REQUEST FOR PROPOSAL

SOLICITATION NUMBER: AG-8447-S-15-0003

DIGITAL AERIAL IMAGERY
Prescott National Forest, Arizona
Cibola National Forest Grasslands, NM, OK, and TX

Solicitation Issue Date: May 11, 2015
Proposal Due Date: June 10, 2015

U.S. DEPARTMENT OF AGRICULTURE
FARM SERVICE AGENCY
AERIAL PHOTOGRAPHY FIELD OFFICE

NOTICE TO OFFEROR

Any proposal submitted for this RFP must be identified with the following information labeled on the outside of the mailing package:

SOL.NO: AG-8447-S-15-0003
DUE DATE: June 10, 2015, 3:00 PM MT
RECEIVING OFFICE: CONTRACTING

Mail To: AERIAL PHOTOGRAPHY FIELD OFFICE
CONTRACTING OFFICER
2222 WEST 2300 SOUTH
SALT LAKE CITY UTAH 84119

NOTICE TO PROSPECTIVE OFFERORS :

OFFERORS ARE CAUTIONED TO NOTE THE FOLLOWING SPECIAL REQUIREMENTS:

See Section L for Proposal Preparation Instructions, including page limits.

Items include 4-band, 8-bits per band color corrected stereo imagery, stereo block files, and orthorectified imagery. An option for increased quantity is included (Section B-5).

NOTE: This project contains requirements that vary from similar past projects:

- C-5.3: Minimum sun angle requirements to reduce shadows; overlap requirements for stereo coverage and minimal tree lean
- C-6.1 & 6.3: Pre-production sample requirements
- C-6.5: Stereo block file projection
- Exhibit 4 and 8: Changes in progress report and flight line/exposure numbering requirements
- L-2.3(a): Past performance references required without recent APFO digital imagery contracts
- L-2.3(b): Sample requirements for non-frame based sensors and proposed deviation from original image resolution tolerances in Attachment B

This RFP is a Total Small Business Set-Aside (FAR 52.219-6) and is subject to the Availability of Funds Clause (FAR 52.232-18).

The complete text of any or all clauses referenced herein may be obtained by submitting a request, identifying this solicitation number, to the Contracting Officer, USDA, FSA, Aerial Photography Field Office, 2222 West 2300 South, Salt Lake City, Utah 84119. Complete copies of the FAR in loose-leaf or CFR form may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402.

SOLICITATION, OFFER AND AWARD

1. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700) ▶ RATING

2. CONTRACT NUMBER	3. SOLICITATION NUMBER	4. TYPE OF SOLICITATION	5. DATE ISSUED	6. REQUISITION/PURCHASE NUMBER
	AG-8447-S-15-0003	☐ SEALED BID (IFB) ☒ NEGOTIATED (RFP)	5/11/2015	

7. ISSUED BY CODE

USDA-FSA-Aerial Photography Field Office
2222 West 2300 South
Salt Lake City, UT 84119-2020

8. ADDRESS OFFER TO *(If other than Item 7)*

Contracting Officer, USDA/FSA-APFO
2222 West 2300 South
Salt Lake City, UT 84119-2020

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

SOLICITATION

9. Sealed offers in original and 1 copies for furnishing the supplies or services in the Schedule will be received at the place specified in Item 8, or if handcarried, in the depository located in Rm. 10, Aerial Photography Field Office until 15:00 *(Hour)* local time 6/10/2015 *(Date)*

CAUTION - LATE Submissions, Modifications, and Withdrawals: See Section L, Provision No. 52.214-7 or 52.215-1. All offers are subject to all terms and conditions contained in this solicitation.

10. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE *(NO COLLECT CALLS)*			C. E-MAIL ADDRESS
		AREA CODE	NUMBER	EXT.	
	Michelle C. Clifford	801	844-2909		michelle.clifford@slc.

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OFFER *(Must be fully completed by offeror)*

NOTE: Item 12 does not apply if the solicitation includes the provisions at 52.214-16, Minimum Bid Acceptance Period.

12. In compliance with the above, the undersigned agrees, if this offer is accepted within _____ calendar days *(60 calendar days unless a different period is inserted by the offeror)* from the date for receipt of offers specified above, to furnish any or all items upon which prices are offered at the price set opposite each item, delivered at the designated point(s), within the time specified in the schedule.

13. DISCOUNT FOR PROMPT PAYMENT *(See Section I, Clause No. 52.232-8)*	10 CALENDAR DAYS (%)	20 CALENDAR DAYS (%)	30 CALENDAR DAYS (%)	CALENDAR DAYS (%)

14. ACKNOWLEDGMENT OF AMENDMENTS *(The offeror acknowledges receipt of amendments to the SOLICITATION for offerors and related documents numbered and dated)*:	AMENDMENT NO.	DATE	AMENDMENT NO.	DATE

15A. NAME AND ADDRESS OF OFFEROR — CODE ____ FACILITY ____

16. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*

15B. TELEPHONE NUMBER			15C. CHECK IF REMITTANCE ADDRESS IS DIFFERENT FROM ABOVE - ENTER SUCH ADDRESS IN SCHEDULE.	17. SIGNATURE	18. OFFER DATE
AREA CODE	NUMBER	EXT.	☐		

AWARD *(To be completed by Government)*

19. ACCEPTED AS TO ITEMS NUMBERED	20. AMOUNT	21. ACCOUNTING AND APPROPRIATION

22. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION:
☐ 10 U.S.C. 2304(c)) ☐ 41 U.S.C. 253(c) ( )

23. SUBMIT INVOICES TO ADDRESS SHOWN IN *(4 copies unless otherwise specified)* ▶ ITEM

24. ADMINISTERED BY *(If other than Item 7)* CODE ____

25. PAYMENT WILL BE MADE BY CODE ____

26. NAME OF CONTRACTING OFFICER *(Type or print)*

27. UNITED STATES OF AMERICA
(Signature of Contracting Officer)

28. AWARD DATE

IMPORTANT - Award will be made on this Form, or on Standard Form 26, or by other authorized official written notice.

PART I - THE SCHEDULE

SECTION B - SUPPLIES OR SERVICES AND PRICES/COSTS

B-1 DIGITAL AERIAL PHOTOGRAPHY SERVICES/SUPPLIES

Furnish direct digital aerial imagery and all related services and supplies in accordance with the requirements, specifications, terms, conditions, clauses, and provisions specified herein.

1.1 Services and Supplies

For purposes of this combined service/supply contract, the services portion is considered the management, execution, and related services associated with the acquisition of the imagery. The supply portion is considered all material, processing, and activities required to manufacture the end products derived from the raw imagery acquired during the services portion of the contract.

1.2 Intended Use of Imagery

The imagery shall be used by the United States Forest Service for forest and range resource management, monitoring and inventory. Imagery is used to support the management of land, minerals, vegetation, wildlife habitat, recreation and travel. Additional supported activities include watershed health assessments, riparian monitoring, forest health evaluations, and preliminary engineering conceptual designs. Aerial imagery depicting the current vegetation condition is needed to establish structural class, canopy closure, and plant association for use in determining vegetation departure from the historic range of variability and in establishing baseline monitoring data. Natural resource and other data will be collected and evaluated by means of photo interpretation (visual display and stereo viewing), image processing and geographic information systems (GIS) technologies.

B-2 PROJECT AREA(S)

Provide aerial imagery services and related materials for the acquisition and production of leaf-on, 25cm resolution, 4-band, direct digital stereo imagery for the following project area(s):

Project Item	Project Area	Square Miles	Approximate Acquisition Period	UTM Zone	Project Code	Project Identifier
1	Prescott National Forest, AZ	2,204	Date of award through September 30, 2015*	12	613090	FS-5-15-1
2	Cibola National Forest Grasslands (Black Kettle, Kiowa, McClellan Creek, Rita Blanca), NM, OK, and TX	1,733	Date of award through September 30, 2015*	13	613030	FS-5-15-2

*Early summer acquisition is preferable for conditions best meeting the intended use of the imagery.

B-3 CONTRACT DELIVERABLES

3.1 Base Item Deliverables. The following deliverables are required under this contract.

(a) Stereo Imagery

Stereo Imagery Deliverables	**Section & Paragraph Reference(s)**
Project Flight Plan – submit prior to notice to proceed	Section C-5.2
Pre-production Samples for Image Files and Stereo Block File	Section C-6.1(b) Section C-6.5(b)
25cm, 4-Band, 8-bit per band, Color Corrected, Georeferenced, Uncompressed Digital Image Files	Section C-6.1
Stereo Block Files	Section C-6.5
Supplemental GPS Ground Data	Section C-6.4
Project Geodatabase	Section C-7.2
Progress Reports	Section C-7.1

(b) Orthorectified Imagery

Orthorectified Imagery Deliverables	**Section & Paragraph Reference(s)**
Pre-production Samples – one DOQQQ per landscape	Section C-6.2
25cm, 4-band, 8-bit per band, Digital Orthorectified Quarter-Quarter Quadrangles (DOQQQ)	Section C-6.2
RMSE Accuracy and Quality Control Reports, Aero-Triangulation Report (included with DOQQQ)	Section C-8.1
Seamline Feature Class and Orthorectified Image Index Feature Class included in Project Geodatabase	Section C-7.2

B-4 OPTIONS

4.1 Option for Increased Quantity (FAR 52.217-6) (Mar 1989)

The Government may increase the quantity of supplies called for in the Schedule at the unit price specified. The Contracting Officer may exercise the option upon mutual agreement with the Contractor prior to the end of the approximate acquisition period stated in Section B-2, or extension thereof. Delivery of the added items shall continue at the same rate as the like items called for under the contract, unless the parties otherwise agree. The quantity may be increased by up to 30% of the original combined quantities stated in B-5.1 and B-5.2 of this section.

B-5 PRICING

Project Items may be awarded separately (i.e. to two offerors), if determined to be the best value to the Government, pricing and other factors considered.

1. Insert pricing in B-5.1 and B-5.2 based on the possibility of separate awards.
2. Insert pricing for award of both project items in B-5.3.

5.1 PROJECT ITEM 1: PRESCOTT NATIONAL FOREST, AZ

Insert proposed pricing below based on award of single project item only.

Project Item 1: Prescott National Forest, Arizona						
Item	**Description**	**Section**	**Qty**	**Unit**	**Unit Price**	**Total Amount**
Item 1	Stereo Imagery & 3 Stereo Block Files	B-3.1(a)	2,204	Square Miles	$	$
Item 1A	Orthorectified Imagery	B-3.1(b)	712	DOQQQ*	$	$
					Total	**$**

* Insert average price of DOQQQ.

5.2 PROJECT ITEM 2: CIBOLA NATIONAL FOREST GRASSLANDS, NM, OK, TX

Insert proposed pricing below based on award of single project item only.

Project Item 2: Cibola National Forest Grasslands (Black Kettle, Kiowa, McClellan Creek, Rita Blanca), NM, OK, TX						
Item	**Description**	**Section**	**Qty**	**Unit**	**Unit Price**	**Total Amount**
Item 2	Stereo Imagery & 6 Stereo Block Files	B-3.1(a)	1,733	Square Miles	$	$
Item 2A	Orthorectified Imagery	B-3.1(b)	590	DOQQQ*	$	$
					Total	**$**

* Insert average price of DOQQQ.

5.3 PRICING FOR AWARD OF BOTH PROJECT ITEMS

Insert pricing for award of both project items below.

Project Item 1: Prescott National Forest, Arizona						
Item	**Description**	**Section**	**Qty**	**Unit**	**Unit Price**	**Total Amount**
Item 1	Stereo Imagery & 3 Stereo Block Files	B-3.1(a)	2,204	Square Miles	$	$
Item 1A	Orthorectified Imagery	B-3.1(b)	712	DOQQQ*	$	$
					Total	**$**
Project Item 2: Cibola National Forest Grasslands (Black Kettle, Kiowa, McClellan Creek, Rita Blanca), NM, OK, TX						
Item	**Description**	**Section**	**Qty**	**Unit**	**Unit Price**	**Total Amount**
Item 2	Stereo Imagery & 6 Stereo Block Files	B-3.1(a)	1,733	Square Miles	$	$
Item 2A	Orthorectified Imagery	B-3.1(b)	590	DOQQQ*	$	$
					Total	**$**

* Insert average price of DOQQQ

B-6 GOVERNMENT-PROVIDED INFORMATION

Upon Contract award, the Government shall provide the information listed below. Shapefiles provided may be in projections that differ from the projection requirements of the final product. The contractor is responsible for notifying the Contracting Officer of any discrepancies or problems encountered in using this information within two business days.

6.1 Project Boundary Shapefile

The Contractor will be furnished upon award one (1) Esri® compatible shapefile containing the project boundary for each Project Item awarded. Due to the unique footprint of digital sensors the Contractor is responsible for the complete stereo coverage acquisition of the project shapefile area, including the boundaries.

6.2 Metadata Templates

The Contractor will be furnished upon award data text files (.txt), as applicable, containing Federal Geographic Data Committee (FGDC) compliant metadata templates with Remote Sensing Extensions where applicable to be used for: (1) the georeferenced uncompressed digital image files in Section C-6.1; (2) the DOQQQ files required in Section C-6.2 (if awarded); (3) the Stereo Block Files in Section C-6.5; (4) the Project Geodatabase in Section C-7.2. Templates will not be provided for other required metadata.

6.3 Stereo Block Area Boundary Files

The contractor will be furnished upon award an Esri® compatible shapefile containing the area boundaries for creation of stereo block files in Section C-6.5.

6.4 DOQQQ Shapefile

The Contractor will be furnished upon award Esri® I compatible shapefile(s) containing the required DOQQQs for each project item awarded. The shapefile does not include the buffer area required in Section C-6.2. The contractor must add the required buffer to the shapefile provided.

6.5 Project Geodatabase Template

The Contractor will be furnished upon award one (1) Esri® compatible file geodatabase template for use in producing the Project Geodatabase in Section C-7.2.

PART I - THE SCHEDULE

SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

C-1 SCOPE OF CONTRACT

The general scope of the contract is to procure precise vertical aerial imagery for natural resource inventory and analysis and stereo model review. The Contractor is responsible for furnishing direct digital imagery and related services and supplies in accordance with requirements, specifications, terms and conditions specified herein.

1.1 Technical Requirements and Specifications

The technical requirements and specifications of this contract are described in this section and Attachments A, B, and C which define the essential elements in securing high quality digital imagery. Any deviation from the specifications stated herein may cause increased time and effort in using the imagery as intended.

1.2 Labor and Materials

The Contractor shall furnish all materials, equipment, transportation, superintendence, and labor as required herein. The Contractor shall execute and finish the imagery acquisition, imagery production and related services for the project specified and shall deliver to the USDA all materials called for in Section F-2, Materials to be Delivered.

C-2 APPLICABLE DOCUMENTS

2.1 Attachments

The following documents attached to this solicitation document are considered requirements and specifications under the resulting contract(s), as applicable to the Contractor's technical proposal:

(a) Aerial Photography Field Office (APFO) USDA Specification for Digital Camera Based Acquisition, Modified for USFS Resource Imagery March 26, 2012 (Attachment A)
(b) Aerial Photography Field Office (APFO) USDA Digital Imagery Quality Specification, Modified for USFS Resource Imagery March 26, 2012 (Attachment B)
(c) USDA Digital File Format Specification, Version 1.0, January 24, 2013

2.2 References

The following documents referenced in this solicitation document are considered requirements and specifications under the resulting contract(s), as applicable to the Contractor's technical proposal:

(a) Federal Geographic Data Committee (FGDC) Specification, FGDC-STD-001-1998 ("Content Standard for Digital Geospatial Metadata")
(b) Federal Geographic Data Committee (FGDC) Specifications, FGDC-STD-007.3-1998 ("Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy")
(c) Code of Federal Regulation (CFR) Title 14 ("Federal Aviation Regulations")
(d) GeoTIFF Revision 1.0 Specification, dated December 28, 2000 (Version 1.8.2)
(e) TIFF Specification Revision 6 dated June 3, 1992 (Adobe Systems Inc.)

C-3 GENERAL REQUIREMENTS

The Contractor shall furnish all materials, equipment, transportation, superintendence, and labor required to plan, acquire, manage, and process digital imagery for the project items as specified in Section B, Supplies or Services and Price/Cost.

C-4 EQUIPMENT REQUIREMENTS

4.1 Platform/Camera Requirements

(a) The direct digital imagery acquisition requirements will be for the collection of visible (Red, Green, Blue) and color near infrared (IR) imagery captured simultaneously. The digital sensor system shall be a tested, stable, geometrically calibrated system with appropriate documentation and comply with the technical requirements and specifications of this contract, and Attachment A: USDA Digital Camera Specification which defines the essential elements in securing high quality direct digital imagery.

(b) Platform/Camera Approval: Any equipment (platform and cameras) proposed to be used by the Contractor must be approved for use by the Contracting Officer (see Attachment A, paragraph 4.0, Digital Camera Approval Requirements, for instructions and process for platform/camera approval). If the platform and camera proposed for use are not owned by the Contractor, a written statement of availability from the owner of the equipment shall be provided to the Contracting Officer.

(b) System Malfunction: The Contracting Officer shall have the right to require the removal of a camera from use when deficiencies in imagery attributable to the camera are found to exist (see Attachment A, paragraph 3.7, System Malfunctions). Any platform/camera removed from use by the Contracting Officer shall not be returned to use on any APFO contract until the cause of the malfunction is corrected to the satisfaction of the Contracting Officer. That determination will be based on acceptable samples, field reports, manufacturer reports, and/or calibration reports.

4.2 Aircraft Requirements

(a) FAA Certification. All aircraft used in the performance of this contract shall be maintained and operated in accordance with all regulations required by the U.S. Department of

Transportation, Federal Aviation Administration (FAA). Aircraft operated in the acquisition of aerial imagery under this contract shall be FAA certified to a service ceiling with operating load (crew, sensor system, oxygen, and other required equipment) of not less than the highest altitude required.

(b) Positive Control Airspace. The project item areas may contain areas of controlled or restricted airspace. It is the responsibility of the Contractor to obtain all approvals necessary to assure that required clearances are achieved. When the flight plan and location of any project area coverage fall within positive-control airspace, the aircraft must contain the appropriate equipment to operate in such positive-control areas within the purview of the Federal Aviation Regulations. In addition, 18 USC Section 795 requires permission of the commanding officer to photograph or map some military and naval installations. If any delay to the acquisition or production schedule is caused due to 18 USC Section 795 or similar statutes, the Contractor is required to notify the Contracting Officer in writing within 72 hours and shall include detail information regarding the issue, point of contact at the installation, and estimated delay. (See Section H-1, Permits and Clearances.)

(c) Aircraft Configuration. The design of the aircraft shall be such that when the sensor system is mounted with all its parts within the outer structure, an unobstructed field of view is obtained. The field of view shall be shielded from the exhaust gases, oil, effluence, and air turbulence. The sensor system port glass shall be free of scratches and of such quality that it will not degrade the resolution or the accuracy of the sensor system.

(d) Airborne Global Positioning System. The aircraft shall have an Airborne Global Positioning System (ABGPS), Inertial Measurement Unit (IMU) system capable of generating accurate control points used in the creation of the photo-center point feature class (see Section C-7.2, Project Geodatabase).

C-5 IMAGERY ACQUISITION REQUIREMENTS

5.1 Photographic Conditions

Imagery shall be acquired leaf-on when skies are clear, free from smoke, clouds, cloud shadows, excessive haze, and well-defined images can be resolved. The ground shall be free from snow below timberline, standing water (other than natural or man-made ponds and lakes), flood waters from streams which have overflowed their banks, and wet ground which obscures vegetation or other features. If any conditions besides clouds and cloud shadows noted above are present at time of acquisition, the Contracting Officer should be contacted to determine whether conditions would be acceptable for acquisition due to potential mission time constraints.

5.2 Flight Planning

The Contractor shall create a flight plan to be submitted to the Contracting Officer for review prior to receiving the Notice to Proceed to commence acquisition of the project area. The flight plan shall provide a layout necessary for acquiring precision, high quality, stereo imagery, and be submitted as shapefiles compatible with Esri® ArcGIS 10.1 and newer version software.

Shapefiles shall include the following: a DEM-applied coverage polygon shapefile, a flight line shapefile, and an exposure station point shapefile. Table attributes should include pre-determined flying altitudes (above sea level) and exposure station locations. Exposure station location shall include at a minimum flight line and exposure number in consecutive order.

5.3 Flight Requirements

The Contractor shall obtain precise vertical digital imagery in accordance with the following technical requirements:

(a) Spatial Resolution: All imagery shall be acquired at 25cm ground sample distance (GSD) or higher resolution.

(b) Radiometric Resolution: All imagery shall be collected at a minimum of 12-bits per band.

(c) Minimum Sun Angle: All imagery shall be collected during the portion of the day when the minimum sun angle exceeds 45 degrees. Where practical, a higher sun angle should be utilized over steep canyon areas to minimize shadow and enable viewing of ground features.

(d) Overlaps: Endlap: Optimum 62%; Minimum 57%; Recommended Maximum 67%
Sidelap: Optimum 30%; Minimum 20%; Recommended Maximum 45%

The minimum overlaps above may not be adequate for stereo viewing in areas of high relief. The contractor is responsible for determining overlaps necessary to ensure stereo viewing and/or ortho mosaic compilation with minimal tree lean. The recommended maximum may be exceeded in order to provide this coverage.

(e) Flight Line Direction: North-South or East-West flight lines only

(f) Coverage: Imagery shall be collected to provide complete stereo coverage of the project area and boundaries in the government-provided shapefile defined in Section B-6.1, Project Boundary Shapefile.

(g) Tilt. It is desired that exposures be made when the optical axis of the digital sensor is in a vertical position. The Contractor shall not acquire imagery when the tilt (departure from the vertical) of any exposure exceeding four degrees (4º) or relative tilt between any two successive exposures exceeding six degrees (6º). Tilt shall not average more than 2 degrees (2º) in any 16 km (10 mile) section of a flight line and shall not average more than 1 degree (1º) for the entire project.

(h) Crab. Any series of two or more images shall not be crabbed in excess of five degrees (5º) as measured between images in a line and between adjoining lines.

C-6 DIGITAL IMAGERY PROCESSING

Digital images shall be processed to meet the requirements of this section, Attachment B, USDA Digital Imagery Quality Specifications, and Attachment C, USDA Digital File Format Specifications. GeoTIFF files must be processed to meet requirements of Adobe TIFF and GeoTIFF Specifications. All image files and supporting files shall use the naming convention specified in Exhibit 2, File Naming Convention and shall be stored on a hard drive (See Section D-1.2) according to the Hard Drive Directory Structure Template, Exhibit 10.

The Contractor shall create a metadata file for each digital image and stereo block file described in this section. Metadata files shall be created in accordance with the template provided by the Government (see Section B-6.2) and Federal Geographic Data Committee (FGDC), FGDC-STD-001-1998 specification. Metadata files shall be compatible with ArcGIS 10.1 and must parse cleanly through the USGS metadata parser "mp" version 2.9.23 with Remote Sensing Extensions without any errors.

6.1 Color Corrected Stereo Image Files

The Contractor shall produce 4-band, 8-bit per band, color corrected, georeferenced, uncompressed, digital image files at the resolution stated in Section C-5.3 to provide stereo coverage of the project area and boundaries defined in the Project Boundary Shapefile, (see Section B-6.1). The image shall be submitted in the native camera footprint. Non-frame based sensors shall submit imagery in a tile format comparable to frame-based sensors. File sizes shall be no larger than 1.3 gigabytes. The file shall be projected in the 1983 North American Datum (NAD83), using the native Universal Transverse Mercator (UTM) zone specified in Section B-2 in meters. If any digital image files are rejected by the contractor's quality control process and/or reflights are acquired, only one acceptable image file shall be submitted.

(a) Image Quality: The Contractor shall make necessary radiometric adjustments, including stretching, dodging, color correction, etc., to the acquired imagery in order to match ground conditions at the time of exposure and to ensure the best possible color balance for both natural color and color infrared. Images shall ***not*** contain 0 cell values.

(b) Pre-Production Sample: Prior to production, the Contractor shall submit a radiometrically corrected GeoTIFF image for evaluation of contrast and color balance for each of the varying landscapes, including:

1. Cibola NGL:
    - i. Canadian River; Mills Canyon Area
    - ii. Any grassland area with drainage
    - iii. Any grassland area mixed with agriculture
    - iv. Cheyenne NW Quad area
2. Prescott NF:
    - i. Upper elevation vegetation
    - ii. Mid elevation vegetation
    - iii. Lower elevation vegetation
    - iv. Riparian drainage

One sample image of each landscape described above meeting all requirements of this section and C-6 must be submitted as a GeoTIFF for evaluation of naming convention, tags, metadata, etc. The Government will evaluate and provide a selection with comments no later than five (5) business days from receipt. Additional samples may be submitted for review if approved by the Contracting Officer.

(c) File Format. The georeferenced tagged image file (GeoTIFF) shall have the following band order: Red, Green, Blue, and Infrared. GeoTIFF files shall be properly georeferenced so that the image is oriented north up when viewed in GIS software including Esri® ArcMap and ERDAS Imagine. The ImageDescription tag shall contain the following project item name: "USDA-FSA-APFO-U.S. Forest Service Resource Program."

(d) Raster Support Files. The Contractor shall provide an AUX (Esri® and ERDAS compatible Auxilary statistic/projection file) and a RRD (Esri® and ERDAS compatible Reduced Resolution Dataset pyramid file) for each image file. Each AUX file shall have statistics calculated with the Skip Factor in the X and Y as 1, and Bin Type as Direct. In addition, the AUX file shall contain the proper projection information for the tile and shall match the information in the GeoTIFF header. Each RRD file shall be created using a 3X3 kernel, Binomial Interpolation.

(e) Georeferenced Accuracy. The principal point shall have an accuracy not exceeding a 6 meter offset from true ground.

6.2 Digital Orthorectified Quarter-Quarter Quadrangle (DOQQQ) Tiles

The Contractor shall provide ortho-rectification services to produce 4-band, 8-bits per band, mosaicked digital orthorectified quarter-quarter quadrangles (DOQQQs) for the project area defined in the Project Boundary Shapefile referenced in Section B-6.1, plus a 100 meter buffer beyond the boundary. The DOQQQ shall cover the entire image area of one quarter of a quarter of a USGS standard quadrant, plus a 100 meter buffer on all four sides. The 100 meter buffer is not included in the DOQQQ shapefile provided. The DOQQQs shall be projected in NAD83 UTM Zone specified in Section B in meters.

(a) Image Quality: The Contractor shall radiometrically balance the images used to create the DOQQQs to eliminate any checkerboard pattern appearance across the project, or for as large of a block practical. Exceptions to this requirement may be made in cases where block or project-wide radiometric balancing would cause significant discoloration across the project, such as reflights. Significant radiometric differences among image frames inhibits interpretation of ground features. The DOQQQs shall not contain any borders, artifacts, or other non-image items. The image portion of the DOQQQ file shall ***not*** contain 0 cell values. The non-image or no-data portion of the DOQQQ file shall be set to 0,0,0,0.

(b) Image Source: The Contractor may use imagery from multiple exposures, i.e., using the "sweet spot" from a preceding or succeeding image, when creating the tile images. Using "chips" (imagery pieces from other frames) to correct defects is also permitted. All exposures shall be from the same type of sensor and must be from the same acquisition season. When multiple exposures are used in creating a tile, the acquisition date with the largest area shall be

used when reporting dates in a single date field, such as metadata or attribute data. An average or mean date shall not be used.

(c) Seamlines: Image seams should be blended to a smooth seam. Visible seamlines within or between tiles which exhibit a noticeable edge or displacement effect are not acceptable. Sharp contrast should not be visible at seams, as it affects image interpretation. Seamlines should be centered on linear features such as roads, rivers, streams, and trails when available. When linear features are not available, seamlines shall be placed at landcover type transition areas such as between a meadow and forested area or based on terrain breaks derived from topographic data such as ridgelines and valley bottoms. Placement of seamlines in tree and shrub vegetation should be minimized.

