Federal Digital Imagery General Contract Guideline
Version 1.0 Date:5-3-2007

This guide recommends language and specifications for solicitations of offers for aerial digital imagery products and/or services for federal contracts. These guidelines may be used by agencies outside of the federal government.

The aim of the solicitation process is to communicate the Government s intent to procure products and/or services. To provide for an efficient and fair competition that ensures the Government s needs are met in a timely and cost efficient fashion, a procurement notice is issued. This notice, that bids will be requested, allows bidders sufficient time to exercise their business judgment and prepare their bids. Thereafter, bids and information are solicited through the issuance of a document called the request for proposal (RFP). RFP s are prepared using the General Contract Guideline

The contract provisions in Parts I, II, and III of the General Contract Guideline (GCG) will constitute a complete contract except for the prices or costs and fee in Part B. The Contractor must fill out Part B when the offer is submitted. Solicitations for basic contracts, as well as solicitations on existing contracts must be in the following order:

Part I   The Schedule
Section	**Description**
A -	Solicitation/Contract Form
B -	Products or Services and Prices/Costs
C -	Description/Specifications/Statement of Work
D -	Packaging and Marking
E -	Inspection and Acceptance
F -	Deliveries or Performance
G -	Contract Administration Data
H -	Special Contract Requirements

Part II - Contract Clauses
I -	Contract Clauses

Part III - List of Documents, Exhibits, and Other Attachments
J -	List of Attachments

Part IV   Representations and Instructions
K -	Representations and Certifications, and Other Statements of Contractors
L -	Instructions, Conditions, and Notice to Contractors
M -	Evaluation Factors for Award

Once a contract has been awarded, sections A-K of the solicitation will become a part of the basic contract, while sections L & M will not be part of the resulting contract, but will remain in the pre-award documentation.

Section A
Solicitation/Contract Form

This section of the contract contains GSA Standard Form (SF) 33, Solicitation, Offer, and Award which must be used as the cover sheet for the RFP and may constitute Section A of the contract. If an offer from SF 33 leads to further changes, the resulting contract must be prepared as a bilateral document on SF 26, Award/Contract. **The most important information in these forms is the time by which the offer must be submitted and the requirement for signature by an authorized representative of the contractor. Standard Forms 26 and 33 may be obtained via the internet at:**

http://contacts.gsa.gov/webforms.nsf/(formslist)?openform&count=1000&category=Standard+Forms&expandview.

A listing of the forms may be accessed by clicking on standard (SF) forms in the top right portion of the web page, then selecting the SF form number, and then the version for the document.

Products or Services and Prices/Costs

This section of the contract gives potential contractors a summary description of the contract requirements and provides a place for contractors to submit their proposed prices. A brief description of the products or services is included; e.g., item number, national stock number/part number if applicable, nouns, nomenclature, and quantities. This also includes incidental deliverables such as manuals and reports.

Description/Specifications/Statement of Work

This section of the contract contains the detailed description of the products to be delivered or the work to be performed under the contract. Any description, specifications, or statement of work needed in addition to Section B will be included

Some portions of this section of the contract contain variables that need to be assigned appropriate values by the Contracting Officer.

Any use of trade, product, or firm names in this document is for descriptive purposes only and does not imply endorsement by the U.S. Government

1. SCOPE OF CONTRACT

2. APPLICABLE DOCUMENTS

3. GENERAL REQUIREMENTS
    3.1. Project Management
        3.1.1. Progress Reports.   A Progress Report is required for each day progress is made or delays have been encountered in acquiring project photography. Reports shall be transmitted by e-mail following each day of progress. E-mail address will be provided at contract award
        3.1.2. Subcontract Management. If the Contractor uses subcontractors in the performance of the contract, a plan and procedure will be established to manage its subcontractors. The Contractor is encouraged to maximize its use of partnerships and subcontractors to accomplish the requirements of this contract
    3.2. Quality Control
        3.2.1.1.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 monitor the image quality and coverage, and shall undertake immediate re-flights of any imagery where the quality fails to meet minimum requirements of the contract specifications. Any photography/imagery submitted for inspection which does not meet minimum requirements may be rejected. The nature and urgency of this project may require the Government to make equitable financial adjustments for non-conforming materials where product use is adversely impacted. Inspection and acceptance procedures are described in Section E, Inspection and Acceptance.
        3.2.1.2. [if the contract is less than $100,000] 52.246-1   CONTRACTOR INSPECTION REQUIREMENTS   (APR 1984): The Contractor is responsible for performing or having performed all inspections and

tests necessary to substantiate that the supplies or services furnished under this contract conform to contract requirements, including any applicable technical requirements for specified manufacturers' parts. This clause takes precedence over any Government inspection and testing required in the contract's specifications, except for specialized inspections or tests specified to be performed solely by the Government.

3.2.1.3. [if the contract is greater than $100,000] 52.246-2

3.2.1.4. [if the contract is greater than $100,000] 52.246-4   INSPECTION OF SERVICES-FIXED-PRICE   (AUG 1996): The Contractor shall provide and maintain an inspection system acceptable to the Government covering the services under this contract. Complete records of all inspection work performed by the Contractor shall be maintained and made available to the Government during contract performance and for as long afterwards as the contract requires.

3.2.1.5. Quality Control Plan. Prepare a self-inspection and quality control plan and incorporate the plan into the contract. The self-inspection and quality control plan shall include, but is not limited to:

3.2.1.5.1.   Document the specific methods and procedures that will be used to ensure that the Acceptable Quality Level has been attained for geospatial horizontal accuracy.

3.2.1.5.2.   Document the specific methods and procedures that will be used to ensure that the Acceptable Quality Level has been attained for spatial specifications.

3.2.1.5.3.   Document the specific methods and procedures that will be used to ensure that the Acceptable Quality Level has been attained for radiometric specifications.

3.2.1.5.4.   Designate a Point-of-Contact for quality control issues and provide said information to the Contracting Officer.

3.2.1.5.5.   Additional information as needed.

4. EQUIPMENT REQUIREMENTS

4.1. Aircraft Requirements

4.1.1.   Platform Type – All equipment shall be connected, attached, mounted and secured to the aircraft airframe in a manner to provide a safe environment for the crew. All aircraft and airframe modifications used in the performance of this Project shall be maintained and operated in accordance with all regulations required by the Federal Aviation Administration. Any inspections or maintenance of the aircraft for performance of this Project which results in missed data collection shall not be considered as an excusable cause for delay. The Contractor shall ensure that the aircraft has a proven service ceiling, with operating load (fuel, crew, sensor, and other required equipment), of not less than the highest altitude required to acquire the data.

