5 (Green)	12 52 68 54	7.65	7.78	7.95	8.09	8.19	8.27	8.44	8.54	+/- 0.2
C6 (Blue)	12 52 68 59	7.71	7.71	7.68	7.87	8.11	8.19	8.41	8.69	+/- 0.2
C7 (NIR)	12 52 68 73	7.66	7.82	7.98	8.10	8.29	8.47	8.63	8.99	+/- 0.2

Keystone Equipment (continue)

ULTRACAM

ULTRACAM

Electronics and Sensor Calibration

Camera: **UltraCam Eagle M3**
Serial: **UC-EpII-1-52617043-f100**

Panchromatic Camera: **9 * FTF9060-M Area CCD Sensor by DALSA**
Multispectral Camera: **4 * FTF9060-M Area CCD Sensor by DALSA**

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Keystone Equipment (continue)

ULTRACAM

Calibration of Negative Substrate Voltage (VNS):

For optimum performance of the DALSA CCD sensors, the negative substrate voltage is adjusted to a value specified by DALSA.

This voltage value is measured to achieve the best anti-blooming performance possible for each particular sensor.

Currently used VNS and VOG values (operation values):

Cone_Sensor	Sensor Type	Sensor Serial Number	VNS Voltage [V]	VOG Voltage [V]
00_00	FTF9060-M	20 1289/106	22.20	6.68
00_01	FTF9060-M	20 1289/100	21.60	6.41
00_02	FTF9060-M	20 1289/083	21.40	6.62
00_03	FTF9060-M	20 5220/030	21.40	6.30
01_00	FTF9060-M	20 1289/085	21.60	6.23
01_01	FTF9060-M	20 9941/062	21.40	6.13
02_00	FTF9060-M	21 0265/015	21.40	6.11
02_01	FTF9060-M	20 5221/022	22.00	6.14
03_00	FTF9060-M	20 5221/009	20.00	5.88
04_00 (red)	FTF9060-M	20 1289/102	21.60	6.92
05_00 (green)	FTF9060-M	20 9941/066	21.20	6.14
06_00 (blue)	FTF9060-M	20 1289/084	21.60	6.50
07_00 (NIR)	FTF9060-M	20 1289/105	22.20	6.35

Keystone Equipment (continue)

ULTRACAM

Calibration of Intensity Threshold for Exposure Control:

Each CCD sensor and electronics module varies slightly in global sensitivity and intensity scale.

Therefore the maximum possible intensity of each sensor needs to be measured to evaluate the sensitivity behavior of the CCD and electronics.

This value is used as a threshold for the exposure control dialogue shown in the in-flight user interface of the Eagle.

Currently used Threshold values (operation values):

Cone_Sensor	Sensor Type	Sensor Serial Number	Intensity Threshold [DN] Tap 1	Tap2
00_00	FTF9060-M	20 1289/106	13390	12530
00_01	FTF9060-M	20 1289/100	13320	12390
00_02	FTF9060-M	20 1289/083	13360	12400
00_03	FTF9060-M	20 5220/030	13930	12680
01_00	FTF9060-M	20 1289/085	13450	12170
01_01	FTF9060-M	20 9941/062	13500	12260
02_00	FTF9060-M	21 0265/015	13510	12620
02_01	FTF9060-M	20 5221/022	12510	11530
03_00	FTF9060-M	20 5221/009	14150	13110
04_00 (red)	FTF9060-M	20 1289/102	13170	12020
05_00 (green)	FTF9060-M	20 9941/066	14180	13090
06_00 (blue)	FTF9060-M	20 1289/084	13070	12270
07_00 (NIR)	FTF9060-M	20 1289/105	13040	12370

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Keystone Equipment (continue)

ULTRACAM

Summary

Camera:	**UltraCam Eagle M3**
Serial:	**UC-EpII-1-52617043-f100**
Laboratory Calibration Date:	**Oct-18-2023**
Camera Revision:	**Re04.00**
Date of Report:	**Oct-18-2023**
Version of Report:	**V01**

The following calibrations have been performed for the above mentioned digital aerial mapping camera:

- Geometric Calibration
- Radiometric Calibration
- Shutter Calibration
- Sensor and Electronics Calibration

This equipment is operating fully within specification as defined by Vexcel Imaging GmbH.

Dr. Michael Gruber
Chief Scientist, Photogrammetry
Vexcel Imaging GmbH

Dipl. Ing. (FH) Helmut Jauk
Senior Project Engineer R&D
Vexcel Imaging GmbH

21. QA/QC Plan: If the advertisement requires submission of a QA/QC plan, include it here. **Otherwise, leave this section blank. If a QA/QC plan is included in this section and was not required by the advertisement, it will be redacted.**

Per the RFP and if selected, Dewberry's QA/QC plan will be submitted to the DOTD PM within 10 business days of the award notification to the Consultant.

22. Sub-consultant information: If one or more sub-consultants will be used, provide the name, address, point of contact and phone number for each. Otherwise, leave this section blank.

FIRM NAME (Name must match exactly as registered with Louisiana's Secretary of State (SOS): including punctuation, include screenshot(s) from SOS at the end of Section 20)	ADDRESS	POINT OF CONTACT AND EMAIL ADDRESS	PHONE NUMBER
Keystone Aerial Surveys, Inc.	Northeast Philadelphia Airport 9800 Ashton Road Philadelphia, PA 19114	John Schmitt John.schmitt@vexcelgroup.com	215.677.3119 x315
Forte and Tablada, Inc.	9424 Interline Avenue Baton Rouge, LA 70809	Brad Holleman bholleman@forteandtablada.com	225.927.9321

(Add rows as needed)

23. Location: If location is an evaluation criterion for this advertisement (see page 2) and the prime consultant intends to establish a local presence, describe the plan for doing so. **Otherwise, leave this section blank. Any information included in this section will be redacted if not required by the Evaluation Criteria section of the advertisement.**

N/A