(d) Partial DOQQQ: When a DOQQQ partially covers the boundary, the Contractor may elect to submit a partial DOQQQ so that it completely covers the boundary, plus a 100 meter buffer on the outside of the boundary.

(e) Pre-Production Sample: Prior to production of the DOQQQs', the Contractor shall submit for Government review a sample DOQQQ for each diversified project landscape (see Section 6-1(b)). The samples shall be a GeoTIFF and meet all image requirements in this section, including tags specified in Attachment C, submitted on a standard DVD. The Government will evaluate and provide an approval or disapproval with comments no later than five (5) business days, with a goal of three (3) business days. Additional project item area samples may be submitted for review if approved by the Contracting Officer.

(f) Spatial Resolution: Specified in Section C-5.3(a).

(g) Horizontal Accuracy: All well-defined points tested on orthorectified tiles shall fall within 6.0 meters of true ground at a 95% confidence level (see FGDC-STD-007.3-1998, page 3-10).

(h) Digital Elevation Model (DEM): The Contractor may use any digital elevation model for terrain-correcting the imagery required to meet horizontal accuracy specifications in paragraph (g) and quality requirements of this section and Attachment B. The Contractor shall document the elevation dataset used during the orthoimagery production process including, but not limited to corrections made to an existing dataset, in the process description metadata field.

(i) File Format: The DOQQQ tiles shall be a georeferenced tagged image file following the naming convention in Exhibit 2 and Exhibit 5, Quarter-Quarter Quad Numbering Logic. The ImageDescription tag shall contain the following project item name "USDA-FSA-APFO-U.S. Forest Service Resource Program."

(j) Raster Support File: The Contractor shall provide an AUX (Esri® and ERDAS compatible Auxilary statistic/projection file) and a RRD (Esri® and ERDAS compatible Reduced Resolution Dataset pyramid file) for each image file. Each AUX file shall have statistics calculated with the Skip Factor in the X and Y as 1, and Bin Type as Direct. In addition, the AUX file shall contain the proper projection information for the tile and shall match the information in the GeoTIFF header. Each RRD shall be created using a 2X2 kernel,

Binomial Interpolation. The files shall use the same naming convention as the image tiles but with an ".rrd" and ".aux" extension respectively.

(k) Metadata: Metadata shall include a separate lineage section for each georeferenced, uncompressed digital image file used in the creation of the DOQQQ. The lineage title will contain the actual file name of the image tile used.

6.3 Compressed Project Mosaic (CPM) *(Not Applicable to this Contract)*

6.4 Supplemental GPS Ground Data

The Contractor shall provide any GPS ground data used to supplement the ABGPS positional data adjustments. For example, base stations, ground control, or CORS. The data shall use the same datum and projection required for the GeoTIFF image files.

(a) File Format: Supplemental data shall be delivered in a non-proprietary format mutually agreeable to the Government and Contractor. Contractor may use any consistent and logical naming convention. The files shall be stored on a hard drive (See Section D-1.2) according to the Hard Drive Folder Structure Template, Exhibit 10.

(b) Metadata: The Contractor shall create a metadata file for each supplemental ground data file that was used to supplement positional data compatible with ArcGIS 10.1. A template will not be provided by the Government.

6.5 Stereo Block Files

The Contractor shall provide stereo block files so that digital image files created in Section C-6.1, Color Corrected Stereo Images, can be brought in and viewed in stereo-pairs with very minimal adjustment to the x or y parallax. Data fields in the stereo block file shall be populated with sensor specific data. Each block file should include the average flying height for the area covered by that block file, rather than for the entire project area. The file shall be projected in the 1983 North American Datum (NAD83), 1988 North American Vertical Datum (NAVD) GEOID12A (or most recent), using the native Universal Transverse Mercator (UTM) zone specified in Section B-2 in meters. In the case of reflights or the completion flight line(s) during an additional acquisition season, the stereo block file must be updated to include new and/or reflown imagery for the affected flight lines.

(a) Image Reference Structure: One stereo block file shall be produced for each area contained in the Stereo Block Area Boundary Shapefile provided under B-6.3 and each bit depth of stereo imagery provided.

(b) Pre Production Sample: The Contractor shall provide a sample stereo block file pointing to and containing two (2) overlapping sets of four (4) stereo images in adjoining flight lines. The block file shall point to only the eight (8) images provided with the sample.

(c) File Format. The stereo block files shall be Leica Photogrammetry Suite (LPS) compatible and shall be readable in Stereo Analyst extensions for ERDAS IMAGINE 2011 and Esri® ArcGIS 10.1 and newer. The Government prefers .blk files. See Section J, Exhibit 2 for naming convention. The files shall be stored on a hard drive (See Section D-1.2) according to the Hard Drive Folder Structure Template, Exhibit 10.

6.6 Regional Settings

All digital files, including imagery and metadata, shall be created using standard ANSI English-US setting. For example, periods (ACII 46) shall be used to separate the whole number from the fractional portion when recording decimal numbers and data representing a long date shall be recorded as "Thursday, August 18, 2013 5:09:38 PM."

C-7 PROJECT MANAGEMENT

The Contractor shall establish and maintain a project management system with a designated project manager for this effort. Project management consists of those activities required to plan, manage, administer, and control efforts to accomplish the objective of the contract. The project manager identified in the proposal will serve as the primary point of contact for the Contractor's activity with the Government. Any change in project manager during performance of this contract must be approved by the Contracting Officer based on a written request including a summary of the candidate's experience.

7.1 Progress Reports

A Progress Report is required for each day progress is made in acquiring project imagery. Each progress report shall be sent by email transmission not later than the day following performance and only for days when performance was accomplished. In the event that day is a holiday or non-business day, the report shall be sent on the next business day. Separate reports are required from each photographic crew assigned to a project item. Such "next day" reporting shall start when the Contractor receives the Notice to Proceed, and continue until the area is completed or the photographic season and any extensions end. If reflights are determined necessary or ordered by the Contracting Officer, progress reports covering such performance are required. An e-mail address will be provided at contract award. See Exhibit 4, Progress Report, for syntax and example.

7.2 Project Geodatabase

The Contractor shall produce a file Geodatabase, compatible with Esri® ® ArcGIS 10.1 and newer versions, according to the template provided by the Government (see Section B-6.5), projected in the same coordinate system as specified in Section B-2. The geodatabase shall contain a feature data set that contains a polygon feature class for each georeferenced exposure footprint, a line feature class for each flight line, and a point feature class for each photo center location delivered under this contract. If ortho option items are awarded, the project geodatabase shall also contain a polygon feature class for an orthorectified image index and a line feature

class for the seamlines. The photo-center location, UTM coordinates, shall be corrected to reflect the physical ground location and shall be accurate within 6 meters (19.7 feet) of true ground. The coordinates shall be expressed in meters and formatted to the same datum and projection required for the GeoTIFF image files. The project geodatabase shall be resubmitted with corrections reflecting any image corrections, reflights, or completion of additional flights after original submission. The filename for the Geodatabase and all feature data sets shall use the naming convention specified in Exhibit 2, File Naming Convention. The files shall be stored on a hard drive (See Section D-1.2) according to the Hard Drive Directory Structure Template, Exhibit 10.

(a) Photo Center Point Feature Class. The project acquisition feature dataset shall include the following attributes for the photo center point feature class:

ATTRIBUTE DESCRIPTION	COLUMN NAME	DATA TYPE	EXAMPLE
Project Identification Code	PROJID	Char(6)	613090
Flight Line number	FLTLN	Char(4)[±]	0070
Exposure number	EXPNUM	Char(4)[±]	0001
Date of exposure (YYYY-MM-DD)	IDATE	Char(10)	2015-08-27
Image file name	NAME	Char(50)	613090_0070_ 0001_20150827.tif
Point Acquisition date/time[*]	DATE	Char(16)	08/27/2015 13:52
Color Type[**]	BCON	Char(3)	M4B
Camera type[***]	CAM_TYPE	Char(20)	Digital
Camera manufacturer	CAM_MAN	Char(50)	Zeiss
Camera model	CAM_MOD	Char(25)	DMC
Sensor serial number	SENSNUM	Char(100)	30029
UTM zone	UTM	Char(3)	12
Corrected center point northing	NORTH	Double(19)[‡]	4342654.243
Corrected center point easting	EAST	Double(19)[‡]	448901.634
Flight altitude in meters at camera (MMMMM.MM; MSL)	FLTALT	Double(19)[‡]	7048.63
Number of GPS satellites acquired	GPSNUM	Short Integer	5
Position Dilution of Precision (PDOP)	PDOP	Double(19)[‡]	1.5
IMU omega value (UTM) (Radians)	OMEGA	Double(19)[‡]	.0001358
IMU phi value (UTM) (Radians)	PHI	Double(19)[‡]	.01073000
IMU kappa value (UTM) (Radians)	KAPPA	Double(19)[‡]	-.873265

± Padded with leading zeros
‡ Double data type shall be length of 19 (18 precision, 11 scale)
* Local 24-hour clock. The start/end time will be for the collection of the individual polygon (will be the same for frame-based systems)
** Possible values are: NC (natural color), CIR (color infrared), and M4B (4-band)
*** Possible values are: Digital or Film

(b) Flight Line Feature Class. The project acquisition feature dataset shall include the following attributes for the flight line feature class:

ATTRIBUTE DESCRIPTION	COLUMN NAME	DATA TYPE	EXAMPLE
Project Identification Code	PROJID	Char(6)	613090
Flight Line number	FLTLN	Char(4)±	0070
Date of exposure (YYYY-MM-DD)	IDATE	Char(10)	2015-08-27
Flight Line start date/time*	SDATE	Char(16)	08/27/2015 13:52
Flight Line end date/time*	EDATE	Char(16)	08/27/2015 13:53
Color Type**	BCON	Char(3)	M4B
Camera type***	CAM_TYPE	Char(20)	Digital
Camera manufacturer	CAM_MAN	Char(50)	Intergraph
Camera model	CAM_MOD	Char(25)	DMC
Sensor serial number	SENSNUM	Char(100)	30029
Flight Line Direction	DIR	Char(20)	North
Flight altitude in meters at camera (MMMMM.MM; MSL)	FLTALT	Double(19)‡	7048.63

± Padded with leading zeros
‡ Double data type shall be length of 19 (18 precision, 11 scale)
* Local 24-hour clock. The start/end time will be for the collection of the individual polygon (will be the same for frame-based systems)
** Possible values are: NC (natural color), CIR (color infrared), and M4B (4-band)
*** Possible values are: Digital or Film

(c) Image Footprint Polygon Feature Class. The project acquisition feature dataset shall include the following attributes for the image footprint polygon feature class. The image footprint polygon shall represent the actual ground displacement of the image acquired:

ATTRIBUTE DESCRIPTION	COLUMN NAME	DATA TYPE	EXAMPLE
Project Identification Code	PROJID	Char(6)	613090
Flight Line number	FLTLN	Char(4)±	0070
Exposure number	EXPNUM	Char(4)±	0001
Date of exposure (YYYY-	IDATE	Char(10)	2015-08-27

MM-DD)			
Image file name	NAME	Char(50)	613090_0070_ 0001_20150827.tif
Polygon start date/time*	SDATE	Char(16)	08/27/2015 13:52
Polygon end date/time*	EDATE	Char(16)	08/27/2015 13:53
Color Type**	BCON	Char(3)	M4B
Camera type***	CAM_TYPE	Char(20)	Digital
Camera manufacturer	CAM_MAN	Char(50)	Intergraph
Camera model	CAM_MOD	Char(25)	DMC
Sensor serial number	SENSNUM	Char(100)	30029
Corrected center point latitude (DD.DDDDDD)	LAT	Double(19)‡	57.71936
Corrected center point longitude (-DDD.DDDDDD)	LON	Double(19)‡	-135.41498

± Padded with leading zeros
‡ Double data type shall be length of 19 (18 precision, 11 scale)
* Local 24-hour clock. The start/end time will be for the collection of the individual polygon (will be the same for frame-based systems)
** Possible values are: NC (natural color), CIR (color infrared), and M4B (4-band)
*** Possible values are: Digital or Film

(d) Seamline Feature Class. The feature class for orthorectified tiles in Paragraph 6.2 (if awarded) shall include the following attributes:

ATTRIBUTE DESCRIPTION	COLUMN NAME	DATA TYPE	EXAMPLE
Project Identification Code	PROJID	Char(6)	613090
Area Name	AREA_NM	Char(100)	Prescott National Forest
Method of Creation***	METHD	Char(10)	Manual
Software Used to Generate Seamlines	SOFT	Char(50)	Socet_Set

*** Possible values are: Manual or Automatic

(e) Orthorectified Image Index Feature Class. A single feature class for all orthorectified tiles in Paragraph 6.2 (if awarded) shall include the following attributes.

ATTRIBUTE DESCRIPTION	COLUMN NAME	DATA TYPE	EXAMPLE
Project Identification Code	PROJID	Char(6)	613090
Area Name	AREA_NM	Char(100)	Prescott National Forest
Majority Date of Imagery (YYYY-	IDATE	Char(10)	2015-08-27

MM-DD)			
Image File Name	NAME	Char(50)	m_3311162_ne_2_13_25_20150721.tif
Pixel Resolution in centimeters	RES	Double(5)	25
Color Type**	BCON	Char(3)	M4B
Image Type***	IMG_TYPE	Char(20)	DOQQQ

** Possible values are: NC (natural color), CIR (color infrared), and M4B (4-band)
*** Possible values are: DOQ, DOQQ, DOQQQ

(f) Metadata. The Contractor shall create metadata files in accordance with the template provided by the Government (see Section B-6.2) and Federal Geographic Data Committee (FGDC), FGDC-STD-001-1998 specification. Metadata files shall be compatible with ArcGIS 10.1 and must parse cleanly through the USGS metadata parser "mp" version 2.9.23 with Remote Sensing Extensions without any errors.

C-8 QUALITY CONTROL

Quality control shall be exercised by the Contractor continuously throughout the performance of the contract. Procedures shall be established to assure that all contract materials are delivered in accordance with the delivery schedule and at the required level of accuracy and quality. The Contractor shall inspect and constantly monitor the image quality and coverage, and shall undertake immediate reflights of any imagery where the quality fails to meet minimum requirements of the contract specifications.

8.1 RMSE Accuracy and Quality Control Report

The Contractor shall provide RMSE accuracy reports and quality control reports generated during the AT and/or orthorectification processes for all image files. The reports shall include the residuals of the final computations of the imagery being adjusted to real world coordinates. The results of the computations and an accuracy analysis of final adjustment with respect to the project specifications are to be documented for both the stereo and ortho deliverables. The reports shall be delivered in a non-proprietary format mutually agreed upon and may use any consistent and logical naming convention. The following items shall be included in this report(s):

a) ABGPS/IMU and GPS Control Base Station's equipment configuration
b) Antenna height and offset
c) CORS stations
d) The final AT solution coordinates
e) RMSE X, Y, and Z
f) Horizontal and vertical datums
g) GEOID

If information/data is provided in another deliverable, the duplication would be eliminated in a manner mutually agreed upon.

PART I - THE SCHEDULE

SECTION D - PACKAGING AND MARKING

D-1 MEDIA

All media containing digital imagery and text files shall be labeled and shipped in packaging designed for their protection.

1.1 Digital Versatile Disk

All digital versatile disks (DVDs) shall be delivered on archival media, single-sided, 4.7 Gigabyte (120-minutes) DVD-R discs. DVD-R(A), DVD-RW, DVD+R, or DVD+RW formats are not acceptable. DVDs shall be submitted in a "slim" sized jewel case with the DVD label (See Section J, Exhibit 5, Figure 1, DVD Labeling Requirements) readable without opening the case or removing the DVD from the case.

1.2 Internal SATA Hard Drives

All hard disk drives (HDDs) used to deliver imagery shall be internal Serial Advanced Technology Attachment (SATA) II & III, 3½ inch, 6.0 Gbit/s transfer-rate hard drives, with a minimum rotation speed of 7,200 rpm, not more than 2 Terabyte capacity. Maximum disk space that can be used cannot exceed ninety percent (90%). The SATA drives shall be formatted using Microsoft's NTFS file system. Each drive will be enclosed in a static bag and shall have one label attached directly to the outer surface of the static bag and one placed directly on the internal hard drive identifying the project contained on the drive in accordance with Section J, Exhibit 5, Figure 2, Hard Drive Labeling Requirements. The drives shall become property of the Government and will not be returned to the Contractor.

D-2 PACKAGING AND MARKING FOR SHIPMENT

All material shall be packed for shipment in such a manner that will insure acceptance by common carrier and safe delivery at destination. Containers and closures shall comply with the Interstate Commerce Commission regulations, Uniform Freight Classification rules, or regulations of other carriers as applicable to the mode of transportation. Damaged materials will be replaced by the Contractor at no cost to the Government.

All shipping containers shall be clearly marked with delivery address in Section F-1, Place of Delivery – FOB Destination, within Consignee's Premises.

A packing slip itemizing the deliverables included shall accompany each shipment.

D-3 SHIPPING RECEIPTS

Receipts from common carriers for shipment of materials shall be retained by the Contractor and be made available to the Contracting Officer upon request.

PART I -THE SCHEDULE

SECTION E - INSPECTION AND ACCEPTANCE

E-1 INSPECTION AND ACCEPTANCE (FEB 1988)(AGAR 452.246-70)

The Contracting Officer or the Contracting Officer's duly authorized representative will inspect and accept the supplies and/or services to be provided under this contract.

Inspection and acceptance will be performed at:

Aerial Photography Field Office
2222 West 2300 South
Salt Lake City, Utah 84119-2020

E-2 INSPECTION PROCEDURE

All materials specified in Section F-2, Materials to be Delivered, will be inspected to determine conformance to all contract requirements and specifications. Inspection of the image files will be performed utilizing a comprehensive method of quality assurance inspection procedures including sampling to test for compliance to the horizontal accuracy requirement. (Refer to FAR 52.246-2, Inspection of Supplies-Fixed Price and FAR 52.246-4, Inspection of Services-Fixed Price)

If inspection of materials reveals deficiencies that may cause increased time and effort in using the digital imagery and aerial photography as intended, the Government may require the Contractor to perform the services again in conformity with contract requirements, at no increase in contract amount. When the defects in services cannot be corrected by re-performance, the Government may:

(a) Require the Contractor to take necessary action to ensure that future performance conforms to contract requirements and
(b) Reduce the contract price to reflect the reduced value of services performed.

E-3 INSPECTION SCHEDULE

The Government will make every effort to inspect all material specified within 60 calendar days after they are received at the point designated. Partial delivery of materials for a line item will delay the inspection schedule. Should the inspection procedure be delayed longer than 60 days, the Contractor will be notified of the reason(s) for delay and given the estimated completion date. Contract materials will be inspected in the order of their receipt, unless otherwise prioritized by the Government. Inspection of project items where the photographic season is open will be given priority over projects for which the season has closed.

The Contractor will be notified in writing whether the materials are satisfactory and what areas, if any, shall be reacquired and what materials, if any, shall be remade because of nonconformity with contract requirements.

E-4 PARTIAL COVERAGE

If the Contractor obtains only partial coverage for any project item during the season, all partial imagery and contract deliverables shall be processed and delivered according to the requirements specified for completed imagery. Interim products may be required to satisfy partial delivery. The requirement for processing partial coverage may be waived only by the Contracting Officer.

E-5 ACCEPTANCE

5.1 Final Acceptance

Final acceptance will be made by the Contracting Officer after inspection by the Government of all required materials delivered at the specified destination. The acceptance date shall be the date of the letter, by the Government to the Contractor, stating all materials are acceptable and an invoice may be submitted.

5.2 Partial Acceptance of a Completed Project

The Government may make a partial acceptance on a completed Project Item due to the rejection of deficient or non-compliant material(s). A partial acceptance will result in a contract price reduction based on the final determination of contract material compliance to contract requirements and specifications. The Government will issue an acceptance letter to the Contractor, stating the materials that have been accepted and the materials that have been rejected, at which time an invoice may be submitted.

5.3 Partial Acceptance of a Project with a Contract Season Extension

Partial acceptance on an incomplete Project Item, as listed in Section B, Supplies or Services and Prices/Costs, will be made only after the acquisition season has ended and all materials required for the project area have been delivered, inspected, and accepted by the Government. The acceptance date shall be the date of the letter by the Government to the Contractor identifying the amount of partial acceptance and at which time an invoice maybe submitted.

E-6 CLAUSES INCORPORATED BY REFERENCE (FEB 1998) (FAR 52.252-2)

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

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES:

52.246-02 Inspection of Supplies - Fixed Price (AUG 1996)

52.246-04 Inspection of Services - Fixed Price (AUG 1996)

52.246-16 Responsibility for Supplies (APR 1984)

PART I - THE SCHEDULE

SECTION F - DELIVERIES OR PERFORMANCE

F-1 PLACE OF DELIVERY - FOB DESTINATION, WITHIN CONSIGNEE'S PREMISES

The materials to be furnished hereunder shall be delivered, all transportation charges paid by the Contractor, and in accordance with FAR Clause 52.247-35, F.o.b. Destination, Within Consignee's Premises, to:

USDA Aerial Photography Field Office
Attn: Contracting – Resource
2222 West 2300 South
Salt Lake City, Utah 84119-2020

Offers submitted on a basis other than F.o.b. Destination within consignee's premises will be deemed unacceptable or rejected as non-responsive.

F-2 MATERIALS TO BE DELIVERED

One set of materials shall be delivered as required and consist of the following items. Unless otherwise specified, all deliverables must be delivered on an internal hard drive as specified in Section D-1.2. Corrected or resubmitted materials must be delivered on media separate from original materials being submitted and include a separate packing slip. The Contractor shall maintain a copy of the digital data until the Government formally accepts the deliverables.

2.1 STEREO IMAGERY DELIVERABLES (See Section B-3.1)

Stereo Imagery Deliverables	Format	Metadata Required	Media	Sample Naming (See Exhibit 2)	Gov't Approval Required	Quantity & Frequency
Project Flight Plan Section C-5.2	Esri® Compatible Shapefile	None	Email or DVD	None	Review Only	Prior to Notice to Proceed
Pre-production Image Samples Section C-6.1	GeoTIFF	Yes	DVD or FTP site	613090_0025_0001_20150827_8b.tif	Yes	One image for each landscape defined in Section C-6.1
4-Band, 8-bit per band, Color Corrected, Georeferenced, Uncompressed Digital Image Files Section C-6.1	GeoTIFF (see Table 2.1(a) below)	Yes, one per image file	Internal Hard Drive	613090_0025_0001_20150827_8b.tif	Yes	Entire project item, unless interim partial delivery approved
Pre-production samples for Stereo Block File Section C-6.5	.blk or .prj	Yes	DVD or FTP site	613090_8b_01.blk	Yes	One block file with 8 images; 4 overlapping images from two adjoining overlapping flight lines
Stereo Block Files for each Area Section C-6.5	Either .blk or .prj	Yes, one per block file	Internal Hard Drive	613090_8b_01.blk thru 613090_8b_04.blk	Yes	Include with stereo imagery delivery; updated with reflights
Project Geodatabase Project Acquisition Feature Dataset Image Footprint Feature Class Flight Line Feature Class Photo Center Feature Class	Esri® File Geodatabase	Yes, one file per geodatabase	Internal Hard Drive	Project_Geodatabase_613090_5dash15.gdb prescott_613090_5dash15_1 georeferenced_613090_25_4_8_5dash15_1 flight_line_613090_5dash15_1 photo_center_613090_5dash15_1	Yes	Include with stereo imagery; update with additional feature classes or reflights
Progress Reports	Content of email or attached text file See Exhibit 4	No	Email	N/A	No	One per day per project area for each day imagery is acquired

(a) Stereo Imagery Support Files

Base Item(s): 8-Bit Color Corrected Stereo Imagery Deliverables Support Files Included with Image Files			
Frame-Based Sensor		**Scanning (Pushbroom) Sensor Files for Each Flight Line**	
.tif	uncompressed, georeferenced image	.ads	header with pointers to .tif segments
.aux	auxiliary statistic/projection file	.hist	xml file containing histogram
.rrd	reduced resolution dataset pyramid file	.min	minification header
.txt & xml	Metadata in both .txt and .xml format	.odf	orientation data file
		.odf.adj	adjusted orientation after AT
		.sup	support/orientation file
		.tif	image segment
		.txt & .xml	Metadata and other text files
Image naming convention with above extensions, ie: 613090_0025_0001_20150827_8b.rrd			

2.2 ORTHORECTIFIED IMAGERY DELIVERABLES (See Section B-3.1)

Option Items 1A & 2A: DOQQQ Orthorectified Imagery Deliverables	**Format**	**Metadata Required**	**Media**	**Sample Naming (See Exhibit 2)**	**Gov't Approval Required**	**Quantity & Frequency**
Pre-production Samples	GeoTIFF	Yes	DVD or FTP site	m_3311162_ne_2_13_25_20150721.tif	Yes	One DOQQQ for each landscape defined in Section C-6.1
Digital Orthorectified Quarter Quadrangles (DOQQQ) Auxiliary File Pyramid File Metadata File	GeoTIFF AUX RRD TXT & XML	Yes, one file for each DOQQQ	Internal Hard Drive	m_3311162_ne_2_13_25_20150721.tif m_3311162_ne_2_13_25_20150721.aux m_3311162_ne_2_13_25_20150721.rrd m_3311162_ne_2_13_25_20150721.xml	Yes	Entire project item, unless interim partial delivery approved
RMSE Accuracy and Quality Control Reports (included with DOQQQ)	ASCII	None	Internal Hard Drive	Contractor determined	No	Include with ortho delivery
Seamline Feature Class and Orthorectified Image Index Feature Class included in Project Geodatabase	Esri® file Geodatabase	Yes, one for geodatabase	Internal Hard Drive or DVD	seamlines_613090_5dash15_1 ortho_index_613090_25_4_5dash15_1	Yes	Include with ortho delivery; updated with corrections or reflights

F-3 SCHEDULE FOR DELIVERY OF MATERIALS

All delivery materials required in this contract shall be shipped within the time period specified below. Failure to ship within this period will be considered as failure by the Contractor to prosecute the work as to ensure completion and will render the contract subject to default. Date of shipment will be shown by postmark or carrier receipt.

3.1 Original Materials - Delivery Schedule

All contract materials, including options, required for a project item shall be shipped no later than the period specified below from the end of the acquisition period, or any season extension thereof. Early delivery of materials is encouraged to facilitate timely inspection and avoid delays due to peak seasonal inspection workload.

DELIVERY SCHEDULE				
Item Number	**Project Area**	**Deliverables**	**Calendar Days from End of Acquisition**	**Shipment Date**
Item 1	Prescott NF, AZ	Stereo Image Files and supporting files	90	November 30, 2015
Item 1A		DOQQQ and supporting files	120	December 29, 2015
Item 2	Cibola NF NGL (Black Kettle, Kiowa, McClellan Creek, Rita Blanca), NM, OK, TX	Stereo Image Files and supporting files	90	November 30, 2015
Item 2A		DOQQQ and supporting files	120	December 29, 2015

3.2 Remake Materials - Delivery Schedule

Remake materials shall be shipped as soon as possible after correction is made, but no later than 30 days after receipt in the Contractor's facility of the materials or data required to make the corrections. Only materials as specifically requested by the Contracting Officer to be remade shall be submitted for inspection. Signed delivery receipts will be required to verify date of receipt of such data or materials by the Contractor.

F-4 PERFORMANCE OF THE WORK

The Contracting Officer will authorize and direct the acquisition period to begin or end anytime within thirty (30) days before or after the approximate acquisition dates specified in Section B,

depending upon the weather, ground, foliage, and sun angle conditions required for the project item. No imagery shall be undertaken before the Notice to Proceed is issued or after the final date of the acquisition period (or its extension) has occurred.