4.1.2.   Sensor Mount - The digital camera/sensor and its mount shall be checked for proper installation prior to each mission. The sensor mount shall be

regularly serviced and maintained and shall be insulated against aircraft vibration.

4.1.3.   Port Opening – The design of the port opening(s) in the aircraft shall be such that the field of view is unobstructed when a sensor is mounted with all its parts above the outer structure. The field of view shall, so far as is practicable, be shielded from air turbulence and from any outward flows, such as exhaust gases, oil, etc.

4.1.4.   Optical Flat –

4.1.4.1. If an optical flat is used, the physical characteristics of the window (such as size, thickness, smoothness, flatness, parallelism, glass quality, and optical transmissivity) shall be reported to the CO prior to use. The optical flat shall meet the following specifications:

4.1.4.1.1.   Optical quality;

4.1.4.1.2.   Mounted in material eliminating mechanical stress to the window;

4.1.4.1.3.   Free of blemishes, dirt, significant scratches, etc.;

4.1.4.1.4.   Shall not degrade the resolution or the accuracy of the camera.

4.1.4.1.5.   If an aircraft camera has a port glass it shall be preferable 50mm thick but not less than 37mm thick. The surface finish shall be 80/50 or better. Glass material shall be polished crown, group category M. (Mil Specs Mil-W-1366F (ASG) October 1995, C-1 optical quality or better.)

4.2. IMU

4.2.1.   Inertial Measurement Unit: If an IMU is employed in the digital imaging system, the IMU shall be capable of determining the absolute orientation (roll, pitch, and yaw) and meet or exceed manufacturer's specifications.

4.3. Global Positioning System:

4.3.1.   Carrier-phase airborne multi-channel kinematic GPS (minimum L1 and L2 channels) shall be acquired and used along with IMU measurements (if IMU is used) in processing trajectories. The performance specification for post-processed positioning solution accuracy shall be no worse than **Y** units relative to the National Spatial Reference Frame.

4.3.2.   The GPS antenna shall be an FAA-approved antenna suitable for geodetic quality carrier-phase multi-channel reception (channels L1 and L2 at a minimum) and installed in accordance with FAA airframe modification requirements. Antenna should be located in a location near the camera to minimize lever arm lengths, and also in a location to provide optimal GPS signal quality and continuous reception in an appropriate, unobstructed location on the plane.

4.4. Camera/Sensor Requirements

4.4.1.   General Requirements:

4.4.1.1. Any sensors (in addition to those submitted at the time of offer) proposed to be used by the Contractor must have a manufacturer's type certification from the USGS, or equivalent. In addition, the Contractor shall possess a USGS Data Providers certification or equivalent.

4.4.1.2. Tested and calibrated precision digital sensors for acquiring digital imagery are required and must meet contract specifications. Sensor systems must be compatible with precision stereoscopic mapping instruments and with mensuration procedures used in photogrammetric surveys and in preparing accurate orthoimagery.

4.4.1.3.. If the sensor platform and sensor proposed for use are not owned by the Contractor, a written statement of availability from the owner of the equipment shall be furnished to the Contracting Officer.

4.4.1.4. Acquisition of the digital imagery may be from airborne or space borne platforms capable of meeting minimum specified criteria.

4.4.2. Specifications: Only digital sensor systems, which meet the requirements of these specifications, and as determined by appropriate sensor system documentation, certification and sample imagery submitted, shall be used.

4.4.2.1. Calibration: The sensor system shall be calibrated, geometrically stable and capable of meeting minimum specified criteria for photogrammetric mapping.

4.4.2.2. For Stereo Applications - Field of View: The sensor shall be high enough resolution and have a large enough Field of View (FOV) to provide the required Ground Sample Distance (GSD) and stereo coverage of a ground swath defined in the Project Instructions.

4.4.2.3. Ground Sample Distance:

4.4.2.3.1. For multispectral applications: All red, green and blue (RGB) and near infrared (CIR) color bands must be collected at the required GSD to provide true multispectral imagery at that GSD. The creation of interpreted, interpolated, or sharpened color data is prohibited for the Multispectral requirements.

4.4.2.3.2. For planimetric requirements: Color interpretation or pan sharpening will be permitted to achieve the GSD requirements..

4.4.2.4. Radiometry:

4.4.2.4.1. The digital imaging system shall acquire spectral bands as required in the project instructions. All use of contrast, brightness, and other radiometric image enhancements shall be discussed in the final report.

4.4.2.4.2. **[Optional]** The raw images must be submitted along with enhanced images. Raw imagery is defined as the data that is retrieved from the sensor system before any conversion to processed format.

4.4.2.5. Bit Depth: The sensor shall capture a minimum of X-bits per color channel.

4.4.3. Maintenance:

4.4.3.1. The contractor shall perform all maintenance on the digital sensor in accordance with the manufacturer's recommended and established procedures. The contractor shall maintain a complete history of all maintenance done to the digital sensor 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.

4.4.4. Image Collection:

4.4.4.1. The sensor and its mount shall be checked for proper installation prior to each mission. Unless stated otherwise in the SOW, the preference of the Government is that the Contractor use sensor configurations that advance imagery parallel to the line of flight.

4.4.4.2. Automatic Exposure Control. An automatic exposure control device is permitted, but a manual override capability is required for some types of terrain to achieve proper exposure.

4.4.5. Malfunctions: The Contracting Officer shall be notified of all direct digital sensor system malfunctions within one working day. A malfunction is defined as a failure anywhere in the direct digital sensor system that causes an interruption of the normal operations of the system. Also, any malfunctions of the GPS or Inertial Measurement Unit (IMU) collection systems shall be recorded and reported within one working day.

4.5. Calibration Requirements

4.5.1. Testing and Evaluation of Proposed Digital Sensor Systems

4.5.1.1. Proposed digital sensor systems will be evaluated to determine if they meet the contract specifications, based on current technical descriptions and samples. The Contracting Officer (CO) shall have the right to require the removal of a sensor from use when deficiencies in imagery attributable to the sensor are found to exist.

4.5.2. Calibration Requirements: A report detailing the calibration of the sensor system shall be submitted. Any incomplete reports shall be cause for rejection of the data. Calibration reports for each digital imaging system used shall be supplied to the CO at the beginning of the performance period.