4.1 Notice To Proceed

The Notice to Proceed will be given by telephone or email, and confirmed by signed correspondence. Failure of the Contractor to proceed with flights on a project item within ten (10) calendar days after a "Notice to Proceed" is given, without documentation of weather or ground preventing imagery collection, may be considered as evidence of failure to perform the work so as to ensure its timely completion.

4.2 Acquisition Period Extension

The Government reserves the right to extend the acquisition period of this contract beyond the approximate period indicated in Section B, at no increase in price, by written notice to the Contractor at any time prior to the end of the acquisition period. (Refer to FAR 52.217-08, Option to Extend Services)

4.3 Option to Extend the Term of the Contract (MAR 2000) (FAR 52.217-9)

IT IS THE EXPRESSED INTENT OF THE GOVERNMENT TO HAVE ALL IMAGERY REQUIRED UNDER THIS CONTRACT COMPLETED WITHIN THE ACQUISITION PERIOD SPECIFIED IN SECTION B.

The Government may extend the term of this contract, at no increase in price, by written notice to the Contractor within six (6) months after the acquisition period has ended. The Contracting Officer may extend this option twice. (Refer to FAR 52.217-9 “Option to Extend the Term of the Contract”.)

F-5 CLAUSES INCORPORATED BY REFERENCE (FEB 1998) (FAR 52.252-2)

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

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES:

52.242-15 Stop Work Order (AUG 1989)

52.242-17 Government Delay of Work (APR 1984)

PART I - THE SCHEDULE

SECTION G - CONTRACT ADMINISTRATION DATA

G-1 CONTRACTING OFFICE

The Aerial Photography Field Office (APFO) of the United States Department of Agriculture (USDA), Farm Service Agency (FSA), is responsible for the solicitation, award, and administration of this contract.

Communications shall be directed to:

Contracting Officer, USDA - FSA
Aerial Photography Field Office
2222 West 2300 South
Salt Lake City, Utah 84119-2020

Telephone (801) 844-2916
Facsimile (801) 956-3640

Written correspondence shall reference the contract number plus the project item number.

G-2 CONTRACTING OFFICER'S REPRESENTATIVE

Each awarded contract may have a Contracting Officer's Representative (COR). Such designations will be made either at the time of award or by appointment letter.

G-3 CONTRACT INTERPRETATION

Technical assistance regarding interpretation of the specifications and/or terms of the contract will be provided by the Contracting Officer or the COR. Only the Contracting Officer has authority to award, modify, and terminate contracts. The Contractor is encouraged to visit the USDA-APFO facilities and discuss the contract and inspection procedures.

3.1 DISCREPANCIES

Any discrepancy in the schedule or official flight data shall be immediately called to the attention of the Contracting Officer for decision. A discrepancy shall not be adjusted without approval of the Contracting Officer, except at the Contractor's own risk and expense.

G-4 PROGRESS REPORTS

Progress Reports are required for this contract. If completion instructions contained in the reports (see Section J, Exhibit 4) are not adequate, contact the Contracting Officer for clarification. It is essential that all items of information requested on the report be provided. Progress Reports shall be prepared and submitted for performance periods during the acquisition period as stated in Sections C-7.1 and F-2. Failure to comply with the requirement may result in $25,000 or 5 percent of the contract amount, whichever is less, being withheld from payment. (Refer to FAR 52.242-2, Production Progress Reports)

G-5 SUBCONTRACTS

If the Contractor uses subcontractors in the performance of the contract, a plan and procedure will be established to manage its subcontractors. Before entering into a subcontract that was not included in the proposal, the Contractor shall inform the Contracting Officer and submit information required by the Contracting Officer to determine acceptability and approval of the anticipated subcontractor and imagery acquisition equipment to be used. Information required may include a subcontract management plan, references, key personnel, processing software/methods, etc. The Contractor is solely responsible for the performance and cost control of its partnerships and subcontractors.

G-6 CHARGES TO CONTRACTOR

The USDA may, at its option, correct deficiencies found to exist in connection with materials submitted by the Contractor and deduct from the Contractor's vouchers the cost thereof to the Government. When the deficiencies to be corrected are such that the cost exceeds $500.00 at current prices, such corrections will be made only with the prior approval of the Contractor, except in the event of termination for default.

G-7 ELECTRONIC INVOICING AND PAYMENT REQUIREMENTS

Payment requests must be submitted electronically through the U.S. Department of the Treasury’s Invoice Processing Platform System (IPP).

“Payment request” means any request for contract financing payment or invoice payment by the Contractor. To constitute a proper invoice, the payment request must comply with the requirements identified in the applicable Prompt Payment clause included in the contract, or the clause 52.212-4 Contract Terms and Conditions-Commercial Items in commercial item contracts. The IPP website address is: https:/www.ipp.gov.

G-8 PERFORMANCE-BASED PAYMENTS

The Contractor shall adhere to the following performance-based payment description and schedule. Reference Section I-2 Performance-Based Payments (FAR 52.232-32).

8.1 Performance-Based Payments

(a) Proper invoices (see Section G-7) shall be submitted on a line item basis and include information and certification required in FAR Clause 52.232-32, Performance-Based Payments.

(b) Upon the delivery of materials for a line item, the Contractor may submit an invoice for a maximum of sixty percent (60%) of the total quantity delivered for that line item multiplied by the awarded unit price. Only one performance-based payment will be made per line item within a month. Additional performance-based payment for any corrections or resubmittals will not be accepted.

(c) No other performance-based payments shall be issued without the Contracting Officer's approval.

8.2 Performance Criterion

In addition to required information and certification required in Section I-2, the request for a performance-based payment must include the quantity of products delivered for the line item. If the Contractor did not complete acquisition within the acquisition period specified in Section B-2, or any approved extensions, a performance-based payment may be requested based on the percentage of the item delivered and must include certification in accordance with FAR Clause 52.232-32, Performance-Based Payments, of the approximate square miles or other unit acquired.

8.3 Final Acceptance

Upon final acceptance by the Government of a Project Line Item, a proper invoice may be submitted to the Contracting officer.

G-9 PARTIAL PAYMENTS

For a partially completed Project Item awarded, as defined in Section E-5.3, Partial Acceptance of a Project with a Contract Season Extension, a partial payment can be made not to exceed ninety (90) percent of the accepted amount, less any performance-based payments paid. Any payment thus made is a partial payment of the contract. Upon acceptance of the complete Project Item awarded, the remaining payment, to total the full payment due for the project item awarded, will be made. Partial payments shall be approved by the Contracting Officer under the conditions stated in FAR 52.232-1, Payments.

G-10 PAYMENT DUE DATE

The required payment date will be thirty (30) calendar days after the date of actual receipt of a proper invoice by the office designated to receive the invoice, or the date all contract deliverables are accepted, whichever is later. The date of the check issued in payment or the date of the payment by electronic funds transfer shall be considered to be the date payment is made.

G-11 INTEREST ON OVERDUE PAYMENTS

The Prompt Payment Act, Public Law 100-496 (96 Stat. 85, 31 USC 1801) is applicable to partial and final payments only under this contract and requires the payment to Contractors of interest on overdue payments and improperly taken discounts. Interest is not payable on Performance Based Payments.

Determinations of interest due will be made in accordance with the provisions of the Prompt Payment Act and Office of Management and Budget Circular A-125.

PART I - THE SCHEDULE

SECTION H - SPECIAL CONTRACT REQUIREMENTS

H-1 PERMITS AND RESPONSIBILITIES

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occurs as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

H-2 AIRSPACE PERMITS AND CLEARANCES

It shall be the responsibility of the Contractor to determine and secure all necessary permits and clearances for controlled or restricted airspace areas.

The Contractor shall contact the Federal Aviation Administration (FAA) watch supervisor in charge of the Air Traffic Control (ATC) facility to gain approval to operate within controlled airspace. It is suggested that pre-flight coordination be completed at least one week in advance. The FAA suggests that on the day of the flight, the photo mission pilot will contact the ATC facility and:

(a) Confirm previous arrangements, and

(b) State that "this is a photo survey mission" via air/ground communications, and subsequently inform the controller when the flight line is commenced.

Military Operation Areas (MOA) will be identified in advance, and if necessary a contact for airspace clearance established. The Contractor is responsible for obtaining flight approvals and security clearances if required by the U.S. Department of Defense. Photographic and digital materials of classified areas shall be stored, handled, and shipped in accordance with existing security regulations. In the event of difficulty, the Contracting Officer shall be contacted for guidance and/or assistance.

H-3 AIRCRAFT REGULATIONS AND CERTIFICATIONS

All aircraft used in the performance of the work under this contract shall be maintained and operated in accordance with all regulations required by the U.S. Department of Transportation, Federal Aviation Administration (FAA). Aircraft operated in the acquisition of aerial photography or digital imagery under this contract shall be FAA certified to the highest flying altitude required to obtain proposed imagery.

H-4 OWNERSHIP OF CONTRACT MATERIALS

The Government shall receive copyright and ownership to all data delivered under this contract, including but not limited to photographic materials, imagery, databases, and paper products, upon formal acceptance. The Contractor agrees to transfer copyright to the Government upon payment of the delivery invoice (see G-8, Performance-Based Payments) or final acceptance, whichever occurs first. The Contractor may maintain copyright and ownership of all original or derived works which are not required submittals under this contract. The Contractor is encouraged to create, market, and sell derived works not related to or in direct competition with the data delivered under this contract. For example, if this contract requires 30cm georeferenced, uncorrected imagery be delivered to the Government, the Contractor may create 50cm imagery from the original product, prior to its submittal to the Government, and resell it to other Government agencies or the general public. However, the Government also maintains the rights to derive additional products from the data delivered under this contract. No public distribution of the original or derived works shall be made prior to acceptance by the Government unless specified in the contract or authorized by the Contracting Officer.

H-5 NOTICE TO THE GOVERNMENT OF DELAY

The Contractor shall immediately, upon becoming aware of any difficulties in meeting performance requirements during the photographic season or when difficulties are encountered which may delay deliveries under the contract, notify the Contracting Officer in writing thereof. Such notification shall identify difficulties, the reasons therefore, and the estimated period of anticipated delay.

FAILURE OF THE CONTRACTOR TO GIVE SUCH NOTICE MAY PRECLUDE LATER CONSIDERATION OF ANY CLAIM FOR NON-PERFORMANCE DUE TO WEATHER CONDITIONS OR ANY REQUEST FOR AN EXTENSION OF CONTRACT TIME.

H-6 WAGE DETERMINATION

The Wage Determination applicable to any contract resulting from this solicitation is determined by the location of the Contractor's establishment. Wage Determination number 1995-0222, Revision 38, dated January 14, 2015, will be applicable for Contractors located nationwide. See Section J, Exhibit 5, Wage Determination.

H-7 INDUSTRY SMALL BUSINESS STANDARD

The small business industry size standard for the type of services covered by this procurement, under NAICS code 541922, is the average annual receipts of the concern and its affiliates for the preceding three (3) years not in excess of $7.5 million.

PART II - CONTRACT CLAUSES

SECTION I - CONTRACT CLAUSES

I-1 STATEMENT OF EQUIVALENT RATES FOR FEDERAL HIRES (MAY 2014) (FAR 52.222-42)

In compliance with the Service Contract Act of 1965, as amended, and the regulations of the Secretary of Labor (29 CFR part 4), this clause identifies the classes of service employees expected to be employed under the contract and states the wages and fringe benefits payable to each if they were employed by the contracting agency subject to the provisions of 5 U.S.C. 5341 or 5332.

THIS STATEMENT IS FOR INFORMATION ONLY.
IT IS NOT A WAGE DETERMINATION.

Employee Class	Monetary Wage - Fringe Benefits
Aircraft Pilot	$28.36
First Officer	$25.82
Aerial Photographer	$14.17

I-2 PERFORMANCE-BASED PAYMENTS (APR 2012) (FAR 52.232-32)

(a) *Amount of payments and limitations on payments*. Subject to such other limitations and conditions as are specified in this contract and this clause, the amount of payments and limitations on payments shall be specified in the contract's description of the basis for payment.

(b) *Contractor request for performance-based payment*. The Contractor may submit requests for payment of performance-based payments not more frequently than monthly, in a form and manner acceptable to the Contracting Officer. Unless otherwise authorized by the Contracting Officer, all performance-based payments in any period for which payment is being requested shall be included in a single request, appropriately itemized and totaled. The Contractor's request shall contain the information and certification detailed in paragraphs (l) and (m) of this clause.

(c) *Approval and payment of requests*.

(1) The Contractor shall not be entitled to payment of a request for performance-based payment prior to successful accomplishment of the event or performance criterion for which payment is requested. The Contracting Officer shall determine whether the event or performance criterion for which payment is requested has been successfully accomplished in accordance with the terms of the contract. The Contracting Officer may, at any time, require the Contractor to substantiate the successful performance of any event or performance criterion which has been or is represented as being payable.

(2) A payment under this performance-based payment clause is a contract financing payment under the Prompt Payment clause of this contract and not subject to the interest penalty provisions of the Prompt Payment Act. The designated payment office will pay approved requests on the 30th

day after receipt of the request for performance-based payment by the designated payment office. However, the designated payment office is not required to provide payment if the Contracting Officer requires substantiation as provided in paragraph (c)(1) of this clause, or inquires into the status of an event or performance criterion, or into any of the conditions listed in paragraph (e) of this clause, or into the Contractor certification. The payment period will not begin until the Contracting Officer approves the request.

(3) The approval by the Contracting Officer of a request for performance-based payment does not constitute an acceptance by the Government and does not excuse the Contractor from performance of obligations under this contract.

(d) *Liquidation of performance-based payments*.

(1) Performance-based finance amounts paid prior to payment for delivery of an item shall be liquidated by deducting a percentage or a designated dollar amount from the delivery payment. If the performance-based finance payments are on a delivery item basis, the liquidation amount for each such line item shall be the percent of that delivery item price that was previously paid under performance-based finance payments or the designated dollar amount. If the performance-based finance payments are on a whole contract basis, liquidation shall be by either predesignated liquidation amounts or a liquidation percentage.

(2) If at any time the amount of payments under this contract exceeds any limitation in this contract, the Contractor shall repay to the Government the excess. Unless otherwise determined by the Contracting Officer, such excess shall be credited as a reduction in the unliquidated performance-based payment balance(s), after adjustment of invoice payments and balances for any retroactive price adjustments.

(e) *Reduction or suspension of performance-based payments.* The Contracting Officer may reduce or suspend performance-based payments, liquidate performance-based payments by deduction from any payment under the contract, or take a combination of these actions after finding upon substantial evidence any of the following conditions:

(1) The Contractor failed to comply with any material requirement of this contract (which includes paragraphs (h) and (i) of this clause).

(2) Performance of this contract is endangered by the Contractor's --

(i) Failure to make progress; or

(ii) Unsatisfactory financial condition.

(3) The Contractor is delinquent in payment of any subcontractor or supplier under this contract in the ordinary course of business.

(f) *Title.*

(1) Title to the property described in this paragraph (f) shall vest in the Government. Vestiture shall be immediately upon the date of the first performance-based payment under this contract, for

property acquired or produced before that date. Otherwise, vestiture shall occur when the property is or should have been allocable or properly chargeable to this contract

(2) "Property," as used in this clause, includes all of the following described items acquired or produced by the Contractor that are or should be allocable or properly chargeable to this contract under sound and generally accepted accounting principles and practices:

(i) Parts, materials, inventories, and work in process;

(ii) Special tooling and special test equipment to which the Government is to acquire title;

(iii) Nondurable (*i.e*., noncapital) tools, jigs, dies, fixtures, molds, patterns, taps, gauges, test equipment and other similar manufacturing aids, title to which would not be obtained as special tooling under subparagraph (f)(2)(ii) of this clause; and

(iv) Drawings and technical data, to the extent the Contractor or subcontractors are required to deliver them to the Government by other clauses of this contract.

(3) Although title to property is in the Government under this clause, other applicable clauses of this contract (e.g., the termination clauses) shall determine the handling and disposition of the property.

(4) The Contractor may sell any scrap resulting from production under this contract, without requesting the Contracting Officer's approval, provided that any significant reduction in the value of the property to which the Government has title under this clause is reported in writing to the Contracting Officer.

(5) In order to acquire for its own use or dispose of property to which title is vested in the Government under this clause, the Contractor shall obtain the Contracting Officer's advance approval of the action and the terms. If approved, the basis for payment (the events or performance criteria) to which the property is related shall be deemed to be not in compliance with the terms of the contract and not payable (if the property is part of or needed for performance), and the Contractor shall refund the related performance-based payments in accordance with paragraph (d) of this clause.

(6) When the Contractor completes all of the obligations under this contract, including liquidation of all performance-based payments, title shall vest in the Contractor for all property (or the proceeds thereof) not --

(i) Delivered to, and accepted by, the Government under this contract; or

(ii) Incorporated in supplies delivered to, and accepted by, the Government under this contract and to which title is vested in the Government under this clause.

(7) The terms of this contract concerning liability for Government-furnished property shall not apply to property to which the Government acquired title solely under this clause.

(g) *Risk of loss*. Before delivery to and acceptance by the Government, the Contractor shall bear the risk of loss for property, the title to which vests in the Government under this clause, except to the extent the Government expressly assumes the risk. If any property is lost (see 45.101), the basis of payment (the events or performance criteria) to which the property is related shall be deemed to be not in compliance with the terms of the contract and not payable (if the property is part of or needed for performance), and the Contractor shall refund the related performance-based payments in accordance with paragraph (d) of this clause.

(h) *Records and controls.* The Contractor shall maintain records and controls adequate for administration of this clause. The Contractor shall have no entitlement to performance-based payments during any time the Contractor's records or controls are determined by the Contracting Officer to be inadequate for administration of this clause.

(i) *Reports and Government access.* The Contractor shall promptly furnish reports, certificates, financial statements, and other pertinent information requested by the Contracting Officer for the administration of this clause and to determine that an event or other criterion prompting a financing payment has been successfully accomplished. The Contractor shall give the Government reasonable opportunity to examine and verify the Contractor's records and to examine and verify the Contractor's performance of this contract for administration of this clause.

(j) *Special terms regarding default*. If this contract is terminated under the Default clause,

(1) the Contractor shall, on demand, repay to the Government the amount of unliquidated performance-based payments, and

(2) title shall vest in the Contractor, on full liquidation of all performance-based payments, for all property for which the Government elects not to require delivery under the Default clause of this contract. The Government shall be liable for no payment except as provided by the Default clause.

(k) *Reservation of rights*.

(1) No payment or vesting of title under this clause shall --

(i) Excuse the Contractor from performance of obligations under this contract; or

(ii) Constitute a waiver of any of the rights or remedies of the parties under the contract.

(2) The Government's rights and remedies under this clause --

(i) Shall not be exclusive, but rather shall be in addition to any other rights and remedies provided by law or this contract; and

(ii) Shall not be affected by delayed, partial, or omitted exercise of any right, remedy, power, or privilege, nor shall such exercise or any single exercise preclude or impair any further exercise under this clause or the exercise of any other right, power, or privilege of the Government.

(l) *Content of Contractor's request for performance-based payment*. The Contractor's request for performance-based payment shall contain the following:

(1) The name and address of the Contractor;

(2) The date of the request for performance-based payment;

(3) The contract number and/or other identifier of the contract or order under which the request is made;

(4) Such information and documentation as is required by the contract's description of the basis for payment; and

(5) A certification by a Contractor official authorized to bind the Contractor, as specified in paragraph (m) of this clause.

(m) *Content of Contractor's certification.* As required in paragraph (l)(5) of this clause, the Contractor shall make the following certification in each request for performance-based payment:

I certify to the best of my knowledge and belief that --

(1) This request for performance-based payment is true and correct; this request (and attachments) has been prepared from the books and records of the Contractor, in accordance with the contract and the instructions of the Contracting Officer;

(2) (Except as reported in writing on _____), all payments to subcontractors and suppliers under this contract have been paid, or will be paid, currently, when due in the ordinary course of business;

(3) There are no encumbrances (except as reported in writing on _____) against the property acquired or produced for, and allocated or properly chargeable to, the contract which would affect or impair the Government's title;

(4) There has been no materially adverse change in the financial condition of the Contractor since the submission by the Contractor to the Government of the most recent written information dated _____; and

(5) After the making of this requested performance-based payment, the amount of all payments for each deliverable item for which performance-based payments have been requested will not exceed any limitation in the contract, and the amount of all payments under the contract will not exceed any limitation in the contract.

I-3 WARRANTY OF SUPPLIES OF A NONCOMPLEX NATURE. (JUN 2003)
(FAR 52.246-17)

As prescribed in 46.710(a)(1), insert a clause substantially as follows:

(a) Definitions. As used in this clause-

"Acceptance" means the act of an authorized representative of the Government by which the Government assumes for itself, or as an agent of another, ownership of existing supplies, or approves specific services as partial or complete performance of the contract.

"Supplies" means the end items furnished by the Contractor and related services required under this contract. The word does not include "data."

(b) Contractor's obligations.

(1) Notwithstanding inspection and acceptance by the Government of supplies furnished under this contract, or any condition of this contract concerning the conclusiveness thereof, the Contractor warrants that for a period of one year from the date of final acceptance of all materials:

(i) All supplies furnished under this contract will be free from defects in material or workmanship and will conform with all requirements of this contract; and
(ii) The preservation, packaging, packing, and marking, and the preparation for, and method of, shipment of such supplies will conform with the requirements of this contract.

(2) When return, correction, or replacement is required, transportation charges and responsibility for the supplies while in transit shall be borne by the Contractor. However, the Contractor's liability for the transportation charges shall not exceed an amount equal to the cost of transportation by the usual commercial method of shipment between the place of delivery specified in this contract and the Contractor's plant, and return.

(3) Any supplies or parts thereof, corrected or furnished in replacement under this clause, shall also be subject to the terms of this clause to the same extent as supplies initially delivered. The warranty, with respect to supplies or parts thereof, shall be equal in duration to that in paragraph (b)(1) of this clause and shall run from the date of delivery of the corrected or replaced supplies.

(4) All implied warranties of merchantability and "fitness for a particular purpose" are excluded from any obligation contained in this contract.

(c) Remedies available to the Government.

(1) The Contracting Officer shall give written notice to the Contractor of any breach of warranties in paragraph (b)(1) of this clause within 30 days after discovery of the defect.

(2) Within a reasonable time after the notice, the Contracting Officer may either-

(i) Require, by written notice, the prompt correction or replacement of any supplies or parts thereof (including preservation, packaging, packing, and marking) that do not conform with the requirements of this contract within the meaning of paragraph (b)(1) of this clause; or
(ii) Retain such supplies and reduce the contract price by an amount equitable under the

circumstances.

(3) (i) If the contract provides for inspection of supplies by sampling procedures, conformance of supplies or components subject to warranty action shall be determined by the applicable sampling procedures in the contract. The Contracting Officer-

(A) May, for sampling purposes, group any supplies delivered under this contract;
(B) Shall require the size of the sample to be that required by sampling procedures specified in the contract for the quantity of supplies on which warranty action is proposed;
(C) May project warranty sampling results over supplies in the same shipment or other supplies contained in other shipments even though all of such supplies are not present at the point of reinspection; provided, that the supplies remaining are reasonably representative of the quantity on which warranty action is proposed; and
(D) Need not use the same lot size as on original inspection or reconstitute the original inspection lots.

(ii) Within a reasonable time after notice of any breach of the warranties specified in paragraph (b)(1) of this clause, the Contracting Officer may exercise one or more of the following options:

(A) Require an equitable adjustment in the contract price for any group of supplies.
(B) Screen the supplies grouped for warranty action under this clause at the Contractor's expense and return all nonconforming supplies to the Contractor for correction or replacement.
(C) Require the Contractor to screen the supplies at locations designated by the Government within the contiguous United States and to correct or replace all nonconforming supplies.
(D) Return the supplies grouped for warranty action under this clause to the Contractor (irrespective of the f.o.b. point or the point of acceptance) for screening and correction or replacement.

(4) (i) The Contracting Officer may, by contract or otherwise, correct or replace the nonconforming supplies with similar supplies from another source and charge to the Contractor the cost occasioned to the Government thereby if the Contractor-

(A) Fails to make redelivery of the corrected or replaced supplies within the time established for their return; or
(B) Fails either to accept return of the nonconforming supplies or fails to make progress after their return to correct or replace them so as to endanger performance of the delivery schedule, and in either of these circumstances does not cure such failure within a period of 10 days (or such longer period as the Contracting Officer may authorize in writing) after receipt of notice from the Contracting Officer specifying such failure.

(ii) Instead of correction or replacement by the Government, the Contracting Officer may require an equitable adjustment of the contract price. In addition, if the Contractor fails to furnish timely disposition instructions, the Contracting Officer may dispose of the nonconforming supplies for the Contractor's account in a reasonable manner. The

Government is entitled to reimbursement from the Contractor, or from the proceeds of such disposal, for the reasonable expenses of the care and disposition of the nonconforming supplies, as well as for excess costs incurred or to be incurred.

(5) The rights and remedies of the Government provided in this clause are in addition to and do not limit any rights afforded to the Government by any other clause of this contract.

I-4 ASSURANCE REGARDING FELONY CONVICTION OR TAX DELINQUENT STATUS FOR CORPORATE APPLICANTS (FEB 2012) (AGAR 452.209 – 71)

(a) This award is subject to the provisions contained in sections 738 and 739 of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2012, P.L. No. 112-55, Division A, as amended and/or subsequently enacted, regarding corporate felony convictions and corporate federal tax delinquencies. Accordingly, by accepting this award the contractor acknowledges that it –

(1) does not have a tax delinquency, meaning that it is not subject to any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability, and

(2) has not been convicted (or had an officer or agent acting on its behalf convicted) of a felony criminal violation under any Federal or State law within 24 months preceding the award, unless a suspending and debarring official of the United States Department of Agriculture has considered suspension or debarment of the awardee, or such officer or agent, based on these convictions and/or tax delinquencies and determined that suspension or debarment is not necessary to protect the interests of the Government.

(b) If the awardee fails to comply with these provisions, **USDA, Farm Service Agency** may terminate this contract for default and may recover any funds the awardee has received in violation of sections 738 or 739, as amended and/or subsequently enacted.