4.5.2.1. Parameters: The calibration reports shall cover each of the following topics:

4.5.2.1.1. System Calibration – System calibration shall address geometric performance. Parameters to be tested include calibrated focal length, lens distortion parameters, and, if applicable, the principal point location. Also, any radiometric calibration parameters and files shall be provided to the CO. Some of these procedures and parameters may be unique to a manufacturer since hardware varies from manufacturer to manufacturer. The IMU-to-camera alignment shall be checked. Also, updated IMU misalignment angles should be provided as evaluated.

4.5.2.1.2. Boresight Calibration Values – The boresight calibration is the determination of relative orientation between camera and IMU reference frames. If IMU georeferencing will be used, boresight calibration shall be performed according to manufacturer specifications for each project or any time the camera or IMU is mounted, removed, or adjusted. The contractor shall include the method used in boresighting and the final values.

4.5.2.1.3. Determination Of Offsets – The sensor-to-GPS-antenna offset vector components ("lever arm") shall be measured. The offset

vector shall be determined with an absolute accuracy (1F) of X units or better in each component. By convention, this vector is measured from the incident nodal point of the camera lens to the GPS antenna phase center in the coordinate system of the camera. The offset vector components shall be re-determined each time the sensor or aircraft GPS antenna is moved or repositioned in any way.

4.5.2.2. Documentation

4.5.2.2.1. Digital Sensor Documentation Requirements: The contractor shall provide with their proposal detailed documentation of the digital sensor proposed for use. Documentation may include brochures, technical specifications, marketing material, USGS camera type certification, or other descriptive literature. The documentation shall contain at a minimum the following information:

4.5.2.2.1.1. General overview information

4.5.2.2.1.2. Product configuration description

4.5.2.2.1.3. Sensor component description

4.5.2.2.1.4. Technical specifications

4.5.2.2.1.5. Computer management and storage systems

4.5.2.2.1.6. Image acquisition and processing workflow.

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.

4.5.2.3. Multiple Sensor Systems: This refers to systems marketed by the manufacturer that contain more than one sensor. If more than one sensor is used they should be calibrated within tolerances to produce consistent results across the collection area.

4.5.2.3.1. Radiometric quality measurement: The sensors shall be properly calibrated to insure that data are of a radiometric quality equal to X. and are radiometrically consistent across the collection area.

4.5.2.4. Multiple-Sensor System: This refers to a system possessing multiple lenses and arrays. A multi-sensor system should be calibrated within tolerances to produce consistent results across the image area.

4.5.2.4.1. Radiometric quality measurement. The sensors shall be properly calibrated to insure that data are of a radiometric quality equal to X and are radiometrically consistent across the collection area.

4.5.2.5. System Maintenance: The contractor shall perform all maintenance in accordance with the manufacturer's recommended and established procedures. The contractor shall maintain a complete history of all maintenance done to the direct digital sensor 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.

4.5.3. **[Optional] Test Imagery**

4.5.3.1.1. Test Imagery/Product: The Contractor shall acquire and deliver a representative sample of a product similar to the requirement in spatial resolution, spectral resolution, and geographic terrain as specified in the contract. The test data set shall include all bands used for imagery collection. The CO or COR will review this imagery test as soon as possible and notify the Contractor of the results of the review. The Contractor shall not proceed with continued imagery collection until it has received approval from the CO. If the CO rejects the imagery test, a repeat test shall be required. The digital sensor sample imagery shall provide the following minimum characteristics:

4.5.3.1.1.1. Display the same GSD resolution being offered as indicated in the statement of work.

4.5.3.1.1.2. For natural color proposals (RGB bands), the sample image shall be at least 24 bits in color depth.

4.5.3.1.1.3. For color infrared proposals (G,R,IR bands), the sample image shall be at least 24 bits in color depth

4.5.3.1.1.4. For imagery with more than 3 bands, the sample image shall have a bit depth of X-bits per color channel

4.5.3.1.1.5. Sample image shall be orthorectified, with geodetic standards of X datum and Y projection.

4.5.3.1.1.6. Sample shall be produced using the standard indicated in the contract.

4.5.3.1.1.7. The sample imagery shall fit on one standard media, formatted as mentioned in the contract.

4.5.3.1.2. Test Imagery/Product: The Contractor is required to provide a detailed technical description and sample image from the digital sensor being proposed for use.

4.5.3.1.3. Technical Approach: Provide a brief description of equipment and process proposed for this project.

5. IMAGERY ACQUISITION REQUIREMENTS

5.1. Digital Image Acquisition: The contractor shall use digital sensor to acquire imagery over the area described in the project scope.

5.1.1. **[Optional]** The imagery will be controlled with airborne GPS and IMU,

5.2. Flight Planning

5.2.1. Digital Image Collection Survey Plan – Prior to data acquisition, the contractor shall create a Digital Image Collection Survey Plan which will be provided to the government, that specifies the data collection parameters to be used and contains a map of the flight lines and the project coverage area, including flying height and speed over ground, focal length, ground sample distance, side-lap, and end-lap.

5.2.2. Ground Sample Distance – The ground sample distance (GSD) will be defined in the SOW. The GSD is the area on the ground represented by each pixel in a digital image.

5.2.3. Flying Height And Speed –

5.2.3.1. Flying height depends on the required GSD. The maximum speed over ground (SOG) for push broom sensors shall not exceed manufacturer's guidelines. Image smear shall be kept below X %.

5.2.3.2. Departures from flight heights required to produce the desired GSD typically shall not exceed ±Y%.

5.2.4. End-Lap –

5.2.4.1. Consecutive images in a flight line shall have a minimum end-lap of X% of the mean image width if the camera mount provides correction for crab, otherwise Y%. This section does not apply to push broom sensors. See Project Instructions for final parameters.

5.2.4.2. For stereo imagery, forward overlap in the line of flight shall average typically not less than X% or more than Y% at the mean elevation of the terrain, unless otherwise specified. Individual forward overlaps shall not be less than X2% or more than Y2%, excepting the situation where, in a forward overlap in areas of low elevation must exceed Z1% to attain the minimum Z2% forward overlap in adjacent areas of higher elevation. .

5.2.5. Side-Lap –

5.2.5.1. Adjacent images shall have a minimum side-lap of X% of the mean image width if the camera mount provides correction for crab, otherwise Y%.

5.2.5.2. Side Overlap between adjacent parallel flight lines shall typically be X% ± Y% at the mean elevation of the terrain unless otherwise specified. In addition, any point on the flight line as flown shall not deviate from the flight plan location by a distance greater than Z% of the width of coverage of the image, unless requirements dictate otherwise. For special geometric applications, side-lap equaling forward overlap may be required.