I-5 CLAUSES INCORPORATED BY REFERENCE (FEB 1998) (FAR 52.252-2)

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

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES:

52.202-01 Definitions (NOV 2013)

52.203-03 Gratuities (APR 1984)

52.203-05 Covenant Against Contingent Fees (MAY 2014)

52.203-06 Restrictions on Subcontractor Sales to the Government (SEP 2006)

52.203-07 Anti-Kickback Procedures (MAY 2014)

52.203-08 Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity (MAY 2014)

52.203-10 Price or Fee Adjustment for Illegal or Improper Activity (MAY 2014)

52.203-12 Limitation on Payments to Influence Certain Federal Transactions (OCT 2010)

52.203-17 Contractor Employee Whistleblower Rights and Requirement to Inform Employees of Whistleblower Rights (APR 2014)

52.204-04 Printing/Copying Double-Sided on Recycled Paper (MAY 2011)

52.204-07 System for Award Management (JUL 2013)

52.204-08 Annual Representations and Certifications (DEC 2014)

52.204-10 Reporting Executive Compensation and First-Tier Subcontract Awards (JUL 2013)

452.204-70 Inquiries (AUG 2013 - AGAR)

52.209-06 Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment (AUG 2013)

52.211-05 Material Requirements (AUG 2000)

52.215-01 Instructions to Offerors—Competitive Acquisition (JAN 2004)

52.215-02 Audit and Records - Negotiation (OCT 2010)

52.215-08 Order of Precedence - Uniform Contract Format (OCT 1997)

52.215-14 Integrity of Unit Prices (OCT 2010)

52.217-08 Option to Extend Services (NOV 1999)

52.217-09 Option to Extend the Term of the Contract (MAR 2000)

52.219-01 Small Business Program Representations (OCT 2014)

52.219-04 Notice of Price Evaluation Preference for HUBZone Small Business Concerns (JAN 2011)

52.219-06 Notice of Total Small Business Set-Aside (NOV 2011)

52.219-08 Utilization of Small Business Concerns (JUL 2013)

52.219-14 Limitations on Subcontracting (NOV 2011)

52.219-28 Post-Award Small Business Program Rerepresentation (JUL 2013)

52.222-03 Convict Labor (JUN 2003)

52.222-04 Contract Work Hours and Safety Standards Act - Overtime Compensation (MAY 2014)

52.222-19 Child Labor – Cooperation with Authorities and Remedies (JAN 2014)

52.222-21 Prohibition of Segregated Facilities (APR 2015)

52.222-26 Equal Opportunity (APR 2015)

52.222-35 Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (JUL 2014)

52.222-36 Affirmative Action for Workers with Disabilities (JUL 2014)

52.222-37 Employment Reports on Special Disabled Veterans and Veterans of the Vietnam Era, and Other Eligible Veterans (JUL 2014)

52.222-40 Notification of Employee Rights Under the National Labor Relations Act (DEC 2010)

52.222-41 Service Contract Act of 1965, as Amended (MAY 2014)

52.222-44 Fair Labor Standards Act and Service Contract Act - Price Adjustment (SEP 2009)

52.222-50 Combating Trafficking in Persons (MAR 2015)

52.223-06 Drug-Free Workplace (MAY 2001)

52.223-18 Encouraging Contractor Policies to Ban Text Messaging While Driving (AUG 2011)

52.225-13 Restrictions on Certain Foreign Purchases (JUN 2008)

52.227-01 Authorization and Consent (DEC 2007)

52.227-02 Notice and Assistance regarding Patent & Copyright Infringement (DEC 2007)

52.227-03 Patent Indemnity (APR 1984)

52.227-14 Rights in Data - General - Alternate I (MAY 2014)

52.229-03 Federal, State, and Local Taxes (FEB 2013)

52.232-01 Payments (APR 1984)

52.232-08 Discounts for Prompt Payment (FEB 2002)

52.232-09 Limitation on Withholding of Payments (APR 1984)

52.232-11 Extras (APR 1984)

52.232-17 Interest MAY 2014)

52.232-18 Availability of Funds (APR 1984)

52.232-23 Assignment of Claims (MAY 2014)

52.232-25 Prompt Payment (JUL 2013)

52.232-33 Payment by Electronic Funds Transfer – System for Award Management (JUL 2013)

52.232-39 Unenforceability of Unauthorized Obligations (JUN 2013)

52.232-40 Providing Accelerated Payments to Small Business Subcontractors (DEC 2013)

52.233-01 Disputes (MAY 2014)

52.233-03 Protest After Award (AUG 1996)

52.233-04 Applicable Law for Breach of Contract Claim (OCT 2004)

52.242-02 Production Progress Reports (APR 1991)

52.242-13 Bankruptcy (JUL 1995)

52.243-01 Changes - Fixed Price - Alternate II (APR 1987)

52.244-06 Subcontracts for Commercial Items (APR 2015)

52.246-25 Limitation of Liability - Services (FEB 1997)

52.248-01 Value Engineering (OCT 2010)

52.249-04 Termination for Convenience of the Government (Services) (Short Form) (APR 1984)

52.249-08 Default (Fixed-Price Supply and Service) (APR 1984)

52.253-01 Computer Generated Forms (JAN 1991)

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

SECTION J - LIST OF ATTACHMENTS
LIST OF DOCUMENTS, EXHIBITS, AND OTHER ATTACHMENTS

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Attachment A: Aerial Photography Field Office (APFO) Specification for Digital Camera Based Acquisition (4 pages)

Attachment B: Aerial Photography Field Office (APFO) USDA Digital Imagery Quality Specification (4 pages)

Attachment C: USDA Digital File Format Specification, Version 1.0, dated January 24, 2013, (39 pages)

EXHIBIT 1

Figure 1

PROJECT BOUNDARIES AND DOQQ

U.S. DEPARTMENT OF AGRICULTURE
AERIAL IMAGERY
SOLICITATION NO: AG-8447-S-15-0003 (USDA-FS-5-15)
ITEM 1: Prescott National Forest,
ARIZONA
GROUND SAMPLE DIST: 25 cm (9.8 inches)
IMAGERY: 4 Band Direct Digital
PROJECT IDENTIFICATION CODE: 613090

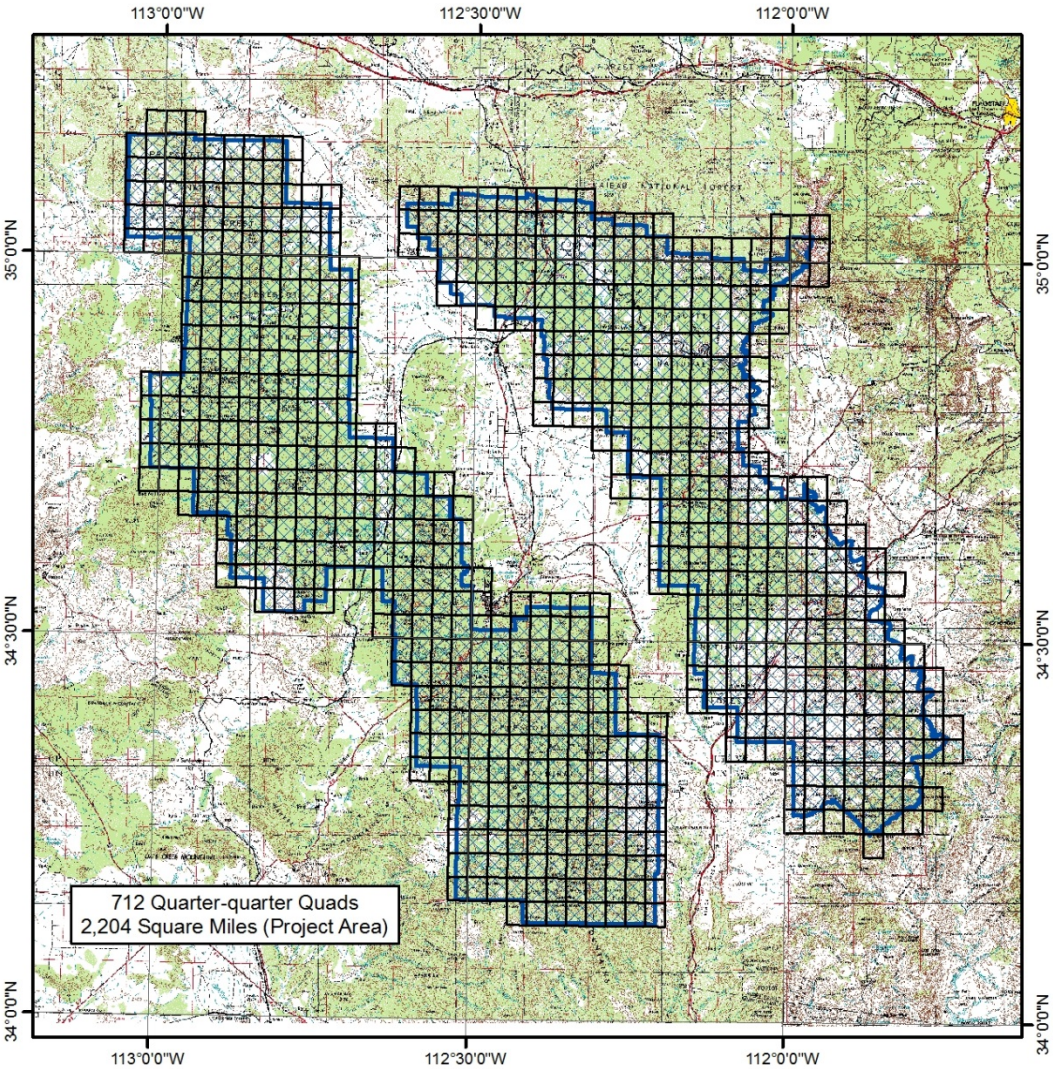


EXHIBIT 1

Figure 2

PROJECT BOUNDARIES AND DOQQQ

U.S. DEPARTMENT OF AGRICULTURE
AERIAL IMAGERY
SOLICITATION NO: AG-8447-S-15-0003 (USDA-FS-5-15)
ITEM 2: Cibola National Forest Grasslands,
NEW MEXICO, OKLAHOMA, & TEXAS
GROUND SAMPLE DIST: 25 cm (9.8 inches)
IMAGERY: 4 Band Direct Digital
PROJECT IDENTIFICATION CODE: 613030

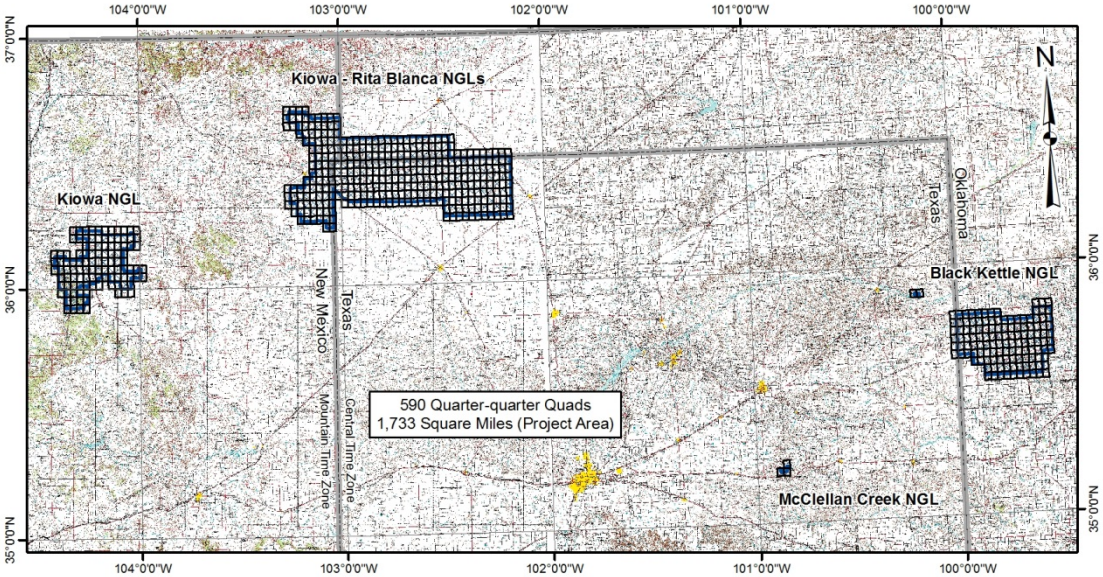


EXHIBIT 2
FILE NAMING CONVENTION

Georeferenced,(Stereo) Digital Image Files:

File Name: <project code>_<flight line >_<exposure>_<yyyymmdd>_<bitspectral>.tif

<project code> - project code for each project item specified in Section B
<flight line> - flight line number (4 characters padded with leading zeros)
<exposure> - consecutively numbered value (4 characters padded with leading zeros)
<yyyymmdd> - image exposure date
<bitspectral> - image bit depth (16b, 8b, 16bp for panchromatic band)

Example: 613090_0070_0001_20150827_8b.tif

Quadrangle, Quarter Quadrangle and Quarter-Quarter Quadrangle Image Tiles:

QQQ File Name: m_<lat><lon><quad>_<loc>_<n>_<xx>_<r>_<yyyymmdd>.tif

QQ File Name: m_<lat><lon><quad>_<loc>_<xx>_<r>_<yyyymmdd>.tif

Q File Name: m_<lat><lon><quad>_<xx>_<r>_<yyyymmdd>

m = multispectral
<lat> - latitude, identified by 2 digit numerical value of a 1º block
<lon> - longitude, identified by 3 digit numerical value of a 1º block (including the leading "0" if needed)
<quad> - quadrangle number, identified by grid number
<loc> - quadrangle location, identified by grid letters (nw, ne, sw, se)
<n> - quarter quadrangle location, identified by number (1, 2, 3, 4)
<xx> – two digit UTM zone
<r> - resolution in centimeters
<yyyymmdd> - date of acquisition (majority date)

QQQ Example: m_3311162_ne_1_12_25_20150721.tif
QQ Example: m_3311162_ne_12_25_20150721.tif
Q Example: m_3311162_12_25_20150721.ecw

Compressed Project Mosaic File: *(Not applicable to this contract)*

File Name: <project code>_<projid>-<item>_<m>.ecw

<project code> - project code
<projid> - project identifier
<item> - item number
<m> - band designator ("m" = multi spectral, "n" = natural color, "c" = infrared)

Example: 613090_5-15-1_m.ecw

EXHIBIT 2 (Cont'd)

Project Geodatahase:

File Name: Project_Geodatabase_<project code>_<projid>.gdb

<project code> - project code for each project item specified in Section B
<projid> - project identifier (from B-2); replace "-" with "dash"

Example: Project_Geodatabase_613090_ 5dash15.gdb

Project Acquisition Feature Dataset:

File Name: <area name>_<project code>_<projid>_<item>

<area name> - name of forest or grassland
<project code> - project code for each project item specified in Section B
<projid> - project identifier (from B-2); replace "-" with "dash"
<item> - project item number

Example: Prescott_613090_5dash15_1

Image Footprint Feature Class:

File Name: <footprint type>_<project code>_<spatial resolution>_<spectral resolution>_<radiometric resolution>_<projid>_<item>

<footprint type> - sensor footprint based upon level of processing. Must be uncorrected, georeferenced, or ortho
<project code> - project code for each project item specified in Section B
<spatial resolution> - ground sample distance in units as dictated by the contract
<spectral resolution> - number of bands
<radiometric resolution> - bit depth (either 8 or 16)
<projid> - project identifier (from B-2); replace "-" with "dash"
<item> - project item number

Example: georeferenced_613090_25_4_8_5dash15_1

Flight Line Feature Class:

File Name: flight_line_<project code>_<projid>_<item>

<project code> - project code for each project item specified in Section B
<projid> - project identifier (from B-2); replace "-" with "dash"
<item> - project item number

Example: flight_line_613090_5dash15_1

Orthorectified Image Index Feature Class:

File Name: ortho_index_<project code>_<spatial resolution>_<spectral resolution>_<projid>_<item>

<project code> - project code for each project item specified in Section B
<spatial resolution> - ground sample distance in units as dictated by the contract
<spectral resolution> - number of bands
<projid> - project identifier (from B-2); replace "-" with "dash"
<item> - project item number

Example: ortho_index_613090 _25_4_5dash15_1

Seamline Feature Class:

File Name: seamlines_<project code>_<projid>_<item>

<project code> - project code for each project item specified in Section B
<projid> - project identifier (from B-2); replace "-" with "dash"
<item> - project item number

Example: seamlines_613090_5dash15_1

Stereo Block File:

File Name: <project code>_<bit>_<block no>.blk

<project code> - project code for each project item specified in Section B
<bit> - image bit depth (16b or 8b)
<block no> - consecutively numbered value for each image bit depth
(2 characters padded with leading zero)

Example: 613090_8b_01.blk through 613090_8b_04.blk

EXHIBIT 3

QUARTER-QUARTER QUAD NUMBERING LOGIC

112° 00' 00"
34° 00' 00" •

01	02	03	04	05	06	07	08
09	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

• 33° 00' 00"
111° 00' 00"

NW	NE
SW	SE

1	2
4	3

The ID for this QQQ would be:
3311162_ne_2

Each Block (ie: A3) is a full Quad within the 1 degree grid; it is further subdivided into 4 quarter-quads, i.e. 3311162_ne

Then the quarter quad is further subdivided into quarter-quarter quads:

Sample: 3311162_ne_2 Where:

Latitude: Identified by 2 digit numerical value of a 1 degree block.
Longitude: Identified by 3 digit numerical value of a 1 degree block, including a leading “0" as needed.
Quadrangle Number: Identified by grid number (01, 02, 03, ... 63, 64).
Quarter Quadrangle Location: Identified by grid letters (nw, ne, sw, se)
Quarter-Quarter Quadrangle Location: Identified by grid numbers (1, 2, 3, 4)

EXHIBIT 4

PROGRESS REPORT CONVENTION

Syntax:

HEADER ITEMS:	field-name ":"[field-body][CRLF]
BODY ITEMS:	body item [CRLF]

Header Items:
All four header items are required to be submitted in each and every submittal.

DESCRIPTION	KEYWORD	FORMAT
Contractor Name	CONTRACTOR	Alphanumeric
Contract Award Number	CONTRACT	Numeric (N-YY)
Award Item	ITEM	Numeric (N)
Date Flown	DATE	Date (YYYYMMDD)

Body Items:
All data elements are required for each line of data submitted. Data elements are to be separated by 5 ASCII decimal 32 (white space). Acquisition and rejected exposure stations can be submitted as separate reports or as a combined report.

DESCRIPTION	KEYWORD	FORMAT
Latitude	N/A	DD.DDDDD
Longitude	N/A	-DDD.DDDDD
Status	N/A	Char(1)*

* Status Field:
A - Indicates the Exposure Station has been collected
R – Indicates the contractor has rejected a previously acquired Exposure Station

When an exposure station is rejected the exposure station will appear in a later report marked with an "R". Each report submitted should include only one status indicator for a particular exposure station.

EXHIBIT 4

PROGRESS REPORT CONVENTION

Text File Naming Convention:

PROJECT IDENTIFIER (N-YY-ITEM)_DATE FLOWN (YYYYMMDD)_STATUS

i.e: 5-15-1_20150827_A

Field Headers:
Text is case sensitive and must occur in the order below on a separate line from the body items.

Body Items:
All data elements are required for each line of data submitted. Data elements are to be separated by 5 ASCII decimal 32 (white space). Acquisition and rejected exposure should be submitted as separate reports.

DESCRIPTION	FIELD HEADER	KEYWORD	FORMAT
Latitude	LAT	N/A	DD.DDDDD
Longitude	LON	N/A	-DDD.DDDDD
Status*	STATUS	N/A	Char(1)*

* Status Field:
A - Indicates the Exposure Station has been collected
R – Indicates the contractor has rejected a previously acquired Exposure Station

Sample Acquired Imagery Report
File name: 5-15-1_20150827_A

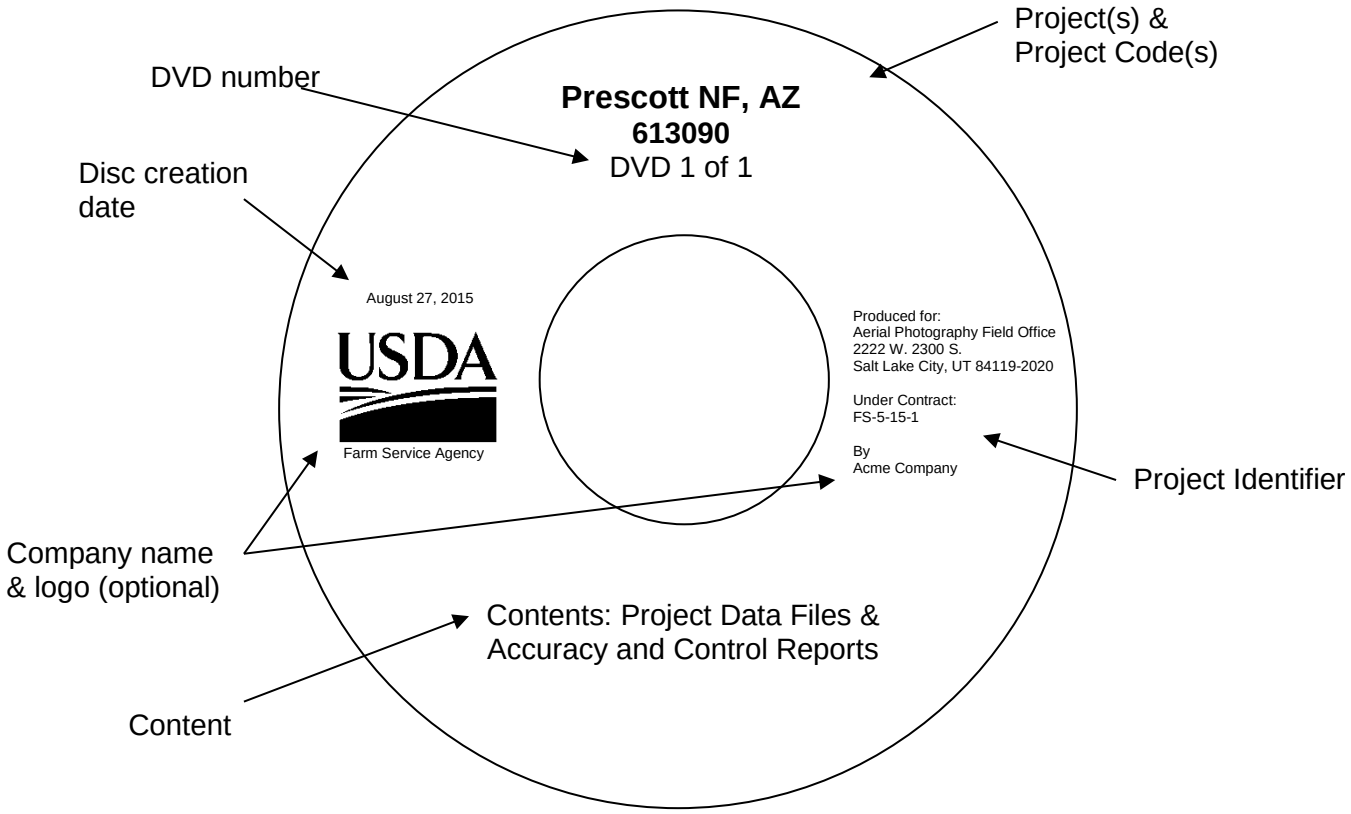
```
LAT,LON,STATUS
64.00002,-144.18751,A
64.04166,-144.18750,A
64.08332,-144.18752,A
64.12501,-144.18751,A
```

Sample Rejected Imagery Report
File name: 5-15-1_20150828_R

```
LAT,LON,STATUS
64.00002,-144.18751,R
64.04166,-144.18750,R
64.08332,-144.18752,R
64.12501,-144.18751,R
```

EXHIBIT 5
Figure 1

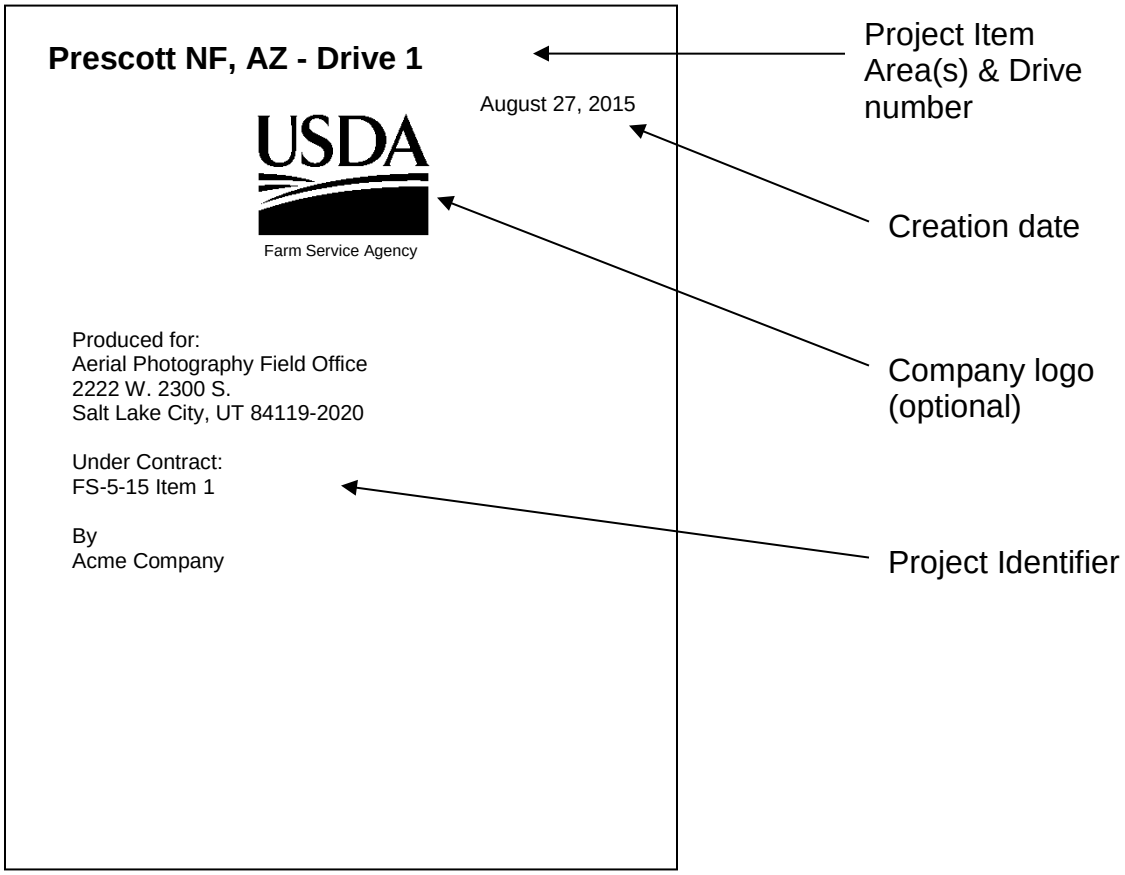
DVD Labeling Requirements



ELEMENT	EXAMPLE
DVD Number	DVD 1 of 1
Company name & logo	Acme Company
Content	Project Data Files & Accuracy and Control Reports
Project Identifier	FS-5-15-1
Creation date	August 27, 2015
Project	Prescott NF, AZ
Project Code	613090

EXHIBIT 5
Figure 2

Hard Drive Labeling Requirements



ELEMENT	EXAMPLE
Company name & logo	Acme Company
Project Identifier	FS-5-15-1
Creation date	August 27, 2015
Project item area & drive number	Prescott NF, AZ – Hard Drive 1

Approximate label dimensions: 3-1/2” (width) x 4-1/2” (height)

EXHIBIT 6

REGISTER OF WAGE DETERMINATIONS UNDER THE SERVICE CONTRACT ACT By direction of the Secretary of Labor	U.S. DEPARTMENT OF LABOR EMPLOYMENT STANDARDS ADMINISTRATION WAGE AND HOUR DIVISION WASHINGTON, D.C. 20210
Diane C. Koplewski, Director Division of Wage Determinations	Wage Determination No: 1995-0222 Revision No: 38 Date of Revision: 01/14/2015

Note: Executive Order (EO) 13658 establishes an hourly minimum wage of $10.10 for 2015 that applies to all contracts subject to the Service Contract Act for which the solicitation is issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.10 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract. The EO minimum wage rate will be adjusted annually.

Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.
Nationwide: Applicable in the continental U.S. Alaska, Puerto Rico, Hawaii and Virgin Islands.

Fringe Benefits Required Follow the Occupational Listing

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

OCCUPATION CODE - TITLE	FOOTNOTE	RATE
31010 - Airplane Pilot		28.36
(not set) - First Officer (Co-Pilot)		25.82
(not set) - Aerial Photographer		14.17

EXCEPT SCHEDULED AIRLINE TRANSPORTATION AND LARGE MULTI-ENGINE AIRCRAFT SUCH AS THE B-727, DC-8, AND THE DC-9.