5.3. Flight Requirements

5.3.1. Acquisition Period

5.3.1.1. Project Instructions may specify ground vegetation conditions; generally described as either leaf-on (maximum vegetation) or leaf-off (minimum vegetation).

5.3.1.2. For shoreline imaging, consideration of the season should be taken into account when trying to image the ground surface. Project Instructions may discuss seasonal fluctuations in sandy beach dynamics. Beach profiles and morphology can significantly vary in response from the energy presented upon the system in relation to the sequencing and fluctuations of weather events and patterns.

5.3.1.3. Requirements: The Contractor shall acquire imagery within the given time/tide windows as required and shall produce a table showing the times of the time/tide windows and the times of the data acquisition. Be

sure to take into account time zones, daylight savings time, and to use Coordinated Universal Time (UTC).

5.3.2. Aircraft & Equipment Operation

    5.3.2.1.Aircraft

        5.3.2.1.1. Crab – While collecting digital imagery, the camera shall be compensated for crab of the aircraft in order to maintain agreed upon sidelap between flightlines.

        5.3.2.1.2. Tilt - It is desired that exposures be made when the optical axis of the sensor is in a vertical position. The Contractor shall not acquire imagery when the tilt (departure from the vertical) of any image exceeding X degrees or relative tilt between any two successive images exceeding Y degrees. Tilt shall not average more than Z degrees in any W distance units section of a flight line and shall not average more than U degree for the entire project.

    5.3.2.2.GPS

        5.3.2.2.1. PDOP/VDOP shall be <X.

        5.3.2.2.2. Record sensor position in latitude and longitude using differentially corrected GPS.

        5.3.2.2.3. Positioning

          5.3.2.2.3.1.GPS Collection

            5.3.2.2.3.1.1. All imagery shall be positioned using kinematic GPS, or equivalent, using at least dual frequency receivers and oriented with an inertial navigation system.

            5.3.2.2.3.1.2. All kinematic GPS (KGPS) solutions should use differential, ionosphere-free, carrier-phase combinations with phase ambiguities resolved to their integer values.

            5.3.2.2.3.1.3. Aircraft trajectories shall be processed using carrier-phase GPS. At a minimum, dual L1 and L2 frequency receivers and one-second collection shall be used.

            5.3.2.2.3.1.4. All KGPS shall use at least X ground stations. For the Continental United States, the ground stations shall be accurately tied to the NSRS (stations in the NGS database); shall be positioned to X distance units accuracy, or better; shall be within or near the project area; and shall be within Y distance units of the entire project area. Additional ground GPS stations may be required, and CORS (continually operating reference stations) can be used as ground stations. The ground stations should be positioned on opposite sides of the operating area. The ground stations shall be positioned, or the flight path arranged, so that during flight operations the aircraft will pass within Z distance units to each ground station at least once.

5.3.2.2.3.1.5. The maximum GPS baseline shall not exceed X distance units at any time during flight. Regardless of aircraft flight time, GPS ground station data shall be collected for no less than X hours.

5.3.2.2.3.1.6. Ground station data shall be submitted to OPUS (Online Positioning User System – http://www.ngs.noaa.gov/OPUS/) for positioning in the NSRS, except where ground station is located over a known monument.

5.3.2.2.3.2. GPS Solution Processing

5.3.2.2.3.2.1. The Contractor shall collect, process, and submit the ground and airborne GPS data, both raw data and final processed data.

5.3.2.2.3.2.2. Differential KGPS solutions for the aircraft shall be obtained independently using each ground station.

5.3.2.2.3.2.3. These independent KGPS solutions shall be compared to display their differences in the north-south, east-west, and vertical components during the operational portions of the flights.

5.3.2.2.3.2.4. The RMS of these differences shall not exceed X units in the horizontal and Y units in the vertical.

5.3.2.2.3.2.5. The KGPS solutions shall model the tropospheric delay using average surface meteorological values at the ground stations collected near the midpoint of operations.

5.3.2.2.3.2.6. The final KGPS solution will be an average of the separate ground station solutions.

5.3.2.2.4. Antenna: The antenna height shall be accurately measured using survey instruments.

5.3.2.3. Ground Station

5.3.2.3.1. Mark – The ground-based receiver shall be set up over a known (or to-be-determined) marked base station and shall run continuously during the mission. If a known base station is used, it must be in the NGS database and hence part of the National Spatial Reference System (NSRS).

5.3.2.3.2. Observations – The position of an existing mark shall be checked by processing one GPS session and comparing the computed position with the NGS published position. A new mark shall be referenced to the NSRS by tying to one or more NGS Continuously Operating Reference Stations (CORS), High Accuracy Reference Network (HARN) stations, or Primary Airport Control Stations (PACS) by static GPS methods. If the distance to the nearest reference receiver is less than 100 kilometers, use at least two independent sessions, each 2 hours long. If the distance to the nearest NGS CORS is greater than 100 kilometers, use at least two sessions, each 4 hours long. Make a

separate tripod set-up and height measurement for each session. Take care in the accurate recording of the height of the antenna both before and after the flight. Record all heights, equipment serial numbers, etc. on the NGS forms: Visibility Obstruction Diagram and GPS Observation Log. For a listing of these and other forms on the NGS WWW site see: www.ngs.noaa.gov/PROJECTS/FBN/. Also, static observations may be processed using the NGS "On-Line User Positioning Service" (OPUS) found at: www.ngs.noaa.gov/OPUS/index.html. Observations to establish a new, permanent mark shall be submitted in NGS "Blue Book" format.

5.3.2.3.2.1. Recovery– For an existing NSRS station, write a digital recovery note in NGS format using NGS software WDDPROC. For a new, permanent station write a digital station description in NGS format using WDDPROC. For a new, temporary mark write a brief description adequate to recover the station. Take three photographs of the base station (photographs of the CORS station are not required). For additional specification guidance on mark setting, GPS observations, data processing, and data submittal in NGS format, see the "General Specifications for Aeronautical Surveys, Volume I, Establishment of Geodetic Control on Airports"

5.3.2.4. Aircraft GPS

5.3.2.4.1. GPS Observations – The aircraft's GPS receiver shall be able to collect carrier phase observations and record, at least, once per second, from a minimum of four satellites (five or more preferred) at both the aircraft and the ground GPS receivers, for off-line processing. All data shall be collected with a Position Dilution of Precision (PDOP) of less than X at a minimum elevation mask angle of Y degrees. After the post–processing, the GPS observation and ephemeris files are used to determine a flight path trajectory.

5.3.2.4.2. GPS Lock – The aircraft shall maintain GPS satellite lock throughout the entire flight mission. If satellite lock is lost, on-the-fly ambiguity resolution methods may be used to recapture lock, while airborne. Report these instances, procedures used, and any other unusual occurrences to the Contracting Officer in the daily report.

5.3.2.4.3. Airborne Positioning And Orientation Report: The Report shall include at least the following paragraphs:

5.3.2.4.3.1. Introduction - Provide an overview of the project and the final processed data sets and list the data sets in table form with the following columns: Dataset ID, Date of Acquisition, Projects covered by the data set, and Description/Flight Line(s) and Identification.

5.3.2.4.3.2.Positioning - Discuss the methodology, the hardware and software used (including models, serial numbers, and versions), the CORS station(s) used, a general description of the data sets, flight lines, dates and times of sessions, the processing (including the type of solution–float, fixed, ion–free, etc.), and the results (discussion of the coordinates and accuracy). Submit a description of the data sets, and the raw and processed data. If the NGS OPUS website was used to process the static data, the Contractor shall provide a copy of the OPUS report. If a known station was used from the NGS database, the Contractor shall identify the station by name and permanent identifier (PID), and provide the published coordinates used in the kinematic position step. If multiple base stations were used, provide processing details, coordinates, and accuracy for all stations.

5.3.2.4.3.3.Image Collection

5.3.2.4.3.4.Static Processing

5.3.2.4.3.5.Kinematic Processing

5.3.2.4.3.6.Data Sets

5.3.2.4.3.7.Orientation - Discuss the factors listed above for Positioning.

5.3.2.4.3.8.Data Collection

5.3.2.4.3.9.Data Processing

5.3.2.4.3.10. Data Sets

5.3.2.4.3.11. Final Results - Describe any unusual circumstances or rejected data, and comment on the quality of the data.

5.3.2.5.IMU

5.3.2.5.1. If an IMU is used it should record sensor position in attitude (pitch, roll and yaw)

5.3.3. Imaging Conditions

5.3.3.1.Ground Condition

5.3.3.1.1. Image acquisition shall not be conducted if clouds or cloud shadows exceed X% in any image or if the land/water interface is obscured by snow, ice, etc. High, thin overcast (clouds) will be permitted above the flying altitude if it does not cause ground mottling or a discernable reduction in light levels and/or ground object shadows. Storm systems and events (e.g. hurricanes, northeasters, and frontal boundaries) that may cause an increase in water levels, tidal heights, and wave activity shall be avoided.
.   or

5.3.3.1.2. Imagery shall not be taken when the ground is obscured by haze, snow, smoke, dust, flood waters, fog, dim illumination, high overcast, or other environmental factors. Clouds and/or shadows of clouds shall not appear in the images except where clouds are outside of river swath area. The Contractor shall consult with the

COR before continuing the flight mission regarding conditions that obscure ground detail.

5.3.3.1.3. **[Optional]** For coastal mapping, any stage of leaf coverage is acceptable as long as the land-water interface is not obscured.

5.3.3.1.4. [Optional] Imagery collection shall be undertaken only when the land-water interface can be well defined. Imagery shall not be attempted where the ground is obscured by clouds, haze, smoke, smog, dust, snow, sleet, rain, etc. Also, imagery shall not be conducted when the ground, and especially land-water interface, is covered by water (flood), snow, or ice.

5.3.3.1.5. Digital imagery shall be acquired only under conditions free from specular reflections that obscure land detail and excessive soil moisture.

5.3.3.2. Atmosphere

5.3.3.2.1. The minimum visibility at the time of collection is X miles. Imagery shall not be collected when haze is present. Visibility is determined by looking at objects on the ground toward the sun. The distance at which the detail of ground objects is clearly defined is the visibility. If the visibility is satisfactory, details of ground objects shall be clearly defined at the edge of the view through the drift sight (assuming the system makes use of a drift sight which may not be the case for some automated digital systems).

5.3.3.3. Illumination

5.3.3.3.1. The images shall be taken when the sun angle is equal to, or more than, Y degrees above the horizon. Use the Government-furnished sun angle chart to determine allowable imaging times.

5.3.3.3.2. The size and number of hot spots (no sun shadow points) and "sun spots" (bright, sun reflectance areas) on the water and shoreline must be kept to a minimum and eliminated if possible because these bright spots can obscure important features. During flight planning, flight line directions and times should be arranged to preclude the occurrence of these spots in critical areas of the photographs (especially shoreline and near shoreline areas).

5.3.3.3.3. For shoreline imaging the ideal sun angle should be between 30 and 45 degrees. Imagery should be collected while the sun is over the water so that any shadows created by elevated objects will point inland and will not obscure the shoreline.

5.3.3.3.4. Sun angles for a given day can be determined from a "Solar Altitude Diagram" or from appropriate computer software. For on-line sun angle solutions, see the U.S. Naval Observatory's WWW site: http://aa.usno.navy.mil/ which computes sun altitudes and sun azimuths for U.S. locations and world-wide positions.

5.3.3.4. **[Optional]** Tide Coordination

5.3.3.4.1. Image Collection Tide Conditions: Image collection may need to be at tide-coordinated stages depending on the required tide

stage defined by the Project Instructions. Imagery shall not be collected during strong onshore winds, high waves or other anomalous weather conditions. Contractor shall acquire, analyze, and submit an offshore buoy report and other weather data for the project area during time of data acquisition (National Data Buoy Center: www.ndbc.noaa.gov, National Climatic Data Center: lwf.ncdc.noaa.gov/oa/ncdc.html).

    5.3.3.4.2. Windows

        5.3.3.4.2.1. NGS-Supplied – The government may supply image acquisition time/tide windows for each coastal area to be mapped, or the contractor may be tasked with window determination. These "windows" cover an extended range of possible flying dates. These time/tide windows will be determined by NGS initially to help ensure that all data meet the NGS tolerances for tide-coordinated image acquisition. If tide windows for additional dates are required, contact NGS.

        5.3.3.4.2.2. Contractor-Determined – If required by the Project Instructions, the Contractor shall determine predicted acquisition time/tide windows (data acquisition times for tide coordination) for MHW and/or MLLW. Note, MHW is the mean of 18.6 years of high water and is not the high water level for any given day, except by coincidence. The same holds true for MLLW time/tide windows.

        5.3.3.4.2.3. The Project Instructions may also require the Contractor to install and/or monitor tide gages in the project areas for either real-time or post-flight tidal height comparisons.