ALL OCCUPATIONS LISTED ABOVE RECEIVE THE FOLLOWING BENEFITS:

HEALTH & WELFARE: $4.02 per hour or $160.80 per week or $696.79 per month

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

HOLIDAYS: A minimum of ten paid holidays per year: New Year's Day, Martin Luther King Jr.'s Birthday, Washington's Birthday, Memorial Day, Independence

Day, Labor Day, Columbus Day, Veterans' Day, Thanksgiving Day, and Christmas Day. (A contractor may substitute for any of the named holidays another day off with pay in accordance with a plan communicated to the employees involved.) (See 29 CFR 4.174)

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

HEALTH & WELFARE (Hawaii): $1.66 per hour, or $66.40 per week, or $297.73 per month hour for all employees on whose behalf the contractor provides health care benefits pursuant to the Hawaii prepaid Health Care Act. For those employees who are not receiving health care benefits mandated by the Hawaii prepaid Health Care Act, the new health and welfare benefit rate will be $4.02 per hour.

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

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

** UNIFORM ALLOWANCE **

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

The contractor or subcontractor is required to furnish all employees with an adequate number of uniforms without cost or to reimburse employees for the actual cost of the uniforms. In addition, where uniform cleaning and maintenance is made the responsibility of the employee, all contractors and subcontractors subject to this wage determination shall (in the absence of a

bona fide collective bargaining agreement providing for a different amount, or the furnishing of contrary affirmative proof as to the actual cost), reimburse all employees for such cleaning and maintenance at a rate of $3.35 per week (or $.67 cents per day). However, in those instances where the uniforms furnished are made of "wash and wear" materials, may be routinely washed and dried with other personal garments, and do not require any special treatment such as dry cleaning, daily washing, or commercial laundering in order to meet the cleanliness or appearance standards set by the terms of the Government contract, by the contractor, by law, or by the nature of the work, there is no requirement that employees be reimbursed for uniform maintenance costs.

The duties of employees under job titles listed are those described in the "Service Contract Act Directory of Occupations", Fifth Edition (Revision 1), dated September 2014, unless otherwise indicated.

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

Conformance Process:

The contracting officer shall require that any class of service employee which is not listed herein and which is to be employed under the contract (i.e., the work to be performed is not performed by any classification listed in the wage determination), be classified by the contractor so as to provide a reasonable relationship (i.e., appropriate level of skill comparison) between such unlisted classifications and the classifications listed in the wage determination. Such conformed classes of employees shall be paid the monetary wages and furnished the fringe benefits as are determined (See 29 CFR 4.6(b)(2)(i)). Such conforming procedure shall be initiated by the contractor prior to the performance of contract work by such unlisted class(es) of employees (See 29 CFR 4.6(b)(2)(ii)). The Wage and Hour Division shall make a final determination of conformed classification, wage rate, and/or fringe benefits which shall be retroactive to the commencement date of the contract (See 29 CFR 4.6(b)(2)(iv)(C)(vi)). When multiple wage determinations are included in a contract, a separate SF-1444 should be prepared for each wage determination to which a class(es) is to be conformed.

The process for preparing a conformance request is as follows:

1) When preparing the bid, the contractor identifies the need for a conformed occupation(s) and computes a proposed rate(s).

2) After contract award, the contractor prepares a written report listing in order the proposed classification title(s), a Federal grade equivalency (FGE) for each proposed classification(s), job description(s), and rationale for proposed wage rate(s), including information regarding the agreement or disagreement of the authorized representative of the employees involved, or where there is no authorized representative, the employees themselves. This report should be submitted to the contracting officer no later than 30 days after such unlisted class(es) of employees performs any contract work.

3) The contracting officer reviews the proposed action and promptly submits a report of the action, together with the agency's recommendations and pertinent information including the position of the contractor and the employees, to the Wage and Hour Division, U.S. Department of Labor, for review (See 29 CFR 4.6(b)(2)(ii)).

4) Within 30 days of receipt, the Wage and Hour Division approves, modifies, or disapproves the action via transmittal to the agency contracting officer, or notifies the contracting officer that additional time will be required to process the request.

5) The contracting officer transmits the Wage and Hour decision to the contractor.

6) The contractor informs the affected employees.

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

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

** OCCUPATIONS NOT INCLUDED IN THE SCA DIRECTORY OF OCCUPATIONS **
Aerial Photographer
The aerial photographer must be skilled in reading flight maps, capable of assisting the pilot to adhere to flight lines, be able to level and operate a cartographic camera and its auxiliary equipment mounted in the aircraft so that the photographs that are taken will have the required forward lap and side lap for use in photogrammetric mapping equipment, and possess a working knowledge of aerial films and camera filters to insure proper exposure of the films.

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

EXHIBIT 7

GLOSSARY, DEFINITIONS AND FILE EXTENSIONS

Acquisition Period: The calendar period in which the project item area imagery is required to be acquired.

Camera System: The combination of lens, cone, magazine(s), and camera filter(s) which have been calibrated as an integral unit.

Contracting Officer's Representative (COR): A person who is responsible for specific technical and administrative duties related to a contract.

Direct Digital Imagery: Vertical, high resolution imagery directly captured using a digital sensor. Either airborne or space-borne systems.

Exposure Stations: Pre-determined locations where photo centers of individual frames are to be exposed.

Georeferenced: Registering data with correct real world coordinates. Defining location using map coordinates and assignment of a known reference system, which allows data to be viewed, queried, and analyzed with other geographic data.

Ground Sample Distance: The ground sample distance is the distance on the ground represented by each pixel in the x and y components.

Original Imagery/Photography: All aerial imagery/photography, as secured by the Contractor, prior to its inspection by the USDA, including any reflights made at the discretion of the Contractor.

Project Item Area: An area or areas described in the Schedule for which an award shall be made to one offeror.

Reflight Photography: Photography reflown to replace original imagery/photography rejected by USDA.

Remake Materials: Any contract materials ordered remade by USDA.

Stereomodel: The area covered by the conjugate images of three successive overlapping exposures.

Uncorrected: No radiometric corrections or enhancements.

FILE EXTENSIONS (Refer to Attachment C for additional file extensions)

.ads: ADS header (text) file, with pointers to .tif segments (for scanning sensors).

.aux: Stands for “auxiliary file.” A file that accompanies the raster in the same location and stores any auxiliary information that cannot be stored in the raster file itself, including statistical information for the raster data set. It can also store the color map, histogram or table, coordinate system, transformation, and projection information.

EXHIBIT 7 (Cont'd)

.blk: Stands for "block file." A term used to describe and characterize all of the information associated with a photogrammetric mapping project, such as projection, spheroid, and datum; imagery; camera or sensor model information; GCPs; and geometric relationship between imagery and the ground. A block file is a binary file.

.gdb: Stands for "geodatabase." A geodatabase is a collection of geographic datasets of various types used in ArcGIS and managed in either a file folder or a relational database.

.hist: Stands for "histogram." XML file containing histogram of imagery.

.odf: File that contains absolute orientation data for every image.

.odf.adj: File that contains adjusted (more accurate) absolute orientation data than what is contained in the .odf data.

.prj: Stands for "project file." A SOCET SET file containing the information required to restore the current state of a work. All necessary files, settings, and preferences are stored in the project file.

EXHIBIT 8

FLIGHT LINE AND EXPOSURE NUMBERING

Flight line numbers and exposure numbers within a flight line shall not be duplicated within a project item.

Flight Line: Flight lines shall be numbered consecutively beginning with flight number 0001 for the project item:

North-South oriented flights: Begin with the most westerly flight line, and continue numbering each flight line consecutively moving eastward through the project.

East-West oriented flights: Begin with the most northerly flight line and continue numbering each flight line consecutively moving southward through the project.

Flight line numbers: shall start at 0001 and remain sequential across the project, regardless of the order flown.

Pre-Submission Reflights: If reflights are necessary prior to submission of the imagery, the flight line number shall remain the same as the original.

Post-Inspection Reflights: If reflights are necessary due to the Government's rejection of images submitted, the last two digits shall remain the same as the original flights. The first digit shall begin with a 1 for the first reflight required, a 2 for the second, etc. For example:

If flight line 0015 requires a reflight, the first reflight would be numbered 1015. If a second reflight were required after resubmission and inspection of the first, it would be numbered 2015.

Exposure Number: Exposures shall be numbered consecutively starting at 0001 at the northern end of each North-South flight line (at the western end for East-West flights) and continue in sequence through the last exposure, regardless of the order flown. The exposure number shall restart at 0001 for each flight line.

Reflights: Exposure numbers shall remain the same as the original flight. A reflight shall contain a minimum of two exposures to ensure consistent stereo coverage.

North-South Flight Line and Exposure Numbering Example

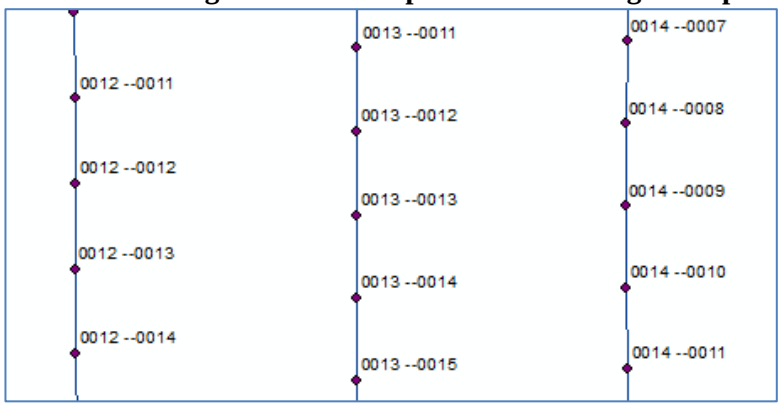
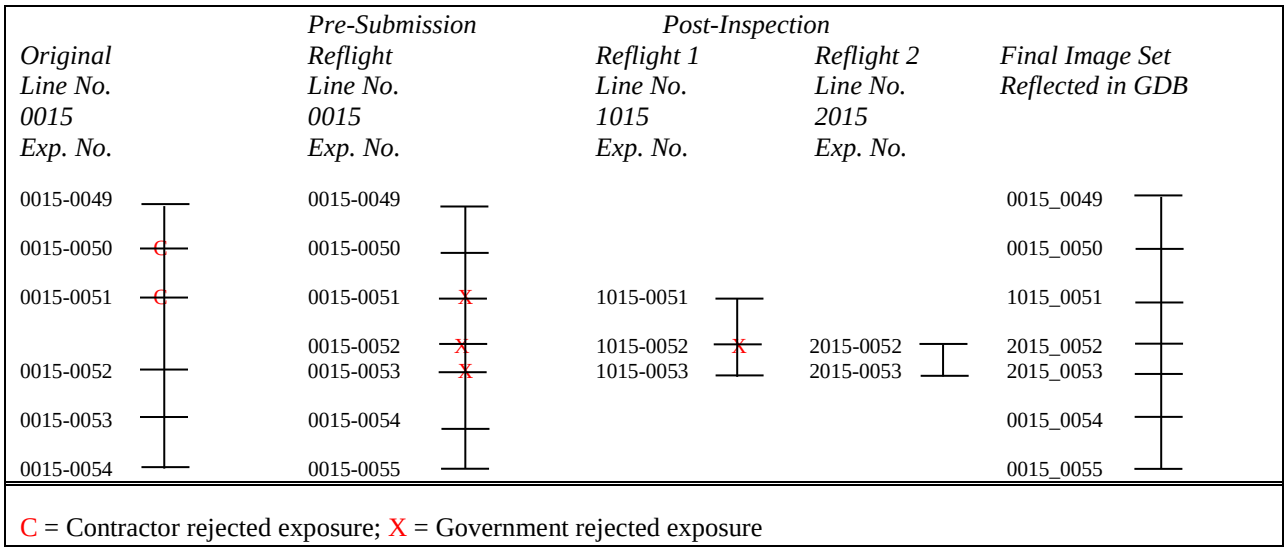


EXHIBIT 8 (Continued)

FLIGHT LINE AND EXPOSURE NUMBERING

Reflight Numbering Examples



Original Exposures	Exposures 0050 & 0051 Reflown Pre-Submission Submitted as follows:	Exposures 0051, 0052 & 0053 Rejected from Inspection (1st Reflight)	Resubmitted Exposure 0052 Rejected from Inspection (2nd Reflight)	Final Imagery Set
0015_0049	0015_0049			0015_0049
0015_0050	0015_0050			0015_0050
0015_0051	0015_0051	1015_0051		1015_0051
	0015_0052	1015_0052	2015_0052	2015_0052
0015_0052	0015_0053	1015_0053	2015_0053	2015_0053
0015_0053	0015_0054			0015_0054
0015_0054	0015_0055			0015_0055

Exposures may need to be renumbered within a flight line if reflights occur before the imagery is submitted to the Government.

EXHIBIT 9

EXAMPLE LISTGEO OUTPUT

The following are example ListGeo Output files only. Refer to Attachment C, USDA Digital File Format Specification for GeoTIFF tag specifications.

ListGeo Output – Non-Orthorectified, Georeferenced, GeoTIFF

The following is an example of a GeoTIFF tag and GeoKey listing from a non-orthorectified, georeferenced GeoTIFF image. This listing is the output of the libgeotiff utility program "listgeo". The projection information below the line "End_Of_Geotiff" is implied by the standard projection and is not stored explicitly in the data file. The descriptions are retrieved from libgeotiff lookup tables in the listgeo application.

```
Geotiff_Information:
   Version: 1
   Key_Revision: 1.0
   Tagged_Information:
      ModelTransformationTag (4,4):
         -0.00290358977   0.260146801      0              521253.412
         0.260078624      0.00303118896    0              4921452.99
         0                0                1              0
         0                0                0              1
      End_Of_Tags.
   Keyed_Information:
      GTModelTypeGeoKey (Short,1): ModelTypeProjected
      GTRasterTypeGeoKey (Short,1): RasterPixelIsArea
      GeogGeodeticDatumGeoKey (Short,1): Datum_North_American_Datum_1983
      GeogEllipsoidGeoKey (Short,1): Ellipse_GRS_1980
      ProjectedCSTypeGeoKey (Short,1): PCS_NAD83_UTM_zone_13N
      PCSCitationGeoKey (Ascii,58): "Universal Transverse Mercator; North American 1983;
GRS80"
      ProjLinearUnitsGeoKey (Short,1): Linear_Meter
      ProjNatOriginLongGeoKey (Double,1): -105
      ProjNatOriginLatGeoKey (Double,1): 0
      ProjFalseEastingGeoKey (Double,1): 500000
      ProjFalseNorthingGeoKey (Double,1): 0
      ProjScaleAtNatOriginGeoKey (Double,1): 0.9996
      End_Of_Keys.
   End_Of_Geotiff.

PCS = 26913 (NAD83 / UTM zone 13N)
Projection = 16013 (UTM zone 13N)
Projection Method: CT_TransverseMercator
 ProjNatOriginLatGeoKey: 0.000000 (  0d 0' 0.00"N)
   ProjNatOriginLongGeoKey: -105.000000 (105d 0' 0.00"W)
   ProjScaleAtNatOriginGeoKey: 0.999600
```

EXHIBIT 9 (Continued)

EXAMPLE LISTGEO OUTPUT

```
 ProjFalseEastingGeoKey: 500000.000000 m
   ProjFalseNorthingGeoKey: 0.000000 m
GCS: 4269/NAD83
Datum: 6269/North American Datum 1983
Ellipsoid: 7019/GRS 1980 (6378137.00,6356752.31)
Prime Meridian: 8901/Greenwich (0.000000/  0d 0' 0.00"E)
Projection Linear Units: 9001/metre (1.000000m)

Corner Coordinates:
Upper Left    (  521253.412, 4921452.989)  (104d43'58.44"W, 44d26'45.84"N)
Lower Left    (  524849.681, 4921494.892)  (104d41'15.73"W, 44d26'46.78"N)
Upper Right   (  521231.112, 4923450.393)  (104d43'59.15"W, 44d27'50.57"N)
Lower Right   (  524827.382, 4923492.296)  (104d41'16.39"W, 44d27'51.52"N)
Center        (  523040.397, 4922472.643)  (104d42'37.43"W, 44d27'18.69"N)
```

ListGeo Output – Orthorectified GeoTIFF

The following is an example of a GeoTIFF tag and GeoKey listing from an orthorectified GeoTIFF image. This listing is the output of the libgeotiff utility program “listgeo”. The projection information below the line “End_Of_Geotiff” is implied by the standard projection and is not stored explicitly in the data file. The descriptions are retrieved from libgeotiff lookup tables in the listgeo application.

```
Geotiff_Information:
   Version: 1
   Key_Revision: 1.0
   Tagged_Information:
      ModelTiepointTag (2,3):
         0            0            0
         337962       3763838      0
      ModelPixelScaleTag (1,3):
         2            2            1
      End_Of_Tags.
   Keyed_Information:
      GTModelTypeGeoKey (Short,1): ModelTypeProjected
      GTRasterTypeGeoKey (Short,1): RasterPixelIsArea
      GTCitationGeoKey (Ascii,45): "6131202012m_3311162_nw_12_2_20120714"
      ProjectedCSTypeGeoKey (Short,1): PCS_NAD83_UTM_zone_12N
      PCSCitationGeoKey (Ascii,21): "NAD83 / UTM zone 12N"
      ProjLinearUnitsGeoKey (Short,1): Linear_Meter
      End_Of_Keys.
   End_Of_Geotiff.
```

EXHIBIT 9 (Continued)

EXAMPLE LISTGEO OUTPUT

PCS = 26915 (name unknown)
Projection = 16015 ()
Projection Method: CT_TransverseMercator
  ProjNatOriginLatGeoKey: 0.000000 (0d 0' 0.00"N)
  ProjNatOriginLongGeoKey: -93.000000 (93d 0' 0.00"W)
  ProjScaleAtNatOriginGeoKey: 0.999600
  ProjFalseEastingGeoKey: 500000.000000
  ProjFalseNorthingGeoKey: 0.000000
GCS: 4269/NAD83
Datum: 6269/North American Datum 1983
Ellipsoid: 7019/GRS 1980 (6378137.00,6356752.31)
Prime Meridian: 8901/Greenwich (0.000000/ 0d 0' 0.00"E)
Projection Linear Units: 9001/metre (1.000000m)

Corner Coordinates:
Upper Left (337962.000,3763838.000) (94d45'16.56"W, 34d 0' 9.55"N)
Lower Left (337962.000,3756208.000) (94d45'11.47"W, 33d56' 1.94"N)
Upper Right (344456.000,3763838.000) (94d41' 3.51"W, 34d 0'13.09"N)
Lower Right (344456.000,3756208.000) (94d40'58.63"W, 33d56' 5.47"N)
Center (341209.000,3760023.000) (94d43' 7.54"W, 33d58' 7.53"N)

EXHIBIT 10

Hard Drive Directory Structure Template

The following table shows the correct data directory structure for hard drives. All directories shall be created at the root directory unless indicated otherwise.

DIRECTORY NAME	DESCRIPTION OF CONTENTS
\georeferenced	Uncorrected or color corrected georeferenced imagery. All stereo block files and associated support files. If a Leica ADS sensor is used, the following files as well: .ads, .hist, .odf, .odf.adj
\gps	*No data is to be stored here*
\gps_base	Any GPS ground data used to supplement the ABGPS positional data adjustments such as base stations or CORS
\index	Project file geodatabase
\minification	All scanning sensor minification files (.min). *Note: This directory shall only include data if a scanning sensor is used*
\ortho	*No data is to be stored here*
\ortho\doqqq	All orthorectified doqqq imagery. All associated .rrd, .aux, and .met files. Includes world files and .ige files
\ortho\doqq	All orthorectified doqq imagery. All associated .rrd, .aux, and .met files. Includes world files and .ige files
\ortho\doq	All orthorectified doq imagery. All associated .rrd, .aux, and .met files. Includes world files and .ige files
\ortho\cpm	All orthorectified, compressed project mosaic imagery. All associated .rrd, .aux, and .met files. May include world files.
\rmse	Root mean square error accuracy and quality control reports

PART IV - REPRESENTATIONS AND INSTRUCTIONS

SECTION K

REPRESENTATIONS, CERTIFICATIONS, AND OTHER STATEMENTS OF OFFERORS

K-1 ANNUAL REPRESENTATION AND CERTIFICATIONS (DEC 2014) (FAR 52.204-8)

(a)

(1) The North American Industry classification System (NAICS) code for this acquisition is **_541922**.

(2) The small business size standard is **_$7.5 Million**.

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

(b)

(1) If the provision at 52.204-7, System for Award Management, is included in this solicitation, paragraph (d) of this provision applies.

(2) If the provision at 52.204-7 is not included in this solicitation, and the offeror is currently registered in the System for Award Management (SAM), and has completed the Representations and Certifications section of SAM electronically, the offeror may choose to use paragraph (d) of this provision instead of completing the corresponding individual representations and certification in the solicitation. The offeror shall indicate which option applies by checking one of the following boxes:

[_] (i) Paragraph (d) applies.

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

(c)

(1) The following representations or certifications in SAM are applicable to this solicitation as indicated:

(i) 52.203-2, Certificate of Independent Price Determination. This provision applies to solicitations when a firm-fixed-price contract or fixed-price contract with economic price adjustment is contemplated, unless—

(A) The acquisition is to be made under the simplified acquisition procedures in Part 13;

(B) The solicitation is a request for technical proposals under two-step sealed bidding procedures; or

(C) The solicitation is for utility services for which rates are set by law or regulation.

(ii) 52.203-11, Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions. This provision applies to solicitations expected to exceed $150,000.

(iii) 52.204-3, Taxpayer Identification. This provision applies to solicitations that do not include the provision at 52.204-7, System for Award Management.

(iv) 52.204-5, Women-Owned Business (Other Than Small Business). This provision applies to solicitations that—

(A) Are not set aside for small business concerns;

(B) Exceed the simplified acquisition threshold; and

(C) Are for contracts that will be performed in the United States or its outlying areas.

(v) 52.209-2, Prohibition on Contracting with Inverted Domestic Corporations—Representation.

(vi) 52.209-5; Certification Regarding Responsibility Matters. This provision applies to solicitations where the contract value is expected to exceed the simplified acquisition threshold.

(vii) 52.214-14, Place of Performance--Sealed Bidding. This provision applies to invitations for bids except those in which the place of performance is specified by the Government.

(viii) 52.215-6, Place of Performance. This provision applies to solicitations unless the place of performance is specified by the Government.

(ix) 52.219-1, Small Business Program Representations (Basic & Alternate I). This provision applies to solicitations when the contract will be performed in the United States or its outlying areas.

(A) The basic provision applies when the solicitations are issued by other than DoD, NASA, and the Coast Guard.

(B) The provision with its Alternate I applies to solicitations issued by DoD, NASA, or the Coast Guard.

(x) 52.219-2, Equal Low Bids. This provision applies to solicitations when contracting by sealed bidding and the contract will be performed in the United States or its outlying areas.

(xi) 52.222-22, Previous Contracts and Compliance Reports. This provision applies to solicitations that include the clause at 52.222-26, Equal Opportunity.

(xii) 52.222-25, Affirmative Action Compliance. This provision applies to solicitations, other than those for construction, when the solicitation includes the clause at 52.222-26, Equal Opportunity.

(xiii) 52.222-38, Compliance with Veterans' Employment Reporting Requirements. This provision applies to solicitations when it is anticipated the contract award will exceed the simplified acquisition threshold and the contract is not for acquisition of commercial items.

(xiv) 52.223-1, Biobased Product Certification. This provision applies to solicitations that require the delivery or specify the use of USDA-designated items; or include the clause at 52.223-2, Affirmative Procurement of Biobased Products Under Service and Construction Contracts.

(xv) 52.223-4, Recovered Material Certification. This provision applies to solicitations that are for, or specify the use of, EPA- designated items.

(xvi) 52.225-2, Buy American Certificate. This provision applies to solicitations containing the clause at 52.225-1.

(xvii) 52.225-4, Buy American--Free Trade Agreements--Israeli Trade Act Certificate. (Basic, Alternates I, II, and III.) This provision applies to solicitations containing the clause at 52.225- 3.

(A) If the acquisition value is less than $25,000, the basic provision applies.

(B) If the acquisition value is $25,000 or more but is less than $50,000, the provision with its Alternate I applies.

(C) If the acquisition value is $50,000 or more but is less than $79,507, the provision with its Alternate II applies.

(D) If the acquisition value is $79,507 or more but is less than $100,000, the provision with its Alternate III applies.

(xviii) 52.225-6, Trade Agreements Certificate. This provision applies to solicitations containing the clause at 52.225-5.

(xix) 52.225-20, Prohibition on Conducting Restricted Business Operations in Sudan--Certification. This provision applies to all solicitations.

(xx) 52.225-25, Prohibition on Contracting with Entities Engaging in Certain Activities or Transactions Relating to Iran—Representation and Certification. This provision applies to all solicitations.

(xxi) 52.226-2, Historically Black College or University and Minority Institution Representation. This provision applies to solicitations for research, studies, supplies, or services of the type normally acquired from higher educational institutions.

(2) The following certifications are applicable as indicated by the Contracting Officer:

[Contracting Officer check as appropriate.]

___ (i) 52.204-17, Ownership or Control of Offeror.

___ (ii) 52.222-18, Certification Regarding Knowledge of Child Labor for Listed End Products.

___ (iii) 52.222-48, Exemption from Application of the Service Contract Labor Standards to Contracts for Maintenance, Calibration, or Repair of Certain Equipment--Certification.

___ (iv) 52.222-52 Exemption from Application of the Service Contract Labor Standards to Contracts for Certain Services--Certification.

___ (v) 52.223-9, with its Alternate I, Estimate of Percentage of Recovered Material Content for EPA-Designated Products (Alternate I only).

___ (vi) 52.227-6, Royalty Information.

___ (A) Basic.

___ (B) Alternate I.

___ (vii) 52.227-15, Representation of Limited Rights Data and Restricted Computer Software.

(d) The offeror has completed the annual representations and certifications electronically via the SAM Web site accessed through https://www.acquisition.gov . After reviewing the SAM database information, the offeror verifies by submission of the offer that the representations and certifications currently posted electronically that apply to this solicitation as indicated in

paragraph (c) of this provision have been entered or updated within the last 12 months, are current, accurate, complete, and applicable to this solicitation (including the business size standard applicable to the NAICS code referenced for this solicitation), as of the date of this offer and are incorporated in this offer by reference (see FAR 4.1201); except for the changes identified below *[offeror to insert changes, identifying change by clause number, title, date]*. These amended representation(s) and/or certification(s) are also incorporated in this offer and are current, accurate, and complete as of the date of this offer.

FAR Clause	Title	Date	Change

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

K-2 INCOMPLETE CONTRACTS AS OF DATE OF PROPOSAL

Indicate below incomplete contracts that would utilize the same resources, including equipment and personnel that are being proposed for utilization on this contract.

Indicate by Square Miles	Remaining Work During Acquisition Period	Remaining Work During Processing Period
U.S. Government Contracts		
All Other Contracts		

K-3 AIRCRAFT TO BE USED IN COMPLETION OF ITEM(S) IN THIS CONTRACT

Make/Model	Registration #	Operating Ceiling	Offeror Owned (check appropriate block)
			[ ] Yes [ ] No *
			[ ] Yes [ ] No *
			[ ] Yes [ ] No *

* If the aircraft is/are not offeror owned, a written statement of availability from the owner of the aircraft must be enclosed. See Section C-2, Description/Specifications/Work Statement.

K-4 CAMERA(S) TO BE USED IN COMPLETION OF ITEM(S) IN THIS CONTRACT

Current calibration report(s) must be enclosed or on file at the Aerial Photography Field Office. If on file with APFO, please indicate report date.

Serial Number	Camera Make/Model	Check if on file	Report Date	Offeror Owned
		[ ]		Yes [ ] No* [ ]
		[ ]		Yes [ ] No* [ ]
		[ ]		Yes [ ] No* [ ]

* If the camera(s) is/are not offeror owned, a written statement of availability from the owner(s) of the camera(s) must be enclosed. See Section C-4, Equipment Requirements.