  5.3.4. Positive Control Airspace

    5.3.4.1. Positive Control Airspace: The proposed 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.

    5.3.4.2. If the project is in controlled air space the appropriate Air Traffic Control Center (AIRTCC) must be contacted. If the project area includes a military installation, the pilot must comply with security regulations.

6. IMAGE DATA PROCESSING

  6.1. General: Image Data Processing shall be documented.

  6.2. The contractor shall provide the following processed image products:

    6.2.1. **[Optional]** Image Tiles

      6.2.1.1. **[Optional]** Image Tile Size: Digital orthorectified images shall be organized for nominal X by Y areas. Images shall extend a minimum of

Z units beyond the image tile boundaries. Tile layout shall be defined by an index sheet and shape file suitable for loading into ArcView.

      6.2.1.2. **[Optional]** Raw Image Tiles

            6.2.1.2.1. Panchromatic image tiles collected and processed at X-bits in a format suitable for stereo-viewing/analysis.

            6.2.1.2.2. RGB image tiles collected and processed at X-bits in a format suitable for stereo-viewing/analysis.

            6.2.1.2.3. CIR image tiles collected and processed at X-bits in a format suitable for stereo-viewing/analysis.

            6.2.1.2.4. Multispectral image tiles collected and processed at X-bits in a format suitable for stereo-viewing/analysis.

      6.2.1.3. **[Optional]** Rectified Image Tiles

            6.2.1.3.1. Pan image tiles collected and processed at X-bits in a format suitable for stereo-viewing/analysis.

            6.2.1.3.2. RGB image tiles collected and processed at X-bits in a format suitable for stereo-viewing/analysis.

            6.2.1.3.3. CIR image tiles collected and processed at X-bits in a format suitable for stereo-viewing/analysis.

            6.2.1.3.4. Multispectral image tiles collected and processed at X-bits in a format suitable for stereo-viewing/analysis.

      6.2.1.4. **[Optional]** Orthorectified Image Tiles

            6.2.1.4.1. Pan image tiles collected and processed at X-bits.

            6.2.1.4.2. RGB image tiles collected and processed at X-bits.

            6.2.1.4.3. CIR image tiles collected and processed at X-bits.

            6.2.1.4.4. Multispectral image tiles collected and processed at X-bits.

   6.2.2. **[Optional]** Mosaic Products

      6.2.2.1. [Optional] Rectified Mosaic

            6.2.2.1.1. Pan image tiles collected and processed at X-bits.

            6.2.2.1.2. RGB image tiles collected and processed at X-bits.

            6.2.2.1.3. CIR image tiles collected and processed at X-bits.

            6.2.2.1.4. Multispectral image tiles collected and processed at X-bits.

      6.2.2.2. **[Optional]** Orthorectified Mosaic

            6.2.2.2.1. Pan image tiles collected and processed at X-bits.

            6.2.2.2.2. RGB image tiles collected and processed at X-bits.

            6.2.2.2.3. CIR image tiles collected and processed at X-bits.

            6.2.2.2.4. Multispectral image tiles collected and processed at X-bits.

6.3. This table serves as an **example** of product categorization with a list of potential specification parameters and suggested values. **It is intended to serve as a guide. Actual parameters and their values should be tailored by an individual item's Scope of Work.**

Table PS-1 Sample Specifications

Item		Standard *(Mfr, lab cal)*	Enhanced *(In-situ & lab cal)*	Precision *(Lab & field cal)*
Geolocation	General	Grossly Specified	More Tightly Specified and Verified	Tightly Specified and Verified In-flight
	CEP (90%)	*< 120 m*	*< 10 m*	< 1 m
	CEP (95%)	*<140 m*	*< 11.5 m*	TBR
	LEP	*TBD*	*TBD*	
Spectral	General	Broad gentle cut on and cut off slopes with minimal control of out-of-band rejection and ripple	Broad band with tighter control of cut on and cut off slopes, out-of-band rejection, and ripple. Verified by analysis.	Broad band or narrow band with very tight control of cut on and cut off slopes, out-of-band rejection and ripple. Analogous with ETM+. Verified by measurement.
	50%point	*TBD*	±20 nm	±10 nm
	Slopes through 50%	< 0.5%/nm	> 0.5%/nm	> 1%/nm
	Out of band rejection, measured across entire detector spectral range	*Not Specified*	< 5%	< 1 %
	Ripple	*Not Specified*	< 10%	< 5%
	Band registration	*Not Specified*	< 0.5 pixels	< 0.1 pixels
Radiometric	General	None required	Absolute and relative radiometry determined by laboratory characterization.	Absolute and relative radiometry determined by laboratory characterization and field measurements.
	Absolute accuracy	*Not Specified*	± 10%	± 5%
	Relative accuracy	*Not Specified*	± 5%	± 2%
	Signal-to-noise ratio	*TBD*	TBD	TBD
Spatial	General	MTF @ Nyquist and aliasing not defined	MTF @ Nyquist and aliasing defined and determined by laboratory.	MTF @ Nyquist and aliasing defined and determined by laboratory and field measurements.
	Relative accuracy	*%5*	± 5%	± 2%
	Linearity	< 5% deviation	< 5% deviation	< 2% deviation
	GSD @ nadir			
	GSD @ geometric mean of useable FOV			

Item		Standard (Mfr, lab cal)	Enhanced (In-situ & lab cal)	Precision (Lab & field cal)
Compression		*TBD*	*TBD*	Lossless
Image Obscuration		typically ≤ 10% cloud cover or cloud shadow, smoke, dust, haze		
Solar Angle		Typically solar noon ± 30 º		
Overlap	Forward	typically 55 – 68% min/max (individual), unless varying topography requires greater max. 57 – 62% average at mean elevation of terrain		
	Side	Typically 30% ± 10% at mean elevation of terrain		

6.4. GPS/IMU Products

    6.4.1.   Airborne Positioning And Orientation   The contractor shall compile the original, raw GPS and IMU data files and processed trajectory files. If IMU geo-referencing is employed, submit the exterior orientation file with the EO parameters.

    6.4.2.   GPS Points   The contractor shall submit an organized list of all GPS points used for the project as base stations, ground control, and check points. Indicate which GPS points are extant ground control points and which stations are newly positioned relative to the National Spatial Reference System.

    6.4.3.   Supplemental Ground Control: Differentially corrected GPS Ground Control used to supplement the Airborne GPS positional data adjustment shall be delivered in a non-proprietary format mutually agreeable to the Government and Contractor.