K-5 PLACE OF PERFORMANCE (OCT 1997) (FAR 52.215-6)

(a) The offeror or respondent, in the performance of any contract resulting from this solicitation, ❑ intends, ❑ does not intend [check applicable block] to use one or more plants or facilities located at a different address from the address of the offeror or respondent as indicated in this proposal or response to request for information.

(b) If the offeror or respondent checks "intends" in paragraph (a) of this provision, it shall insert in the following spaces the required information:

PLACE OF PERFORMANCE (STREET ADDRESS, CITY, STATE, COUNTY, ZIP CODE)	NAME AND ADDRESS OF OWNER AND OPERATOR OF THE PLANT OR FACILITY IF OTHER THAN OFFEROR OR RESPONDENT
_____	_____
_____	_____

K-6 PAST PERFORMANCE REFERENCES

If no previous digital imagery contracts have been held by the offeror with the Aerial Photography Field Office within the past three years, list two (2) references with whom the offeror has held similar contracts. If possible, one reference should be within the Federal Government. List company or agency name, address, name of person to contact, and telephone number:

(1)_____ (2)_____

_____ _____

_____ _____

K-7 KEY PERSONNEL INTENDED FOR PERFORMANCE ON THIS CONTRACT

List all key professional and technical personnel intended to perform on this contract. List may include project manager, lead technical staff, pilot(s), photographer(s), and key back-up or support personnel.

Name	Title	Education	Years of Experience

K-8 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998) (FAR 52.252-1)

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

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) PROVISIONS:

52.203-11 Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions (SEP 2007)

52.204-05 Women-Owned Business (Other Than Small Business) (OCT 2014)

52.225-25 Prohibition on Contracting with Entities Engaging in Certain Activities or Transactions Relating to Iran—Representation and Certifications (DEC 2012)

PART IV - REPRESENTATIONS AND INSTRUCTIONS

SECTION L - INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS

L-1 TYPE OF CONTRACT (APR 1984) (FAR 52.216-01)

The Government anticipates award of a Firm-Fixed-Price contract resulting from this solicitation (may be multiple awards).

L-2 INSTRUCTIONS FOR PREPARATION OF TECHNICAL AND PRICING PROPOSALS

The following instructions establish the acceptable minimum requirements for the format and content of proposals. Offerors are advised to furnish all information in the sequence and format specified below. Failure to furnish all information requested may adversely affect the evaluation of the proposal. Proposals will be evaluated in accordance with the evaluation factors set forth in Section M of this solicitation.

2.1 General Instructions

Proposal must be prepared in two parts: Part I: Pricing Proposal, and Part II: Technical Proposal. Each of the parts shall be separate and complete in itself so that evaluation of one may be accomplished independently from evaluation of the other. The technical proposal must not contain any reference to cost or price.

Proposal should be precise, factual and responsive and must include, but is not limited to, the information listed below. Proposal content shall be organized in two separate parts and be submitted in the order indicated as follows:

2.2 PART I - Pricing Proposal

Pricing information and related data shall be submitted as Part I of the offeror's proposal. Each proposal must contain a signed and dated Standard Form 33 (page 1 of the solicitation) with items 12 through 18 completed. Section B should be submitted in its entirety with the quantities offered, the unit price(s), and the total price(s) for the item(s) indicated in the appropriate locations.

2.3 PART II - Technical Proposal

Response to the following technical statements will form the basis of a proposal's technical merit. Offerors are cautioned to address all requested information as complete and accurate as possible. Data contained in Section K of the solicitation document shall be referenced in support of statements. The technical volume shall not exceed 30 8-1/2”x11” single-sided pages (equivalent double-sided is acceptable). Letters of commitment, resumes, flight plan graphics, camera calibration reports, and documentation to support camera approval may be provided in an attachment without page restriction.

(a) Past Performance History. If no previous digital imagery acquisition contracts have been held by the offeror with the Aerial Photography Field Office within the past three years, list at least two (2) references with whom the offeror has held similar contracts. List past performance references in the space provided in Section K of the solicitation document.

(b) Project Management/Technical Capability. Statement of project management and technical capability that would assure timely completion and shipment of all work by or before the required delivery schedule.

(1) Planned Approach to Imagery Acquisition. Statement should include detailed description of planned approach, procedures, management techniques, capacities, aircraft, cameras and processes to be used in performance of the work. Scheduling and site basing of aerial photo crew and aircraft based on weather patterns and potential fires during the acquisition period, as well as restricted/controlled airspace in vicinity of the project item. Include a full-page sized visual representation of the proposed flight plan(s) depicting key information, such as flight line placement and estimated number of exposures for the project area(s). If subcontracts will be utilized in imagery acquisition, include a subcontractor management plan: proposed subcontractors, what work they will perform, how their performance will be managed and monitored, and contingency plan in the event of faulty performance.

(2) Resource Availability for Project (aircraft, camera and crew) and Potential Impact of Concurrent Workload. List all aircraft and digital sensors intended to be used in completion of this contract, as well as any incomplete contracts utilizing the same resources, in the appropriate locations in Section K of the solicitation document. If availability of equipment is contingent on other contractual commitments running concurrently with the work contemplated by this solicitation, indicate such in proposal statement. Address potential impact of concurrent workload on this project.

(3) Imagery Processing. Statement of technical approach to imagery processing that would assure products and/or services meet all contract specifications and requirements. Statement should include detailed description of the digital image processing techniques, capacities, and processes to be used in performance of the work. **If a non-frame based digital sensor system is being proposed, the proposal must include: 1) a detailed description of the process used in creating files in a tile format similar to that which is produced by a frame based sensor, and 2), two overlapping sample images from the particular sensor proposed over terrain similar to project area. Any proposal to achieve the required spatial resolution (GSD) from imagery acquired outside the original image resolution tolerances in Attachment B, paragraph 3.3, must include samples as described in item 2) above.**

If subcontracts will be utilized for imagery processing, include a subcontractor management plan: proposed subcontractors, what work they will perform, how their performance will be managed and monitored, and contingency plan in the event of faulty performance. The following should be discussed in detail:

(a) Image Processing. Summary of the proposed post-processing workflow such as (i) pan-sharpening (if applicable); (ii) radiometric processing (including histogram

stretching, LUT creation methodology, dodging techniques, and atmospheric condition adjustments; (iii) infrared processing; (iv) geometric processing; and (v) initial acquisition inspection.

(b) Stereo Block. Explain the production and verification processes to ensure the stereo block file can be utilized via software specified in Section C.

(c) Aero-Triangulation (AT). Describe the proposed AT process (such as traditional block solution or direct geopositioning) and the use of any automatic pass and tie points. Describe the process for collecting ground control (if applicable). Describe the proposed workflow for processing the ABGPS and IMU data.

(d) Orthorectification. Explain the orthorectification workflow and include at a minimum: (i) step by step process, (ii) software that will be used; (iii) how results will be verified; (iv) indicate the elevation model that would be used; (v) explain the seamline generation process to create the mosaics, including (a) whether automated or manual seamline generation is being proposed and (b) if the contractor prescribes a proprietary in-house developed method, describe the basic method and anticipated results; and (vi) past experience with similar products from a similar geographical area (i.e. mountains and forest).

(4) Quality Control System. Detailed statement on Contractor quality control system including how processes and deliverables will be QC'd to ensure all contract materials submitted for inspection are in compliance with contract specifications. (See Section C, Description/Specifications/Work Statement for quality control requirements.

(5) Personnel Qualifications. List all key professional and technical personnel intended to perform on this contract in the appropriate location in Section K of this solicitation document. Recommended list includes: Project Manager, Aircraft Pilot(s), Sensor Operator(s), and lead technical staff responsible for or overseeing imagery/ortho processing. Brief resumes, limited to one (1) page, for the Project Manager and lead technical staff, stating name, title, education, project relevant past experience, and years of project relevant experience may be submitted in a separate attachment without counting towards page limitations.

2.4 Solicitation Document and Supporting Data

The offeror's proposal must include the following required information and supporting data specified in the solicitation document:

Section K:

(a) Annual Representations and Certifications
(b) Incomplete Contracts as of Date of Proposal,
(c) Aircraft to be Used in Completion of the Contract,
(d) Cameras or Digital Sensors to be Used in Completion of the Contract,
(e) Past Performance References (if required),
(f) Key Personnel to Perform on the Contract.

Section L:

(a) Camera Calibration Report(s), if most recent report not already submitted/on file
(b) Digital Sensor Sample Imagery (if required)

L-3 DIGITAL SENSOR APPROVAL REQUIREMENTS

Each offeror shall either have on file with the Aerial Photography Field Office, or submit with the offer, (1) a report of calibration, (2) sample digital imagery, (3) digital sensor documentation from the camera/sensor proposed for use. Please refer to Attachment A for digital camera/sensor approval requirements.

For each digital sensor proposed to be used, please indicate which statement is correct:

[ ] Digital Sensor Approval Requirements on file at APFO.

[ ] Digital Sensor Approval Requirements submitted with offer.

[ ] Not required.

L-4 CONTRACT DIFFICULTIES AND CONTINGENCIES

Offerors are cautioned to examine the solicitation, visit the work location if necessary, and evaluate the facilities needed and difficulties attending the execution of the proposed contract. Considerations include local conditions, uncertainty of weather, availability of landing fields, restricted air space, and all other contingencies.

L-5 SERVICE OF PROTEST (SEP 2006) (FAR 52.233-2)

Protests, as defined in Section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO) shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from; Director, Acquisition Management, USDA/FSA/MSD/AG Code 0567, P.O. Box 2415, Washington, D.C. 20013-2415.

The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

L-6 INQUIRIES (FEB 1988) (AGAR 452.204-70)

Inquiries and all correspondence concerning this solicitation should be submitted in writing to the Contracting Officer. Offerors should contact only the contracting officer issuing the solicitation about any aspect of this requirement prior to contract award.

L-6 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998) (FAR 52.252-1)

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

FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) PROVISIONS:

52.207-1 Notice of Standard Competition (MAY 2006)

52.215-01 Instructions to Offerors - Competitive Acquisition (JAN 2004)

PART IV - REPRESENTATIONS AND INSTRUCTIONS

SECTION M - EVALUATION FACTORS FOR AWARD

M-1 PROPOSAL EVALUATION

Proposal evaluation is an assessment of the proposal and the offeror's ability to perform the prospective contract successfully. The Government shall establish an evaluation team that includes appropriate contracting, technical, and other expertise to ensure a comprehensive evaluation of proposals.

1.1 Technical Evaluation Team

The Technical Evaluation Team will evaluate, and rank according to technical merit, all proposals in accordance with the evaluation factors established in this solicitation. The team will not have access to the pricing proposal during the technical evaluation process. The offeror's proposal shall be in the format prescribed in Section L and shall contain a response to each of the areas identified.

1.2 Competitive Range

The Contracting Officer may establish the competitive range based on ratings of each proposal against all evaluation criteria including price. The competitive range shall be comprised of all of the most highly rated proposals. The competitive range can be limited for purposes of efficiency (see FAR 52.215-1(f)(4)). If negotiations are conducted in the source selection process they shall occur after establishment of the competitive range.

1.3 Source Selection Decision

The Contracting Officer shall select for purposes of contract award the proposal which offers the "best value" to the Government, price and other factors considered. The decision shall be based on a comparative assessment of proposals against all source selection criteria in the solicitation.

1.4 Evaluation of Options (JULY 1990)(FAR 52.217-5)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

M-2 EVALUATION FACTORS

Proposals shall be evaluated according to the following criteria including all supporting information furnished by the offeror with the proposal. The technical evaluation factors are listed in descending order of importance. Subfactors are not listed in the order of importance. See Section L for instructions for preparation of technical and pricing proposals.

2.1 Technical Evaluation
Evaluation Factors and Significant Subfactors

(a) Planned Approach to Imagery Acquisition
   1. Project scheduling and site basing of aircraft to ensure completion within the acquisition period in B-2
   2. Address of local conditions and restrictions (i.e. terrain, weather, MOAs, etc.)
   3. Flight plan (graphic and exposure count)
   4. Subcontract management (if applicable)

(b) Resources available for project: aircraft, camera and crew and potential impact of concurrent workload

(c) Imagery Processing, including methods/software for deliverables
   1. Image Processing
   2. Stereo Block Files
   3. Aerial Triangulation/ Orthorectification Process
   4. Subcontract Management (if applicable)

(d) Quality Control methodology and processes to ensure products delivered meet requirements

(e) Key personnel qualifications

2.2 Past Performance History

Past performance will be evaluated based on relevant performance history contained in USDA contract records of projects awarded by the FSA Aerial Photography Field Office. Offeror's past performance will be evaluated according to the following criteria and may include other relevant factors:

(i) Contract performance record;
(ii) Project completion record;
(iii) Delivery schedule compliance record.

If an offeror does not have, or have available, a past performance history, the offeror's proposal will not be evaluated favorably or unfavorably on past performance

2.3 Price Evaluation

All evaluation factors other than cost or price, when combined, are more important than price. The Government reserves the right to make an award to other than the lowest priced offeror, or other than the highest technically rated offeror, when the perceived benefits and tradeoffs provide the Government the greatest value.

Based on comparative evaluations of the pricing proposals for the basic and optional award item requirements the Government will consider for award that offer that represents the greatest value and is determined to be in the best interest and the most advantageous to the Government.

Offerors are cautioned to insert the unit price and the total price for the Project Item(s) in the appropriate locations in Section B. In case of discrepancy between a unit price (i.e., price per square mile) and an extended price (total price), the unit price will be presumed to be correct, subject, however, to correction to the same extent and in the same manner as any other mistake.

2.4 Other Factors

The Contracting Officer will consider, in addition to the evaluation criteria, the prospective Contractor's responsibility record in terms of financial resources, business integrity and ethics, and other standards, as defined in the Federal Acquisition Regulation, Part 9.

M-3 CONTRACT AWARD

3.1 Contract Award

More than one contract may be awarded from this solicitation. The contract (or contracts) will be awarded to the responsible offeror(s) whose proposal represents the greatest value and is determined to be in the best interest and the most advantageous to the Government, price and other factors considered.

3.2 Possibility of Award Without Discussion

Notice is given to all offerors that there is a possibility that award may be made without discussion or further negotiation. Proposals should be submitted initially on the most favorable terms, from a price and technical standpoint, which the offeror can submit to the Government.

3.3 Required or Requested Information

Award will be made only in conjunction with proposals from responsible prospective Contractors. Failure to provide the information, material, and/or documentation either required in Sections K and L may result in the proposal being rejected. Information requested by the Contracting Officer shall be submitted within eight (8) calendar days of the request; failure to do so may result in the proposal being rejected.

AERIAL PHOTOGRAPHY FIELD OFFICE (APFO) SPECIFICATION FOR DIGITAL CAMERA BASED ACQUISITION

(Dated February 1, 2012 – Modified for USFS Resource Imagery March 26, 2012)

1.0 INTRODUCTION AND BACKGROUND

The U.S. Federal Government has not established an independent government evaluation and calibration policy for digital cameras since sensor technology is still rather new. Until a policy is developed and implemented, the U.S. Department of Agriculture (USDA), Farm Service Agency (FSA) has proceeded to validate the quality and capabilities of current digital cameras by obtaining relevant information from camera manufacturers, data providers, and other government agencies and organizations. The following specifications and requirements have been developed to ensure that any digital camera proposed for use on USDA contracts meets minimum requirements to provide the highest quality digital imagery products.

2.0 DIGITAL CAMERA SPECIFICATIONS AND REQUIREMENTS

This document covers camera specifications and requirements for any direct-digital imagery acquisition under contract to APFO. Cameras for acquiring precise vertical digital imagery are required to be tested and calibrated. Cameras proposed for use must be of comparable, or better, precision and quality as traditional film-based stereoscopic mapping cameras. Imagery captured with digital cameras must also be compatible with analytical mensuration procedures used in photogrammetric surveys and in preparing accurate orthophotography. Documentation and sample imagery will be reviewed and verified by the Government before approval is granted. Only approved digital cameras shall be used on contracts administered by APFO.

3.0 GENERAL REQUIREMENTS

Digital cameras must be tested and calibrated with manufacturer certification documentation. The camera must be geometrically stable and suitable for use in precise, high-accuracy photogrammetric orthoimagery applications. All delivered imagery shall be acquired and processed in such a way as to eliminate or minimize pixel or band offset or misalignment between bands. The camera shall provide the following:

3.1 Spatial Resolution

The camera shall provide the spatial resolution and field of view necessary to meet the ground sample distance (GSD) requirement as specified in the contract.

3.2 Image Fusion

Pan sharpening will be permitted to achieve the necessary spatial resolution requirements. The multi-spectral bands may be used at a ratio no greater than 1:5 (multi-spectral to panchromatic) to achieve the required spatial resolution.

3.3 Radiometric Resolution and Accuracy

The camera's sensor shall capture and record a minimum of 12-bits of image information per color channel. If more than one lens and more than one shutter are used in the camera, the difference in radiometric values between two panchromatic or two multi-spectral sensors shall be less than ±5%. For example, a 12-bit image shall not have more than ±205 difference in gray values.

3.4 Spectral Resolution

The camera shall capture, as a minimum, natural color (approximately 440 – 850 nm) and near infrared color (approximately 780 – 850 nm) channel data simultaneously or near simultaneously using a single camera (near simultaneously is defined as less than 500 milliseconds). Additional multi-spectral bands may be collected with a secondary or auxiliary camera and/or system.

3.5 Camera Operation

The digital camera and its mount shall be checked for proper installation prior to each mission. An automatic exposure control device is permitted, but a manual override capability is required for some types of terrain to achieve proper coverage and exposure. The camera mount shall be regularly serviced and maintained and shall be insulated against aircraft vibration.

3.6 Camera Maintenance

The contractor shall perform all maintenance in accordance with the manufacturers recommended and established procedures. The contractor shall maintain a complete history of all maintenance done to the camera system and have it available for Government inspection. The contractor shall provide certification that the system has been maintained, preventive maintenance and calibration performed, to the manufacturers requirements.

3.7 System Malfunctions

The contracting officer shall be notified of all camera malfunctions within 72 hours with a written report of the malfunction. A malfunction is defined as a failure in any element or process of the camera that causes an interruption of the normal operations of the camera system (camera system is defined as the camera and any key components, such as camera mount, airborne global positioning system, and on-board data storage). All malfunctions or failures of global positioning systems or inertial measurement unit systems shall also be reported directly to the contracting officer.

4.0 DIGITAL CAMERA APPROVAL REQUIREMENTS

All digital cameras must be approved by the Contracting Officer before acquiring imagery under any APFO contract. When requesting approval, the Contractor shall submit, or have on file with APFO, a report of calibration (see Paragraph 4.1), sample digital imagery (see Paragraph 4.2), and camera documentation (see Paragraph 4.3).

4.1 Calibration Reports

Calibration reports for each digital camera proposed for use shall be submitted to the contracting officer with the contractor's proposal and prior to project imagery acquisition if the digital camera is removed and remounted. The contractor shall follow manufacturer's specifications for appropriate calibration and recalibration. The calibration reports shall address the geometric performance of the camera, and at a minimum, include:

(a) Date of report
(b) The name of the person or company performing the calibration
(c) The methodology and procedures used for calibration
(d) Final calibration parameters, such as calibrated focal length, lens distortion values, radiometric calibration parameters, and principal point location.

NOTE: The government recognizes that individual calibration reports, procedures, and parameters may be unique to a certain manufacturer since equipment and systems vary from manufacturer to manufacturer.

4.2 Sample Imagery Requirements

The Contractor shall acquire and submit with their proposal, sample images from the digital camera proposed for use. The sample imagery shall provide the following minimum characteristics:

(a) Display the same GSD resolution required in the solicitation.
(b) Represent the type of terrain (agriculture, cropland, forest, etc.) that is similar to the proposed project area.
(c) Re-sampled and submitted as an 8-bits per band image (unless the solicitation requires only 16-bit per band image delivery, in which case the sample imagery shall be submitted as a 16-bits per band image).
(c) If ortho-rectification is required under the proposed solicitation, the sample image shall be ortho-rectified with the projection specified in the solicitation (for example, North American Datum 1983 (NAD83) and UTM Zone 12).
(d) Sample shall be produced and submitted in the footprint and file format specified in the solicitation (for example, DOQQ formatted, GeoTIFF image).
(e) The sample imagery shall fit on one standard CD or DVD. Delivered media will become part of the official Government contract file and will not be returned.

4.3 Camera Documentation Requirements

The Contractor shall provide with their proposal detailed documentation of the digital camera proposed for use. Documentation may include brochures, technical specifications, marketing material, manufacturer's user manuals, or other descriptive literature. The documentation shall contain at a minimum the following information:

(a) General overview information
(b) Product configuration description
(c) Camera component description
(d) Technical specifications
(e) Computer management and storage systems
(f) Image acquisition and processing workflow

.

AERIAL PHOTOGRAPHY FIELD OFFICE (APFO)
USDA DIGITAL IMAGERY QUALITY SPECIFICATION

(Dated February 1, 2012 – Modified for USFS Resource Imagery March 26, 2012)

1.0 SCOPE

This document establishes the image quality criteria to be used in the production of digital imagery products for all contracts issued by the United States Department of Agriculture's (USDA) Aerial Photography Field Office.

2.0 APPLICABLE DOCUMENTS

In the event of conflict between the contents of this specification and the documents referenced herein, the contents of this specification shall take precedence.

2.1 National Agriculture Imagery Program (NAIP) Suggested Best Practices – Final Report, dated Feb 1, 2007 (ITT Space Systems Division)

3.0 GENERAL REQUIREMENTS

USDA uses imagery for various programs including, but not limited to forest management, agriculture land use analysis, natural resource inventory, and extraction of data by means of photogrammetric interpretation. The complex nature and need for consistent imagery requires adherence to exact format and content of this specification.

3.1 Image blemishes, scratches and artifacts. Imagery shall be free of blemishes, scratches, and artifacts that obscure ground feature detail. The following table defines the maximum acceptable limits for blemishes, scratches, and artifacts. Clusters of blemishes, scratches, and artifacts that do not individually meet these criteria may be considered unacceptable.

ACCEPTABLE, IMAGE BLEMISHES, SCRATCHED, AND ARTIFACTS	
1 pixel wide	100 pixels in length
2 pixels wide	60 pixels in length
3 pixels wide	20 pixels in length
4 – 12 pixels wide	12 pixels in length

3.2 Band-to-Band Registration Accuracy. Misregistration between any color bands shall not exceed 1 pixel.

3.3 Original Image Resolution. The original image, original scan, or original capture used to create the imagery shall not be resampled from the original image resolution greater or less than the following numbers in order to meet the Ground Sample Distance (GSD) specified in the contract:

GROUND SAMPLE DISTANCE (GSD)	ORIGINAL IMAGE RESOLUTION	
	MAXIUMUM (meters)	MINIMUM (meters)
0.3-meter	0.15	0.32
0.5-meter	0.25	0.53
1-meter	0.50	1.05

4.0 UNCORRECTED IMAGERY

Uncorrected imagery is defined as imagery that has been minimally processed before exporting to a non-camera specific file format, such as a TIFF. Uncorrected imagery is the closest "match" to a traditional film negative that the direct-digital camera can provide without having the end-user employ special and/or non-standard software.

4.1 Non-image data. Imagery shall only use a pixel digital number (DN) of zero (0) for non-data values.

4.2 Image Quality. The Contractor shall not make any radiometric enhancements, such as gamma correction, histogram stretching, dodging, or other Look Up Table (LUT) adjustments, to the acquired imagery. The imagery shall not contain any borders, artifacts, or other non-image items.

5.0 COLOR CORRECTED IMAGERY

Imagery required to be color-corrected shall be adjusted so that the image matches the ground at the time of exposure. Adjustments shall include, but not limited to, any dodging, gamma correction, histogram stretching, brightness adjustments, and/or color balancing. The files shall not contain any borders, artifacts, or other non-image items.

5.1 Non-image data. Imagery shall only use a pixel digital number (DN) of zero (0) for non-data values.

5.2 Natural Color Image Quality.

(a) Clipping. Imagery shall have a tonal range that prevents the clipping of highlight or shadow detail from the image. When calculated against the luminosity histogram, the cumulative pixel count between the first and last five histogram bin

values (5 and 250 respectively for 8-bit depth) shall not be less than 98.0%, with a preferred value greater than 99%.

(b) Contrast. When calculated against the luminosity histogram, the difference between the histogram digital number (DN) value that contains 99.0% of the cumulative pixel count and the DN value that contains 1.0% shall be greater than ±59% of the bit depth, ±4% (aim point of 150, ±10 for 8-bit depth). If the cumulative pixel count percentage falls between two histogram bin values, the closest value shall be used. For example, if an 8-bit image has a luminosity DN value 222 contains 99% of the cumulative pixel count and DN value 44 contains 1% count, therefore the difference is 178.

BIT DEPTH	DN DIFFERENCE		
	TARGET	MINIMUM	MAXIUMUM
8-bit	150	140	160
16-bit	38,550	35,930	41,170

(c) Brightness. Imagery shall have a mean pixel count within ±7.5% of the middle DN value allowed for the bit depth. For example, an 8-bit depth image must have the histogram mean value between 108 and 147.

BIT DEPTH	MEAN DN	
	MINIMUM	MAXIUMUM
8-bit	108	147
16-bit	27,853	37,683

(d) Color Balance. Imagery should have a neutral tonal range without the dominance of any individual color. The difference between the minimum and maximum DN value in a RBG triplet of any nearly neutral objects within the image shall be less than 5.

5.2 Color infrared Imagery. All color infrared imagery shall have proper contrast to allow highlight and shadow detail.

5.3 Multispectral Imagery. Multispectral Imagery shall be radiometrically processed such than the natural color bands (RGB) meet the quality requirements in paragraph 5.1.

6.0 ORTHORECTIFIED IMAGERY

All orthorectified imagery shall be color-corrected in accordance with paragraph 5.0.

6.1 Geographic Extent. Imagery shall cover the entire image area, including the required minimum buffer on all four sides. Extents shall be computed by projecting the geographic corners and side midpoints to the appropriate projection, then adding the buffer on each side of the resulting minimum bounding rectangle.

6.2 Specular reflections. Specular reflections in the imagery should be minimized, especially in agriculture areas, by patching the area using "chips" from different imagery but shall be from the same type of camera and must be from the same acquisition season. Any chips used in the imagery shall not have more than ±3 pixels offset or the specified horizontal accuracy, whichever is the lesser distance, -between the chip and principal image. Any chips used shall be radiometrically balanced in accordance with paragraph 6.3(a).

6.3 Image Mosaicking. Imagery may be created using multiple image segments from the same acquisition collection to produce the final product.

(a) Radiometric Balance. When a mosaic is made from two or more image segments, the brightness and color values between the image segments will be adjusted to match that of neighboring image segments. The join lines between the overlapping image segments will be chosen to minimize tonal variations. Localized adjustment of the brightness and color values will be done to reduce radiometric differences between join areas.

6.4 Spatial. All orthoimagery shall meet the horizontal accuracy requirement of the specified project.

7.0 DEFINITIONS

Chip – Each separate piece of a mosaicked image that contributes to the final image.

Clipping – The presence of pixels exhibiting the minimum or maximum digital number in an image's dynamic range.

Digital Number – The value (0-255 for an 8-bit image) that depicts the pixel radiance for that color band.

Dodging – Manipulating the intensity of part of a photograph by selectively shading or masking.

Resample – Interpolation of pixel values based upon neighboring pixel values.

Uncorrected Imagery – Imagery that has been minimally processed, including no radiometric enhancements, such as stretching, dodging, or other Look Up Table (LUT) adjustments, to the acquired imagery.

USDA Digital File Format Specification

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1.0 PREFACE

For many years the Aerial Photography Field Office (APFO) has used the "USDA Digital Orthoimagery Quarter Quadrangle (DOQQ) Description and Specification" when contracting for Farm Service Agency's (FSA) National Agriculture Imagery Program (NAIP) imagery. However, APFO is the lead procurement office for all United States Department of Agriculture's (USDA) imagery projects greater than 100 square miles. These programs require a variety of delivery and file formats to meet the needs and diversity of various USDA's users. The previous specification was written specifically for one program, and thus was too rigid to be easily implemented for other acquisitions, resulting in continuous modifications to the specification and inefficiencies in implementation, interoperability, and data exchange. Thus, this specification has been updated to alleviate these issues. The intent is to apply this specification, as written and without modification, to all imagery contracts.

An important area of consideration for the use of imagery (raster) data is the encoding format. Various department agencies that use the APFO for procurement of imagery have valid requirements to make selected imagery data holdings available in Geographic Tagged Image File Format (GeoTIFF) in addition to other formats, including but not limited to JPEG 2000, LizardTech MrSID, and ERDAS Imagine files.

While GeoTIFF (and other formats) are widely used, they have many format options which often result in non-interoperability among disparately developed implementations. This USDA Digital File Format Specification was developed to help meet objectives for deployment of capabilities with automation and interoperability in mind. The primary rationale is to enable more timely support for delivering imagery in a format suitable for direct ingest by Geographic Information System (GIS) and/or Remote Sensing (RS) application software tools readily available to those working to support department activities.

This document specifies the requirements that shall be used for the exchange of georeferenced or ortho rectified imagery when opting to use the varied formats identified in the Appendices. The aim of this specification is to enable the interchange of rectified constraints within the design objectives of promoting interoperability for the exchange of raster information.

2.0 INTRODUCTION

This specification outlines the requirements and encoding rules that shall be used for the exchange of imagery data when opting to use the formats outlined herein. It constitutes a description of the bounds and constraints for the use of each file format within the design objectives of promoting interoperability and data exchange. It conforms with all normative documents identified in Section 5.0.

While GeoTIFF is not the only format detailed in this specification, it is a core format for encoding spatial raster data, and thus is a core component of this specification. GeoTIFF is a public domain specification which allows georeferencing information to be embedded within a TIFF file. Potential embedded information includes projections, coordinate systems, datums, and other information needed to

establish the spatial reference for the imagery or gridded data contained in the file. The GeoTIFF format augments the TIFF format, so TIFF-enabled software incapable of reading and interpreting the specialized georeferencing metadata should still be able to open a GeoTIFF file sufficiently to at least view the image data.

The main body of this specification addresses the scope of this work, conformance with other recognized industry specifications and national specifications, terms and definitions, an acronym and file extension reference, and the applicability and use of this document. The document then addresses various file format requirements and references the Appendices for the file format specifications.

3.0 SCOPE

This document establishes the file format criteria to be used in the production of digital imagery for all contracts issued by APFO. It may also be applied to all internal production activities at APFO that result in products that require archiving and public distribution.

4.0 CONFORMANCE

Any GeoTIFF data claiming conformance with this specification is claiming conformance with applicable normative documents in Section 5, and shall pass conformance requirements testing as part of the quality assurance process upon delivery of data to the USDA.

Other file formats detailed in this specification may or may not conform with normative documentation and reference information in Section 5. These file formats shall still pass testing as part of the quality assurance process upon delivery of data to USDA, to ensure requirements of this specification are met.

5.0 NORMATIVE DOCUMENTS

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies.

5.1 Industry Specifications

- The Tagged Image File Format (TIFF) – Tagged Image File Format, Revision 6.0, Adobe Systems Inc., June 1992. TIFF is a copyrighted standard of Adobe Systems, Inc. (http://partners.adobe.com/public/developer/en/tiff/TIFF6.pdf)

- GeoTIFF Format Specification, Revision 1.0, 10 November 1995; version 1.8.2 The GeoTIFF Format Specification is a public domain extension of TIFF that provides a robust and flexible method of storing georeferencing information is a TIFF file. (http://www.remotesensing.org/GeoTIFF/spec/GeoTIFFhome.html)

Supporting documents describing the scope of this document and call out requirements, and recommendations.

5.2 National Specifications

TBD

5.3 Informative References

NGA Standardization Document - Implementation Profile for Tagged Image File Format (TIFF) and Geographic Tagged Image File Format (GeoTIFF) - NGA.IP.0001_1.0, 2008-11-18

6.0 GLOSSARY

6.1 Terms and Definitions

Affine Transformation – A geometric transformation that scales, rotates, skews, and/or translates images or coordinates between any two Euclidean spaces. It is commonly used in GIS to transform maps between coordinate systems. In an affine transformation, parallel lines remain parallel, the midpoint of a line segment remains a midpoint, and all points on a straight line remain on a straight line. Source: Esri Online Dictionary

Band – A range of wavelengths of electromagnetic radiation. Also, image data gathered at this wavelength range.

Field – Refers only to the entire field, including the value, of the geokey (as defined in the TIFF Specification).

Georeference – Aligning geographic data to a known coordinate system so it can be viewed, queried, and analyzed with other geographic data. (Source: Esri® Online Dictionary)

GeoTIFF – Public domain metadata standard which allows georeferencing information to be embedded within a .TIFF file.

Image File Directory – Contains information about the image. There must be at least 1 IFD in a TIFF file and each IFD must have at least one entry.

Metadata – Description of the content, quality, condition, and other characteristics of the data.

Orthorectification - A process of removing sources of distortion from an image and correcting aerial photography to the point where measurements of a feature on the photograph approximate ground measurements of the same feature. (Source: Satellite Imaging Corporation)

Private tags – TIFF tags numbered 32,768 or higher. Private tags are not defined in the TIFF Specification.

Public tags – TIFF tags that are defined by the TIFF Specification.

Rectified Grid – A grid that has an affine transformation between the grid coordinates and the coordinates of an external coordinate reference system.

Tag – Refers only to the identifying number portion of the geokey (as defined in the TIFF Specification).

6.2 Acronyms and Abbreviations

GeoPDF – A .pdf file created by TerraGo Technologies that contains geospatial information such as layers and object data.

ERDAS – Earth Resources Data Analysis System

JPEG and JPEG 2000 – Joint Photographic Experts Group. A commonly used method of compression for digital imagery. JPEG 2000 is an updated wavelet compression of JPEG with more flexibility in the codestream.

MrSID – Multi-resolution seamless image database. Proprietary format developed by LizardTech for encoding raster graphics.

TIFF – Tagged Image File Format.

6.3 File Extensions

.ecw – Stands for enhanced compression wavelet. An ERDAS ER Mapper compressed file format specifically designed for geospatial imagery.

.ige – Stands for large raster spill file. One of two ERDAS IMAGINE files created when an image requiring more than 4GB of disk space is created. It contains the actual image data in a separate non-HFA file format (normally with the extension .ige).

.img – Stands for “image file.” An ERDAS IMAGINE file used to store raster data, including file information, ground control points, sensor information, layer information, attribute data, statistics,

map information, projection information, pyramid layers, data file values, compression, and block size. This file uses Hierarchal File Format (HFA).

.jp2 – Stands for jpeg 2000. Compressed image created using JPEG 2000 Core Coding; incorporates a wavelet compression algorithm instead of Digital Cosine Transform (DCT) compression used by standard JPEG images; can be stored using lossy and lossless compression.

.pdf – Stands for portable document format. For the purpose of this document, .pdf refers to a geopdf.

.ovr – Stands for overlay file. Similar to the .rrd file, .ovr is a file format for storing pyramid layers for a raster dataset.

.rrd – Stands for "reduced resolution dataset." A file containing pyramids created for a raster dataset.

.sid – Stands for seamless image database. A lossless compressed image file developed by LizardTech

.tif – Stands for "tagged image file." High-quality graphics format often used for storing images with many colors, such as digital photos; short for "TIFF;" includes support for layers and multiple pages. For the purpose of this document, .tif refers to a GeoTIFF.

7.0 APPLICABILITY AND USE OF THIS DOCUMENT

The primary purpose of this document is to establish guidelines and specifications for imagery developed by or for APFO. The intent is to allow for great flexibility of data structure, spatial density, quality, and format, while supporting sharing and reuse of the data.

8.0 TIFF AND GEOTIFF REQUIREMENTS

This section of this File Format Specification defines the minimum set of format options, features, and data elements necessary to promote interoperability for the exchange of Tagged Image File Format (TIFF) and GeoTIFF-formatted files. This section establishes a common frame of reference to address adequate georeferencing parameters and data value attribution needed by geospatial applications to utilize GeoTIFF-formatted images. Only uncompressed TIFF or GeoTIFF imagery that has been georeferenced or orthorectified is addressed by this section of this specification. Requirements for compression (see Sub-Section 8.2.10) and georeferenceable imagery (see Sub-Section 8.2.2) are not supported in this specification.

TIFF is an image file format used for storing and interchanging raster images. TIFF is a portable format, not specific to or favoring any particular operating systems, file systems, compilers, or processors. It is also extensible and designed to evolve as new needs arise.

GeoTIFF is a set of TIFF tags (extensions to the Baseline TIFF Format) that describe spatial information associated with TIFF imagery that originate from any digital sensor, scanned aerial photography, scanned maps, or as a result of geographic analysis or similar processes. GeoTIFF uses a small set of reserved TIFF tags to store a broad range of geo-referencing information.

This specification addresses the following fundamental topics for application and use of TIFF and GeoTIFF files:

- Required TIFF and GeoTIFF tags for standardized use of TIFF and GeoTIFF-formatted files.
- Image data or pixel structures relating to: strips, tiling, compression, precision, number of bands, etc.
- Preferred coordinate reference systems, datums.

This specifications main characteristic allows:

- All types of imagery conformant to TIFF Baseline: bi-level, grayscale, palette color image, 3-bands RGB (full color), and multi-spectral.
- Optional TIFF tiling (TIFF extension specified in section 15 of the TIFF standard) for high volume data. This option cannot be used in conjunction with TIFF striping. The use of this option may cause some interoperability problems, and must be identified as such at a different conformance level.

8.1 Data Capture

TIFF provides 2 tags for specifying the scanner or instrument manufacturer and model: Make and Model. These fields may be populated according to product specification requirements.

However the production process is usually far more complex than the simple acquisition of an image by a scanner or a camera, and the full process needs to be documented by additional metadata (i.e. process description).

Use of Make and Model tags is consequently optional: in case they are populated, the information should be consistent with additional metadata (i.e. process description).

8.2 TIFF and GeoTIFF Requirements

In general, imagery data delivered in TIFF or GeoTIFF format will conform to (not deviate from) the TIFF and GeoTIFF formats as defined in the referenced TIFF and GeoTIFF specifications. The following clauses constrain the implementation of TIFF and GeoTIFF for the purposes of this specification.

8.2.1 General File Structure and Data Value Types

The TIFF structure includes an 8-byte image file header that points to the first Image File Directory (IFD). This specification calls for a single IFD in each TIFF file and this IFD must have at least one entry. The IFD contains information about the image, as well as pointers to the actual data. All used fields are listed, and information that does not fit in the IFD is listed in other parts of the file. The IFD begins with a 2-byte count of the number of directory entries (i.e., the number of fields), followed by a sequence of 12-byte field entries, followed by a 4-byte offset of the next IFD (or 0 in the case there is no other IFD). This 4-byte (32 bit) structure of the offset allows TIFF and GeoTIFF file sizes up to 4GB (2**32 bytes). This specification only supports file sizes up to 2GB.

A GeoTIFF file is a TIFF 6.0 file, and inherits the file structure as described in the corresponding portion of the TIFF Specification. All of the GeoTIFF information is encoded in six TIFF tags, which are designed to store a broad range of georeferencing information, catering to geographic as well as projected coordinate system needs. These GeoTIFF keys will contain no private Image File Directories (IFD's), binary structures, or other private information invisible to baseline TIFF 6.0 readers.

The GeoTIFF 1.0 standard uses a MetaTag (GeoKey) approach to encode dozens of data elements into just six TIFF 6.0 tags. GeoKeys are structurally similar to TIFF 6.0 tags, but at one lower level of abstraction. GeoKeys are used within the tags to store the projection parameters and coordinate system information. All keys are referenced from one tag, the GeoKeyDirectoryTag. See Table 2.1, Appendix A for details. Not all the keys will be used when formatting GeoTIFF in conformance with this specification. This specification requires that only certain essential GeoTIFF keys be populated. Other keys may require default values.

The GeoTIFF specification requires interpret (reader) implementations to support all documented TIFF 6.0 tag data-types, and in particular requires the Institute of Electrical & Electronic Engineers (IEEE) double-precision floating point 'DOUBLE' type tag. The documented data types for use with TIFF tags are:

- BYTE = 8-bit unsigned integer
- ASCII = 8-bit byte that contains a 7-bit American Standard Code for Information Interchange (ASCII) code. The last byte of an ASCII sequence (string) must be null (binary zero)
- SHORT = 16-bit (2-byte) unsigned integer
- LONG = 32-bit (4-byte) unsigned integer
- FLOAT = Single precision (4-byte) IEEE format
- DOUBLE = Double precision (8-byte) IEEE format
- RATIONAL = Two LONGs: the first represents the numerator of a fraction; the second, the denominator
- SBYTE = 8-bit signed (twos complement) integer
- UNDEFINED = 8-bit byte containing anything, depending on the definition of the field.

- SSHORT = 16-bit (2-byte) signed (twos complement) integer
- SLONG = 32-bit (4-byte) signed (twos complement) integer
- SRATIONAL = Two SLONGs: the first represents the numerator of a fraction; the second, the denominator.

Note: Appendix A identifies which data type applies to each tag selected for use by this specification.

TIFF implicitly types all range values (data sample values) as unsigned integer values. The representation of imagery, however, requires the ability to store the range (data) values in additional representations such as signed integer and floating point. Section 19 of the TIFF standard presents a scheme for describing a variety of data sample formats. The BitsPerSample field in the TIFF Image File Directory defines the number of bits per component.

8.2.2 Rectification and Ortho-rectification

A rectified grid has an affine transformation between the grid coordinates and the coordinates of an external coordinate reference system. A rectified grid is defined by an origin in an external coordinate reference system and a set of offset vectors that specify the direction and distance between grid lines within that external coordinate reference system. If the coordinate reference system is related to the earth by a datum, the grid is a georeferenced grid. An orthorectified grid is a georeferenced grid that uses elevation data and where constant scale is maintained throughout the grid.

A referenceable grid is one that can be referenced by some other specified coordinate transform (for example, by a physical sensor geometry model or by a functional fit model of rational polynomials).

This section of this specification is concerned only with georeferenced grids and orthorectified grids. It does not address referenceable grids; for example, those associated with oblique imagery or rubber sheeting.

The GeoTIFF Format Specification describes 5 coordinate transformations 'cases' that the format is able to address:

Case 1: The model-location of a raster point (x,y) is known, but not the scale or orientations.

Case 2: The location of three non-collinear raster points are known exactly, but the linearity of the transformation is not known, and the scale is not to be defined.

Case 3: the position and scale of the data is known exactly, and no rotation or sheering of the image is needed to fit into the model space.

Case 4: (intended for equidistant- sampled data) The raster data requires rotation and/or lateral sheering to fit into the defined model space. To accomplish this, additional information is needed in the form of a transformation matrix. The ModelTransformationTag exists for the purpose of allowing this information to be provided.

Case 5: The raster data cannot fit into the model space with a simple affine transformation. Multiple tie points can be stored in GeoTIFF to allow rubber sheeting of the image in this case.

This specification requires that the scale be identified in the GeoTIFF tags (see Table 2.1 Appendix A), and therefore cases 1 and 2 are not supported. This specification requires only georectified grids and orthorectified grids, therefore case 5 is not supported.

Only cases 3 and 4 are supported by this section of this specification.

8.2.3 Coordinate Reference Systems and Datums

The GeoTIFF Configuration GeoKeys establish the general configuration of the file's coordinate system. Each of these GeoKeys is listed below with their general description followed by limitations and constraints established by this specification:

- GTModelTypeGeoKey – Tag 1024. The GTModelTypeGeoKey defines the general type of model coordinate system used – geographic or projected.
- GTRasterTypeGeoKey– Tag 1025. The GTRasterTypeGeoKey establishes if the raster pixel value (imagery or gridded data range value) is located at a point value or if the value fills the square grid cell.
- GTCitationGeoKey – Tag 1026. The GTCitationGeoKey is used to give an ASCII reference to published documentation on the overall configuration of the GeoTIFF file. This key generally shows the projection name or geographic coordinate system name and the units.

Horizontal datum – GeoTIFF has many datums to choose from in the Geodetic Datum numerical codes. This specification recommends the use of North American Datum (NAD83) as the horizontal datum, but allows for World Geodetic System 1984 (WGS84).

Coordinate systems – GeoTIFF allows many geographic latitude-longitude systems and many projected coordinate systems. There are also tags for parameters of coordinate systems or projections not available in the codes. This section of this specification limits expression of coordinate references to NAD83 latitude and longitude (decimal degrees), NAD83 UTM Grid System Northing and Easting (meters), and geographic or projected WGS84 systems.

8.2.4 Units of Measure

This section of this specification allows only the implied 'angular degree' unit for the geographic coordinate system, and the default 'meters' unit for the UTM projected coordinate system. User-defined geographic or projected coordinate systems are not allowed by this specification. In order to prevent the use of other horizontal units of measure, the use of the GeoKeys related to horizontal units of measure are prohibited (see Tables 2.x in Appendix A).

Default units are:

- Decimal degrees for longitude and latitude (geographic coordinate system)
- Meters for UTM Grid System Easting and Northing (projected / cartographic coordinate system)

8.2.5 Date and Time

There is a TIFF field called DateTime for storing the date and time of file creation. The format for the field in ASCII type is "YYYY:MM:DD HH:MM:SS" with 24 hour time used for the hours and one space character between the date and time, and one terminating NUL character. The length of the string, including the terminating NUL, is 20 bytes. All dates and times shall be expressed in Coordinated Universal Time (UTC).

Use of this tag is recommended in order to support discovery of the data, wherever possible. This information should then be consistent with additional metadata (i.e. required process description). Absence of this tag indicates this information was not available. The Date/Time stamp that will be represented in the TIFF DateTime field shall be the date/time when the image file was created.

8.2.6 Collection and Maintenance Constraints

There are several TIFF tags that can carry and address a variety of collection information. These tags should not be populated for the purpose of this section of this specification. The associated additional metadata (i.e. process description) can optionally be used to carry this type of information when needed.

8.2.7 Tiling

For low-resolution to medium-resolution images, the standard TIFF method of breaking the image into strips is adequate. However high-resolution images (grids greater than 8192 x 8192) can be accessed more efficiently if the image is broken into roughly square tiles instead of horizontally-wide but vertically-narrow strips.

TIFF extensions offer an internal TIFF tiling mechanism which should be used on large grids / images, based on the most common tiling scheme which is a rectangular grid, by specifying

additional fields for rectangular tiles (for example width and length of a tile). Tile dimensions must be a multiple of 16 (TIFF specifies TileWidth and TileLength be a multiple of 16 for performance in some graphics environments and compression schemes such as JPEG). This internal TIFF tiling extension may not always be supported by commercial or public domain software, especially older TIFF readers.

TIFF internal tiling must NOT be used in conjunction with stripping. When using internal tiles, the grid data may need to be padded to tile boundaries when the grid size is not an integer multiple of the selected tile size.

Generally, for small grids, the data should be organized as a single TIFF file with no tiling, in order to maximize interoperability.

For large grids (greater than 8192 x 8192), TIFF tiling becomes a helpful option, the recommended tile size is 1024 x 1024. Another option is external tiling, when each tile is typically stored within separate files; this option is outside the scope of this section of this specification and is therefore not supported.

8.2.8 Number of Bands

The number of bands within a GeoTIFF grid is constrained to be 1-band, 3-bands, and 4 or more bands (multi-spectral). For the case of 3 or more bands, the band interleave shall be the TIFF 'chunky' format, band interleaved by pixel (BIP). In Chunky format the component values for each pixel are stored contiguously. For example, for RGB data, the data is stored as RGBRGBRGB. The BIP data organization can handle any number of bands, and thus accommodates black and white, grayscale, true color, and multi-spectral image data.

Additional information is needed to interpret the image data, such as SamplesPerPixel, BitsPerSample, PhotometricInterpretation, and ExtraSamples:

For 1-band 8-bit Pan Sharpened imagery, the following TIFF fields are documented as follows: SamplesPerPixel = 1, BitsPerSample = 8, PhotometricInterpretation = 1 (BlackIsZero), Do not use ExtraSamples.

For 3-band 8-bit RGB imagery, the following TIFF fields are documented as follows: SamplesPerPixel = 3, BitsPerSample = 8, PhotometricInterpretation = 2 (RGB), Do not use ExtraSamples.

For 4-band 8-bit RGB imagery, the following TIFF fields are documented as follows: SamplesPerPixel = 4, BitsPerSample = 8, PhotometricInterpretation = 2 (RGB), ExtraSamples = 0 (Unspecified data).

For 8-band 16-bit multi-spectral imagery, the following TIFF fields are documented as follows: SamplesPerPixel = 8, BitsPerSample = 16, PhotometricInterpretation = 2 (RGB), ExtraSamples = 0 (Unspecified data).

8.2.9 Range Value Data Types and Precision

For imagery, the range (data) values are constrained to be unsigned integer data, 8 or 16-bits-per-band.

8.2.10 Compression

No TIFF (internal) compression shall be used.

8.2.11 Image File Implementation

This specification addresses the following cases (except explicit contrary notice): base (single) image (one single IFD). The IFD always addresses the image data.

8.2.12 Security Classification

There are no dedicated fields for storing security classification information in TIFF files. Additional metadata should be used to associate security markers and dissemination controls for content of GeoTIFF files. However, inclusion of security constraint information in the ImageDescription tag is an option proposed by this section of this specification in order to support security marking of the data. This provides a consistent place for security metadata within the TIFF structure.

It is recommended to include security constraint information in the ImageDescription field, in addition to the information provided in the additional metadata (i.e. process description) so that this information is displayed even if this metadata is ignored by an application or become separated. This security constraint information should then be consistent with dedicated additional metadata (i.e. process description).

8.2.13 Data Quality

There are neither fields nor any mechanism for storing data quality information (positional accuracy, currency, quality information etc.) in the GeoTIFF format and in this specification. This information needs to be documented by additional metadata (i.e. process description).

9.0 LIZARDTECH'S MRSID REQUIREMENTS

MrSID imagery shall be compressed and saved in Generation Three (MG3) format. When encoding the image, the following settings shall be applied:

- compression block size of 64
- both the transparency and background values set to an RGB value of 0,0,0 (black)
- use the “maximum zoom level” applicable to the input image, for example: -checking the “Use Maximum Zoom Levels for Image” button in the encoding options menu.

Compression Ratio. Compression ratio shall be determined by the project or contract specifications. All compression shall be at the same ratio and settings ("region of interest" compressed at a different ratio will not be accepted).

Header Information. The image header shall contain correct Esri® compatible projection information for the mosaic.

Required Files. All standard MrSID® MG3 files generated by the LizardTech software (i.e., .sid, .sdw, and .txt) shall be included.

Configuration File. Provide the text file created when generating the image.

Auxiliary File. Provide an “.aux” file containing Esri® projection information for each image. The auxiliary file shall contain the proper projection information for the image and shall match the information in the image header.

10.0 JPEG 2000 REQUIREMENTS

JPEG 2000 imagery shall be compressed and saved in the JPEG 2000 format with an unsigned, 8-bit depth. Compression ratio shall be determined by the project or contract specifications. When encoding the image, the following settings shall be applied:

- Tiling: None
- Code blocks: 64
- Precincts: 256 x 256
- Strip height: 12
- Progression order: rpcl
- Quality layers: 8
- Packet length markers: Yes
- Filter: 9-7
- Tile length markers: No
- Transparency: Yes
- Background: Transparent, Black, White (stated in order of preference)

All compression shall be at the same ratio and settings ("region of interest" compressed at a different ratio will not be accepted).

11.0 ERDAS IMG® REQUIREMENTS

IMG imagery shall use the standard outputs as defined in the hierarchical file structure (HFA). The .img file shall be in a tiled format with a block size of 64x64 pixels. The following statistics shall be calculated:

- Minimum and maximum data file values
- Mean of the data file values
- Median of the data file values
- Mode of the data file values
- Standard deviation of the data file values

If the file has been georeferenced, the following map information shall be stored in the raster layer:

- Upper left x, y coordinates
- Pixel size
- Map unit used for measurement (e.g., meters, inches, feet)

An .ige file shall be created for images larger than 4GB. The .ige file shall be in a non-HFA format containing only the actual image data.

12.0 ERDAS ER MAPPER ECW® REQUIREMENTS

When creating ECW files, the following input settings shall be used:

- Output file type is .ecw
- Compression type is set to correct spectral resolution (color RGB, grayscale, multiband)
- Generate NULL opacity mask channel is checked
- Compression ratio shall be determined by the project or contract specifications.
- Output resolution is set by the compressor

ERDAS ER Mapper® **must** be used when compressing imagery to the .ecw format. This ensures that all image keys and tags are correctly populated in the output image header.

APPENDIX A

TIFF/GeoTIFF Image Format Constraints

TIFF Format

The file structure for the Image File Header and Image File Directory can be found in the TIFF product specification in Part 1, Section 2: TIFF Structure. There are four Baseline TIFF image types; Bilevel Images, Grayscale Images, Palette-color Images, and RGB Full Color Images. Each type has specific field requirements which can be found in Sections 3 through 6 of the TIFF document. For the purpose of representing imagery, the grayscale and full-color image baselines are appropriate. The use of any private tags, other than those included in this appendix is prohibited for use.

TIFF Specification Document: Revision 6.0 dated June 3, 1992

Table 1.1 describes the "Baseline Fields" defined in Section 8 of the TIFF specification.
Table 1.2 describes the "CCITT Bilevel Encodings" defined in Section 11 of the TIFF specification.
Table 1.3 describes the "Document Storage and Retrieval" defined in Section 12 of the TIFF specification.
Table 1.4 describes the "Differencing Predictor" defined in Section 14 of the TIFF specification.
Table 1.5 describes the "Tiled Images" defined in Section 15 of the TIFF specification.
Table 1.6 describes the "CYMK Images" defined in Section 16 of the TIFF specification.
Table 1.7 describes the "HalftoneHints" defined in Section 17 of the TIFF specification.
Table 1.8 describes the "Associated Alpha Handling" defined in Section 12 of the TIFF specification.
Table 1.9 describes the "Data Sample Format" defined in Section 19 of the TIFF specification.
Table 1.10 describes the "RGB Image Colorimetry" defined in Section 20 of the TIFF specification.
Table 1.11 describes the "YCbCr Images" defined in Section 21 of the TIFF specification.
Table 1.12 describes the "JPEG Compression" defined in Section 22 of the TIFF specification.

<u>Legend for TIFF table</u>:

- Columns Field, Description, Tag, and Type refer to corresponding specification items of tag according to TIFF specifications.
- ROCN column specifies presence of the item:
    - R: required
    - O: optional
    - C: conditional (Condition must be specified)
    - N: Do not use
- Restricted field values: indicates (when applicable) required values for TIFF tag.

Table 1.1: TIFF 6.0 Baseline Tags

TIFF 6.0 Section 8	**Baseline Field Reference Guide**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
Artist	Person who created the image.	315	ASCII	R	Populate with the name of the organization who created the file.
BitsPerSample	Number of bits per component.	258	SHORT	R	Set to the number of bits used to represent each range (sample) value.
CellLength	The length of the dithering or halftoning matrix used to create a dithered or halftoned bilevel file.	265	SHORT	N	Do not use this key.
CellWidth	The width of the dithering or halftoning matrix used to create a dithered or halftoned bilevel file.	264	SHORT	N	Do not use this key.
ColorMap	Defines an RGB color map for palette color images.	320	SHORT	C	Use only with palette color images.
Compression	Compression scheme used on the image data. Uncompressed CCITT 1D CCITT Group 3 CCITT Group 4 LZW JPEG Packbits (32773)	259	SHORT	R	Set to 1 (No Compression)
Copyright	Copyright notice. When access or usage restrictions (or both) exist for the dataset, populate with the applicable copyright notice of the person or organization that claims the copyright to the image. The complete copyright statement shall be listed in this field including any dates and statements of claims. If no usage restrictions exist, it shall be so stated in this field.	33432	ASCII	C	Populate only when any restrictions have been cited by the requestor.