6.5. Data Files

    6.5.1.   Production Process File. The Contractor shall create brief descriptions of the digital image processing system which shall include a narrative explanation of the process steps taken to produce the imagery in accordance with FGDC specification, Process Description. Separate descriptions are required for the quarter quadrangle image tiles and the mosaic.

    6.5.2.   Project Data Files. The Contractor shall create a project description file. Contractor shall include a project data file containing, at a minimum, the following data:

        Description:
        Project Item Area
        Contract Award Number (to be assigned upon award)
        State (2 digit Abbreviation - MO, KS, etc.)
        Nominal Photo Scale
        Nominal Lens Focal Length
        Coordinate System Datum
        Coordinate Data Collection Method (GPS, Digitizing, etc.)
        [For GPS Collection - Antenna offset in meters]
        Estimated Accuracy of Coordinates (within Meters)
        Standard Deviation in meters
        Date ASCII Exposure Data File was created (YYYYMMDD)

Production System used to produce images: "Free text with quotations   (50 characters max)

Example:
    Missouri,USDA-NAIP-3-04-
1,MO,1:40,000,153mm,CP,35,NAD83, GPS, 1.7m, 50m,
1.45m,20040801, "production hardware & software description"

6.5.3. **[Optional]** Image Frame-Center Data File. The Contractor shall create an image frame-center data file for digital camera systems. Contractor shall include an image frame-center data file containing, at a minimum, the following attributes:

DESCRIPTION	NUMBER OF CHARACTERS IN FIELD
Project Code	6
Date of Exposure (YYYYMMDD)	8
Photo Number	10
Flight Line	4
GPS Time of Exposure	12
Latitude (DD.DDDDD)	8
Longitude (- DDD.DDDDD (Negative))	10
Altitude	14
Pitch	10
Roll	10
Heading	10
Omega	10
Phi	10
Kappa	10
Camera Lens Serial Number	10
Calibrated Focal Length in millimeters (mm)	7
Flight Altitude in meters at camera (MMMMM.MM; MSL)	8
[Optional]:Event Time Shift	10

Mapping Frame Datum
Mapping Frame Projection
Central Meridian
Latitude of the Grid Origin
Grid Scale Factor
False Easting
False Northing
Sequence of the rotation from mapping to image frame:
        First Rotation
        Second Rotation
        Third Rotation
    Kappa Cardinal Rotation
    Boresight Angle Values:
        t_x
        t_y
        t_z

Lever Arm Values:
l_x
l_y
l_z
Shift Values:
X
Y
Z
Principal Point Offsets
X_{pp}
Y_{pp}
Image Size
Pixel Size(microns)
Along track (pixels)
Across track (pixels)

6.6. Processing Types
  6.6.1. Geometric
    6.6.1.1. Accuracy
      6.6.1.1.1. Accuracy and Quality Control Report: The Contractor shall provide [RMSE/CE] accuracy reports and quality control reports generated during the AT or orthorectification processes for all image tiles.
      6.6.1.1.2. Horizontal and Vertical Accuracy: [Customer may elect to use conformance levels or accuracy thresholds in standards such as the National Standards for Spatial Data Accuracy, Accuracy Standards for Large-Scale Maps [American Society for Photogrammetry and Remote Sensing (ASPRS) Specifications and Standards Committee, 1990], or some other standard. Ideally accuracy should be tested against an independent source of equal or greater accuracy. If the product has been tested, the language 'Tested…' should be used. If such an evaluation has not been performed, the language 'Compiled to meet…' should be used. Statistics used to estimate accuracy include Circular Error (CE) and Root Mean Square Error (RMSE).]
        6.6.1.1.2.1. Geospatial horizontal and vertical accuracy of image [Pick #1 or #2 or #3 or #4]
          6.6.1.1.2.1.1. [Optional] National Standards for Spatial Data Accuracy –
            6.6.1.1.2.1.1.1. [CE95/RMSEx/RMSEy/RMSEz/RMSEr]: Meets NSSDA – 95% of image pixels are within X units of their actual position
              6.6.1.1.2.1.1.1.1. Compiled to meet ____ (meters, feet) horizontal accuracy at 95% confidence level
              6.6.1.1.2.1.1.1.2. Compiled to meet____ (meters, feet) vertical accuracy at 95% confidence level

6.6.1.1.2.1.1.1.3. Tested ___ (meters, feet) horizontal accuracy at 95% confidence level

6.6.1.1.2.1.1.1.4. Tested ___ (meters, feet) vertical accuracy at 95% confidence level]

6.6.1.1.2.1.1.2. [CE%%/RMSEx/RMSEy/RMSEz/RMSEr]: Meets Other Standard – nn% of image pixels are within X units of their actual position

6.6.1.1.2.1.1.2.1. Compiled to meet ____ (meters, feet) horizontal accuracy at nn% confidence level

6.6.1.1.2.1.1.2.2. Compiled to meet____ (meters, feet) vertical accuracy at nn% confidence level

6.6.1.1.2.1.1.2.3. Tested ___ (meters, feet) horizontal accuracy at nn% confidence level

6.6.1.1.2.1.1.2.4. Tested ___ (meters, feet) vertical accuracy at nn% confidence level]

6.6.1.1.2.1.2. [Optional] Other Standard

6.6.1.1.2.1.2.1. [CE%%/RMSEx/RMSEy/RMSEz/RMSEr]: Meets Other Standard – nn% of image pixels are within X units of their actual position

6.6.1.1.2.1.2.1.1. Compiled to meet ____ (meters, feet) horizontal accuracy at nn% confidence level

6.6.1.1.2.1.2.1.2. Compiled to meet____ (meters, feet) vertical accuracy at nn% confidence level

6.6.1.1.2.1.2.1.3. Tested ___ (meters, feet) horizontal accuracy at nn% confidence level

6.6.1.1.2.1.2.1.4. Tested ___ (meters, feet) vertical accuracy at nn% confidence level]

6.6.1.1.3. Band to band registration accuracy standard not to exceed X pixel(s).

6.6.1.1.4. Scene to scene edge-matching accuracy standard: not to exceed Y pixel(s).

6.6.1.2. [Optional] Orthorectification Processing

6.6.1.2.1. Digital Orthorectified Images shall be referenced in X projection, Units shall be meters.

6.6.1.2.2. Projection – X projection, Y units

6.6.1.2.3. The horizontal datum is the Y datum.

6.6.1.2.4. The vertical datum is the Z datum.

6.6.1.2.5. The geoid model to be used in converting GPS-derived ellipsoid heights to orthometric heights is W Geoid or the most current version. For GEOID information see: www.ngs.noaa.gov/GEOID

6.6.1.2.6. Contractor shall record all processing steps and software used including version number.

6.6.1.2.7. Contractor shall use either the rapid or precise IGS orbit ephemeris for GPS processing.

6.6.1.2.8. Image Tiles. All tiles shall be full resolution, orthorectified, and projected in the X Datum, using the corresponding native Y projection. The Contractor shall provide rectification services to produce digital orthophoto imagery at the resolution requested. The digital image shall cover the entire image area of one image tile as specified in the project instructions, with a X units buffer on all four sides of the tile and shall be projected in X Datum, using corresponding Y projection. The digital image shall be a orthorectified Z file format. The final tile shall not contain any borders, artifacts, or other non-image items.