DateTime	Date and time of image creation. The date and time that most closely reflects the currency of the data range values.	306	ASCII	R	File creation date
ExtraSamples	Description of extra components. Populate with a value of 0 only if SamplesPerPixel is greater that 3 (4-band images).	338	BYTE	C	Populate with a value of 0 only if SamplesPerPixel is greater than 3 (multi-spectral images).
FillOrder	The logical order of bits within a byte.	266	SHORT	O	Desired value is 1
FreeByteCounts	For each string of contiguous unused bytes in a TIFF file, the number of bytes in the string.	289	LONG	N	Do not use this key.
FreeOffsets	For each string of contiguous unused bytes in a TIFF file, the byte offset of the string.	288	LONG	N	Do not use this key.
GrayResponseCurve	For grayscale data, the optical density of each possible pixel value.	291	SHORT	N	Do not use this key.
GrayResponseUnit	The precision of the information contained in the GrayResponseCurve.	290	SHORT	N	Do not use this key.
HostComputer	The computer and/or operating system in use at the time of image creation.	316	ASCII	O	Optional, but not desired
ImageDescription	A string that describes the subject of the image.	270	ASCII	R	Populate with a description that identifies the acquisition Program name.
ImageHeight	The number of rows of pixels in the image.	257	SHORT or LONG	R	The number of rows of range values.
ImageWidth	The number of columns in the image, i.e., the number of pixels per row.	256	SHORT or LONG	R	The number of columns of range values.
Make	The scanner manufacturer. The manufacturer of the equipment used to generate the image.	271	ASCII	R	The manufacturer of the instrument used to obtain the range values.
MaxSampleValue	The maximum component value used.	281	SHORT	N	Do not use this key.
MinSampleValue	The minimum component value used.	280	SHORT	N	Do not use this key.

Model	The scanner model name or number.	272	ASCII	R	The model name or number of the instrument used to obtain the range values.
NewSubFileType	A general indication of the kind of data contained in this subfile.	254	LONG	N	Do not use this tag.
Orientation	The orientation of the image with respect to the rows and columns. Set this value to the default value of 1. Orientation of the grid indices to the external coordinate reference system is defined by the GeoTIFF tags.	274	SHORT	O	Default is 1
PhotometricInterpretation	The color space of the image. Note: A value for the 4-band case is not defined in the TIFF specification. In the 4-band case, use a value of 2 and populate the ExtraSamples tag with a value of 0.	262	SHORT	R	Allowed values are: 0 - WhiteIsZero 1 - BlackIsZero 2 - RGB 3 – Palette Color 4 - Transparency Mask
PlanarConfiguration	How the components of each pixel are stored. When more than one band is described by the range values, include this tag and set the value to 1. (chunky format).	284	SHORT	C	Default value is 1. Use this tag when more than one band is described by the range values and the component values are stored contiguously (ie chunky format) (Not to be used if Tiling has been used)
ResolutionUnit	The unit of measurement for XResolution and YResolution.	296	SHORT	R	Default value is 2 (inches).
RowsPerStrip	The number of rows per strip **No to be used if Tiling has been used.**	278	SHORT or LONG	C	The TIFF specification recommends selecting the value for RowsPerStrip such that each strip is about 8k bytes; it makes buffering simpler for readers.

SamplesPerPixel	The number of components per pixel.	277	SHORT	R	Allowed values are: 1 - (monochrome or transparency mask) 3 - (RGB) 4 - (4-band data).
Software	Name and version number of the software package(s) used to create the image. Populate with description of the software package(s) used to process/create the range values from the raw instrument data or other source of imagery and gridded data.	305	ASCII	N	Do not use this tag.
StripByteCounts	For each strip, the number of bytes in the strip after compression. **No to be used if Tiling has been used.**	279	LONG or SHORT	C	Populate per TIFF specification when opting to use strips. (Not to be used if Tiling has been used)
StripOffsets	For each strip, the byte offset of that strip **Not to be used if Tiling has been used.**	273	SHORT or LONG	C	Populate per TIFF specification when opting to use strips. (Not to be used if Tiling has been used)
SubFileType	A general indication of the kind of data contained in this subfile. This field is useful when there are multiple subfiles in a single TIFF file.	255	SHORT	N	Do not use this key.
Thresholding	For black and white TIFF files that represent shades of gray, the technique used to convert from gray to black and white pixels.	263	SHORT	O	Desired value is 1.
XResolution	The number of pixels per ResolutionUnit in the ImageWidth direction.	282	RATIONAL	R	Populate with intended display resolution.
YResolution	The number of pixels per ResolutionUnit in the ImageLength direction.	283	RATIONAL	R	Populate with intended display resolution.

Table 1.2: CCITT Bilevel Encodings

TIFF 6.0 Section 11	**CCITT Bilevel Encodings**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
Compression	Compression scheme used on the image data. Uncompressed CCITT 1D CCITT Group 3 CCITT Group 4 LZW JPEG Packbits (32773)	259	SHORT	R	Set to 1 (No Compression)
T4Options[2]	Options for Group 3 Fax compression	292	LONG	N	Do not use this key.
T6Options[3]	Options for Group 4 Fax compression	293	LONG	N	Do not use this key.

Table 1.3: Document Storage and Retrieval

TIFF 6.0 Section 12	**Document Storage and Retrieval**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
DocumentName	The name of the document from which this image was scanned.	269	ASCII	N	Do not use this key.
PageName	The name of the page from which this image was scanned.	285	ASCII	N	Do not use this key.
PageNumber	The page number of the page from which this image was scanned.	297	SHORT	N	Do not use this key.
XPosition	X position of the image.	286	RATIONAL	N	Do not use this key.
YPosition	Y position of the image.	287	RATIONAL	N	Do not use this key.

Table 1.4: Differencing Predictor

TIFF 6.0 Section 14	**Differencing Predictor**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
Predictor	A predictor is a mathematical operator that is applied to the image data before an encoding scheme is applied.	317	SHORT	N	Do not use this key.

Table 1.5: Tiled Images

TIFF 6.0 Section 15	**Tiled Images**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
TileWidth	The tile width in pixels. This is the number of columns in each tile.	322	SHORT or LONG	C	When tiled is allowed: Populate per TIFF specification when opting to use internal tiles.
TileLength	The tile length (Height) in pixels. This is the number of rows in each tile.	323	SHORT or LONG	C	When tiled is allowed: Populate per TIFF specification when opting to use internal tiles.
TileOffsets	For each tile, the byte offset of that tile, as compressed and stored on disk.	324	LONG	C	When tiled is allowed: Populate per TIFF specification when opting to use internal tiles.
TileByteCounts	For each tile, the number of (compessed) bytes in that tile.	325	SHORT or LONG	C	When tiled is allowed: Populate per TIFF specification when opting to use internal tiles.

Table 1.6: CYMK Images

TIFF 6.0 Section 16	**CYMK Images**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
InkSet	The set of inks used in a separated (PhotometricInterpretation=5) image.	332	SHORT	N	Do not use this key.
NumberOfInks	The number of inks. Usually equal to SamplesPerPixel, unless there are extra samples.	334	SHORT	N	Do not use this key.
InkNames	The name of each ink used in a separated (PhotometricInterpretation=5) image, written as a list of concatenated, NUL-terminated ASCII strings. The number of strings must be equal to NumberOfInks.	333	ASCII	N	Do not use this key.
DotRange	The component values that correspond to a 0% dot and 100% dot. DotRange[0] corresponds to a 0% dot, and DotRange[1] corresponds to a 100% dot.	336	BYTE or SHORT	N	Do not use this key.
TargetPrinter	A description of the printing environment for which this separation is intended.	337	ASCII	N	Do not use this key.

Table 1.7: HalftoneHints

TIFF 6.0 Section 17	**HalftoneHints**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
HalftoneHints	The purpose of the HalftoneHints field is to convey to the halftone function the range of gray levels within a colorimetrically-specified image that should retaintonal detail.	321	SHORT	N	Do not use this key.

Table 1.8: Associated Alpha Handling

TIFF 6.0 Section 18	**Associated Alpha Handling**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
ExtraSamples	Description of extra components.	338	BYTE	C	Populate with a value of 0 only if SamplesPerPixel is greater than 3 (multi-spectral images).

Table 1.9: Data Sample Format

TIFF 6.0 Section 19	**Data Sample Format**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
SampleFormat	This field specifies how to interpret each data sample in a pixel. Possible values are: 1 – unsigned integer data 2 – two's complement signed integer data. 3 – IEEE floating point data [IEEE] This field does not specify the size of data samples; the BitsPerSample field does this.	339	SHORT	R	Default value is 1. Select the value corresponding to the sample format used for representing the range (data) values.
SMinSampleValue	The minimum sample value. This tag is used in lieu of MinSampleValue when the sample type is other than integer. The minimum component value used.	340	Any	N	Do not use this key.
SMaxSampleValue	The maximum sample value. This tag is used in lieu of MaxSampleValue when the sample type is other than integer. The maximum component value used.	341	Any	N	Do not use this key.

Table 1.10: RGB Image Colorimetry

TIFF 6.0 Section 20	**RGB Image Colorimetry**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
WhitePoint	The chromaticity of the white point of the image. This is the chromaticity when each of the primaries has its ReferenceWhite value.	318	RATIONAL	N	Do not use this key.
PrimaryChromaticities	The chromaticities of the primaries of the image. This is the chromaticity for each of the primaries when it has its ReferenceWhite value and the other primaries have their ReferenceBlack values.	319	RATIONAL	N	Do not use this key.
TransferFunction[4]	Describes a transfer function for the image in tabular style. Pixel components can be gamma-compensated, companded, non-uniformly quantized, or coded in some other way. The ransferFunction maps the pixel components from a non-linear BitsPerSample (e.g. 8-bit) form into a 16-bit linear form without a perceptible loss of accuracy.	301	SHORT	N	Do not use this key.
TransferRange	Expands the range of the TransferFunction. The first value within a pair is associated with TransferBlack and the second is associated with TransferWhite. The ordering of pairs is the same as for pixel components of the PhotometricInterpretation type.	342	SHORT	N	Do not use this key.
ReferenceBlackWhite	Specifies a pair of headroom and footroom image data values (codes) for each pixel component. The first component code within a pair is associated with ReferenceBlack, and the second is associated with ReferenceWhite. The ordering of pairs is the same as those for pixel components of the PhotometricInterpretation type	532	LONG	N	Do not use this key.

Table 1.11: YCbCr Images

TIFF 6.0 Section 21	**YCbCr Images**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
PhotometricInterpretation	The color space of the image. For Specification: Allowed values are: 0 - WhiteIsZero 1 - BlackIsZero 2 - RGB 3 – Palette Color 4 - Transparency Mask Note: A value for the 4-band case is not defined in the TIFF specification. In the 4-band case, use a value of 2 and populate the ExtraSamples tag with a value of 1.	262	SHORT	N	Do not use this key.
YCbCrCoefficients	The transformation from RGB to YCbCr image data.	529	RATIONAL	N	Do not use this key.
YCbCrSubSampling	Specifies the subsampling factors used for the chrominance components of a YCbCr image.	530	SHORT	N	Do not use this key.
YCbCrPositioning	Specifies the positioning of subsampled chrominance components relative to luminance samples.	531	SHORT	N	Do not use this key.

Table 1.12: JPEG Compression

TIFF 6.0 Section 22	**JPEG Compression**				
Field	**Description**	**Tag**	**Type**	**ROCN**	**Restricted Field Values**
JPEGProc	This Field indicates the JPEG process used to produce the compressed data.	512	SHORT	N	Do not use this key.
JPEGInterchangeFormat	This Field indicates whether a JPEG interchange format bitstream is present in the TIFF file.	513	LONG	N	Do not use this key.
JPEGInterchangeFormatLength	This Field indicates the length in bytes of the JPEG interchange format bitstream.	514	LONG	N	Do not use this key.
JPEGRestartInterval	This Field indicates the length of the restart interval used in the compressed image data.	515	SHORT	N	Do not use this key.
JPEGLosslessPredictors	This Field points to a list of lossless predictor-selection values, one per component.	517	SHORT	N	Do not use this key.
JPEGPointTransforms	This Field points to a list of point transform values, one per component. This Field is relevant only for lossless processes.	518	SHORT	N	Do not use this key.
JPEGQTables	This Field points to a list of offsets to the quantization tables, one per component.	519	LONG	N	Do not use this key.
JPEGDCTTables	This Field points to a list of offsets to the DC Huffman tables or the lossless Huffman tables, one per component.	520	LONG	N	Do not use this key.
JPEGACTTables	This Field points to a list of offsets to the Huffman AC tables, one per component.	521	LONG	N	Do not use this key.

GeoTIFF Format

GeoTIFF data format
All of the GeoTIFF information is encoded in six tags, and numerous keys are available to store projection parameters and coordinate system information. Use of keys and parameters is constrained as indicated . All keys are referenced from one tag, the GeoKeyDirectoryTag. The following information is from the GeoTIFF product specification, Revision 1.0, in Section 1: Baseline GeoTIFF. Specific definitions, formats, and codes can be found in GeoTIFF Format Specification, Revision 1.0. As with baseline TIFF tags, the use of any private GeoTIFF tags, other than those included in this appendix is prohibited.

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Table 2.1 describes the "GeoTIFF Tags" defined in Sections 2.4 – 2.6 of the GeoTIFF Specifications.
Table 2.2 describes the "GeoTIFF Configuration GeoKeys" defined in Sections 2.7 – 2.7.2 of the GeoTIFF Specifications.
Table 2.3 describes the "Geographic CS Parameter Keys" defined in Sections 2.7 – 2.7.2 of the GeoTIFF Specifications.
Table 2.4 describes the "Projected CS Parameter Keys" defined in Sections 2.7 – 2.7.2 of the GeoTIFF Specifications.
Table 2.5 describes the "Vertical CS Parameter Keys" defined in Sections 2.7 – 2.7.2 of the GeoTIFF Specifications.

<u>Legend for GeoTIFF table</u>:

- Columns GeoTIFF tag/key , Description, Tag/Key Id, and Type refer to corresponding specification items of tag according to GeoTIFF specifications.
- ROCN column specifies presence of the item:
    - R: required
    - O: optional
    - C: conditional (Condition must be specified)
    - N: Do not use
- Restricted field values: indicates (when applicable) required values for GeoTIFF geokey.

Table 2.1: GeoTIFF Tags

GeoTIFF Tag	Description	Tag	Type	ROCN	Restricted Field Values
GeoKeyDirectoryTag	Stores GeoKey Directory, which defines and references the "GeoKeys." All Keys in GeoTIFF are referenced from the GeoKeyDirectoryTag All projection and datum information is stored in GeoKeys. See section 2.4 of the GeoTIFF 1.0 Standard.	34735	SHORT	R	This tag references all non-ASCII GeoKeys.
GeoDoubleParamsTag	Used to store all of the DOUBLE valued GeoKeys, referenced by the GeoKeyDirectoryTag For Profile:	34736	DOUBLE	N	Do not use this tag, it is unnecessary because as all Double type GeoKeys are prohibited by this profile.
GeoAsciiParamsTag	Used to store all of the ASCII valued GeoKeys, referenced by the GeoKeyDirectoryTag. See section 2.6.1 of the GeoTIFF 1.0 Standard.	34737	ASCII	R	This tag is used to store all the ASCII-valued GeoKeys.
ModelTiepointTag	Stores raster model tiepoint pairs in the order ModelTiepointTag = (…,I,J,K, X,Y,Z…) where (I,J,K) is the point at location (I,J) in raster space with pixel-value K, and (X,Y,Z) is a vector in model space. The Z value is an offset used in conjuction with the Z pixel scale (tag 33550) to position the data vertically.	33922	DOUBLE	R	Populate this tag with the tie point pair that correlates to the grid origin (grid coordinates 0,0) by convention in the upper left corner of the image. For imagery and typical elevation data (no offset), set Z=0
ModelPixelScaleTag	Used to specify the size of raster pixel spacing in the model space units, consists of the following three values ModelPixelScaleTag = (ScaleX, ScaleY, ScaleZ) The X and Y values must be populated and be equal to the ground distance of one pixel.	33550	DOUBLE	R	Populate per GeoTIFF specification; For imagery, set Z=0, for elevation data, set Z=1 Note: This tag must not be used if the image requires rotation.
ModelTransformationTag	Used to specify the transformation matrix between the raster space and the model space, it has the following organization: ModelTransformationTag = (a,b,c,d,e,….,m,n,o,p)	34264	DOUBLE	C	Use this tag when the image requires rotation in order to be north-oriented. For further explanation see section 2.6.2 Cookbook for Defining Transformations in the GeoTIFF Format Specification, Rev 1.0, 10 Nov 10, 1995; version 1.8.2

GeoTIFF Configuration GeoKeys

These keys are to be used to establish the general configuration of a file's coordinate system, including the types of raster coordinate systems, model coordinate systems, and citations if any.

Table 2.2: GeoTIFF Configuration GeoKeys

GeoTIFF Key	Description	Key ID	Type	ROCN	Restricted Field Values
GTModelTypeGeoKey	Defines general type of model coordinate system used, and to which the raster space will be transformed.	1024	SHORT	R	The applicable codes are: 1 – ModelTypeProjected 2 – ModelTypeGeographic
GTRasterTypeGeoKey	Establishes the raster space coordinate system – RasterPixelIsPoint, RasterPixelIsArea. a. The "PixelIsArea" raster grid space uses coordinates I and J, with (0,0) denoting the upper-left corner of the image, and increasing I to the right, increasing J down. The first pixel-value fills the square grid cell with the bounds top-left = (0,0), bottom-right = (1,1) and so on; by extension this one-by-one grid cell is also referred to as a pixel. An N by M pixel image covers an area with the mathematically defined bounds (0,0),(N,M). b. This raster space designates the upper-left corner of an image. The coordinate pair values for this location shall be “a whole number of pixels.” Each value “must be integer multiple of the resolution” of the image. For a 1-meter resolution image this pair can be odd or even whole numbers, for a 2-meter resolution image this pair needs to even whole numbers. c. The desired result is to have “Exact Pixel Registration,” meaning that pixels from multiple images line up exactly. This should not be	1025	6.3.1.2 codes	R	The applicable codes are: 1 – RasterPixellsArea (use for imagery products) 2 – RasterPixellsPoint (use for non-imagery discrete coverage data)

	confused with overlaps or gaps, but the cells have to fall on an even multiple of the cell width and height from one another, and adjacent images cannot have cells starting halfway, or partially into the cells of the original image				
GTCitationGeoKey	Provided to give an ASCII reference to published documentation on the overall configuration of this GeoTIFF file.	1026	ASCII	R	This key contains detailed product identification and is used to define the imagery file. (ie file name).

Geographic CS Parameter Keys

In general, the coordinate system used will be implied by the projected coordinate system code (Table A.2.3). However, If the model type was chosen to be Geographic (GTModelTypeGeoKey = 2), then the system must be explicitly defined with the following keys.

Table 2.3: Geographic CS Parameter Keys

GeoTIFF Key	Description	Key Id	Type	ROCN	Restricted Field Values
GeographicTypeGeoKey	This key may be used to specify the code for the geographic coordinate system used to map lat-long to a specific ellipsoid over the earth.	2048	SHORT (Code from Section 6.3.2.1)	C	Use when GTModelTypeGeoKey = 2 and ProjectedCSTypeGeoKey is absent. Example: 4326 (ie GCS_WGS84)
GeogCitationGeoKey	This key provides a general citation and reference for all Geographic CS parameters.	2049	ASCII	C	Use when GeographicTypeGeoKey is present. Example: WGS84
GeogGeodeticDatumGeoKey	This key may be used to specify the horizontal datum, defining the size, position and orientation of the reference ellipsoid used in userdefined geographic coordinate systems.	2050	SHORT (code from Section 6.3.2.2)	N	Do not use this key.
GeogPrimeMeridianGeoKey	This key allows specification of the location of the Prime meridian for user-defined Geographic coordinate systems. The default standard is Greenwich, England.	2051	SHORT (Code from Section 6.3.2.4)	N	Do not use this key.
GeogLinearUnitsGeoKey	This key allows the definition of geocentric CS linear units for user-defined GCS.	2052	DOUBLE Code from Section 6.3.1.3)	N	Do not use this key.
GeogLinearUnitSizeGeoKey	Allows the definition of user-defined linear geocentric units, as measured in meters.	2053	DOUBLE	N	Do not use this key.

GeogAngularUnitsGeoKey	This key Allows the definition of geocentric CS Linear units for user-defined GCS and for ellipsoids	2054	SHORT (Code from Section 6.3.1.4)	N	Do not use this key.
GeogAngularUnitSizeGeoKey	Allows the definition of user-defined angular geographic units, as measured in radians.	2055	DOUBLE	N	Do not use this key.
GeogEllipsoidGeoKey	This key may be used to specify the coded ellipsoid used in the geodetic datum of the Geographic Coordinate System.	2056	SHORT (Code from Section 6.3.2.3)	N	Do not use this key.
GeogSemiMajorAxisGeoKey	This key allows the specification of user-defined Ellipsoid Semi-Major Axis (a).	2057	DOUBLE	N	Do not use this key.
GeogSemiMinorAxisGeoKey	This key allows the specification of user-defined Ellipsoid Semi-Minor Axis (b).	2058	DOUBLE	N	Do not use this key.
GeogInvFlatteningGeoKey	This key Allows the specification of the inverse of user-defined Ellipsoid's flattening parameter (f).	2059	DOUBLE	N	Do not use this key.
GeogAzimuthUnitsGeoKey	This key This key may be used to specify the angular units of measurement used to defining azimuths, in geographic coordinate systems. These may be used for defining azimuthal parameters for some projection algorithms, and may not necessarily be the same angular units used for lat-long.	2060	SHORT (Codes from Section 6.3.1.4)	N	Do not use this key.
GeogPrimeMeridianLongGeoKey	This key allows definition of user-defined Prime Meridians, the location of which is defined by its longitude relative to Greenwich.	2061	DOUBLE	N	Do not use this key.

Projected CS Parameter Keys

Table 2.4: Projected CS Parameter Keys

GeoTIFF Key	Description	Key Id	Type	ROCN	Restricted Field Values
ProjectedCSTypeGeoKey	This key contains a coded value for the projection, datum, and possibly plane coordinate zone. Legal values for this key are listed in section 6.3.3.1 of the GeoTIFF 1.0 standard. This code is provided to specify the projected coordinate system. 326zz – UTM Northern Hemisphere 327zz – UTM Southern Hemisphere Where zz is the UTM zone number.	3072	SHORT (Code from Section 6.3.3.1)	C	Use when GTModelTypeGeoKey = 1. Example: 326zz – UTM Northern Hemisphere 327zz – UTM Southern Hemisphere Where zz is the UTM zone number.
PCSCitationGeoKey	This key is provided to give an ASCII reference to published documentation on the Projected Coordinate System. Free text field for describing the projection and datum.	3073	ASCII	C	Use when ProjectedCSTypeGeoKey is present. Citation of Projected Coordinate System. For example: UTM zzN/UTM Where zz is the UTM zone number.
ProjectionGeoKey	This key allows specification of the coordinate transformation method and projection zone parameters.	3074	SHORT (Code from Section 6.3.3.2)	N	Do not use this key.
ProjCoordTransGeoKey	This key allows specification of the coordinate transformation method used.	3075	SHORT (Code from Section 6.3.3.3)	N	Do not use this key.

ProjLinearUnitsGeoKey	This key defines the linear units used by the projection	3076	SHORT (Code from Section 6.3.1.3)	N	Do not use this key.
ProjLinearUnitSizeGeoKey	This key defined the size of user-defined linear units in meters.	3077	DOUBLE	N	Do not use this key.
ProjStdParallel1GeoKey	This key specifies the latitude of the primary standard parallel.	3078	DOUBLE	N	Do not use this key.
ProjStdParallel2GeoKey	This key specifies the latitude of the second standard parallel.	3079	DOUBLE	N	Do not use this key.
ProjNatOriginLongGeoKey	This key defines the longitude of the map projection natural origin.	3080	DOUBLE	N	Do not use this key.
ProjNatOriginLatGeoKey	This key defines the latitude of the map projection natural origin.	3081	DOUBLE	N	Do not use this key.
ProjFalseEastingGeoKey	This key provides the easting coordinate of the map projection natural origin.	3082	DOUBLE	N	Do not use this key.
ProjFalseNorthingGeoKey	This key provides the northing coordinate of the map projection natural origin.	3083	DOUBLE	N	Do not use this key.
ProjFalseOriginLongGeoKey	This key provides the longitude of the false origin.	3084	DOUBLE	N	Do not use this key.
ProjFalseOriginLatGeoKey	This key provides the latitude of the false origin	3085	DOUBLE	N	Do not use this key.
ProjFalseOriginEastingGeoKey	This key provides the easting coordinate of the false origin.	3086	DOUBLE	N	Do not use this key.
ProjFalseOriginNorthingGeoKey	This key provides the northing coordinate of the false origin.	3087	DOUBLE	N	Do not use this key.
ProjCenterLongGeoKey	This key provides the longitude of the center of the projection (not necessarily the origin).	3088	DOUBLE	N	Do not use this key.
ProjCenterLatGeoKey	This key provides the latitude of the center of the projection (not necessarily the origin).	3089	DOUBLE	N	Do not use this key.

ProjCenterEastingGeoKey	This key provides the easting coordinate of the center.	3090	DOUBLE	N	Do not use this key.
ProjCenterNorthingGeoKey	This key provides the northing coordinate of the center.	3091	DOUBLE	N	Do not use this key.
ProjScaleAtNatOriginGeoKey	This key provides the scale at the origin. This is a ratio, so no units are required.	3092	DOUBLE	N	Do not use this key.
ProjScaleAtCenterGeoKey	This key provides the scale at the projection center as a ratio.	3093	DOUBLE	N	Do not use this key.
ProjAzimuthAngleGeoKey	This key provides the azimuth angle east of true north of the central line passing through the projection center.	3094	DOUBLE	N	Do not use this key.
ProjStraightVertPoleLongGeoKey	This key provides the longitude at the straight vertical pole for Polar Stereographic projections.	3095	DOUBLE	N	Do not use this key.

Vertical CS Parameter Keys

Table 2.5: Vertical CS Parameter Keys

GeoTIFF Key	Description	Key Id	Type	ROCN	Restricted Field Values
VerticalCSTypeGeoKey	This key may be used to specify the vertical coordinate system. Note: The 'user defined' code shall be used for the EGM 2008 geoid case, or when using a hydrographic datum. The VerticalCitationGeoKey shall be used to identify the coordinate system/datum for the user defined case.	4096	SHORT (Code from Section 6.3.4.1)	N	Do not use this key.
VerticalCitationGeoKey	This key may be used to document the vertical coordinate system used, and its parameters.	4097	ASCII	N	Do not use this key.
VerticalDatumGeoKey	This key may be used to specify the vertical datum for the vertical coordinate system.	4098	SHORT (Codes from Section 6.3.4.2)	N	Do not use this key.
VerticalUnitsGeoKey	This key may be used to specify the vertical units of measurement used in the geographic coordinate system, in cases where geographic CS's needs to reference the vertical coordinate. This, together with the Citation key, comprises the only fully implemented keys in this section, at present.	4099	SHORT (Code from Section 6.3.1.3)	N	Do not use this key.