6.6.1.3. [Optional] Mosaic Processing

6.6.1.3.1. The accuracy requirements of individual images will be preserved when compiling a mosaic.

6.6.1.3.2. Mosaic Products (MP): Mosaics shall be created using the imagery associated with the tiles created in the paragraph above. MPs will be projected in the predominant Projection zone (i.e. UTM zone or State plane zone) of the mosaic area The Contractor shall produce compressed MP files using the imagery associated with the quarter quadrangle tiles created under this contract.

6.6.1.3.3. The MP shall be compressed and saved in X format. When making the MP, the Contractor shall use the highest N-level (i.e., 9) or (Z)oom-level to maximize the number of pyramid layers. (refer to section 8)

6.6.2. Spatial: Spatial characteristics have two components. One is the Ground Sample Distance and the other is the interpretability. Interpretability can be defined qualitatively or quantitatively. A qualitative specification might describe what sorts of features need to be distinguishable in the imagery. Quantitative methods involve an estimation of the modulation transfer function of the system using either point spread functions or line spread functions.

6.6.2.1. Ground Sample Distance (GSD):

6.6.2.1.1. Utilizing the digital imagery, the contractor shall produce X.Y unit GSD, for both, natural color and color infrared digital images.

6.6.2.1.2. The natural color and color infrared source digital imagery and optional panchromatic data shall be of sufficient resolution to support production of digital orthorectified images to a ground pixel resolution of X,Y units.

6.6.2.1.3. [Optional] If the imagery is to undergo a relative edge response assessment, then bilinear and nearest neighbor re-sampling cannot be used.

6.6.2.1.4. [Optional] Up-sampling: re-sampling from a smaller GSD to a larger GSD is permissible as long as the larger GSD meets specifications.

6.6.2.1.5. Down-sampling: Down-sampling from a larger GSD to a smaller GSD is not allowed.

6.6.2.2. Modulation Transfer Function (MTF) – MTF >= ___. Estimated using [pulse/edge/point] targets. NOTE: MTF can be estimated via line spread functions (LSF) or point spread functions (PSF). LSF can be estimated by imaging either a pulse target or an edge target. PSF can be estimated by imaging domed mirror point targets. An MTF value should be in the range of 0.0 to 1.0.

6.6.2.3. Interpretability: Civil NIIRS rating of ___. NOTE: The Civil National Image Interpretability Rating Scale provides a capability to specify image interpretability requirements. An attached Appendix describes what sorts of interpretations a user should be able to make from a given level of imagery. These levels are further categorized as General, Agricultural, Cultural, or Natural.

6.6.3. Radiometric: The Contractor shall ensure all digital images have proper histograms, color balance, color saturation, and tone balance.

6.6.3.1. At a minimum, all data shall be collected at Z-bit resolution.

6.6.3.2. The histogram of digital images must represent all the pixels within the digital image without clipping highlight or shadow detail from the image.

6.6.3.3. Color balance is defined as balancing the color between the three primary colors and their complimentary secondary color. Red and cyan must be balanced. Green and magenta must be balanced. Blue and yellow must be balanced.

6.6.3.4. Color Saturation is achieved so that minimum colors do not look like a grayscale image and the maximum colors do not bleed into another area of the image.

6.6.3.5. Up-sampling: Up-sampling from a lower bit-depth to a higher bit depth is not allowed (e.g. re-sampling 8-bit data to 12-bit data).

6.6.3.6. [Optional] Down-sampling: Down-sampling from a higher bit-depth to a lower bit-depth is permissible as long as it meets specifications (e.g. re-sampling 12-bit data to 8-bit data).

6.6.3.7. [Optional] Radiometric corrections to these data should be limited to those required to remove tonal variations related to sensor characteristics, solar illumination, atmospheric effects or other systematic effects.

6.6.3.8. For mosaic products, the Contractor shall tone balance the individual images to give the mosaic a consistent and uniform image quality appearance that eliminates any checkerboard effect. The resulting mosaic must maintain the original color and appearance of the color corrected images that comprise the mosaic.

Or

6.6.3.9. For mosaic products, the Contractor shall not tone balance the individual images. The resulting mosaic must maintain the original color and appearance of the color corrected images that comprise the mosaic.

6.6.3.10. Digital orthorectified image characteristics - orthoimages shall be tonally balanced and consistent throughout the entire project. Abrupt variations in tonal balance will not be accepted. The Contractor will be

supplied three sample image patches which illustrate acceptable, marginal, and unacceptable orthoimage tonal balancing characteristics.

Or

6.6.3.11. Digital orthorectified image characteristics - orthoimages shall not be tonally balanced.

6.6.4. Pan Sharpening: The GSD ratio of multi-spectral to panchromatic should be at least X:Y and can be as high as X1:Y1.

6.6.4.1. Normalized Ratio: This algorithm can only be used with nearest neighbor re-sampling. It provides high quality spatial change detection and spatial frequency change detection.

6.6.4.2. Principal Components: This algorithm should be used with either bilinear or cubic convolution re-sampling. This method provides high quality spatial change detection and the best color reproduction. When tested, the IHS 'I' pan transform provides the best statistical results, but is visually less-sharp than the HVS 'V' pan transform images. This algorithm is not recommended for use with Nearest Neighbor re-sampling.

6.6.4.3. Wavelets (From ERDAS Imagine Documentation): Wavelet Theory Wavelet-based image reduction is similar to Fourier transform analysis. In the Fourier transform, long continuous (sine and cosine) waves are used as the basis. The wavelet transform uses short, discrete "wavelets" instead of a long wave. In image processing terms, the wavelet can be parameterized as a finite size moving window. There are a number of prerequisites and limitations to using this algorithm for pan-sharpening:

6.6.4.3.1. The two images be precisely co-registered

6.6.4.3.2. The two images are spectrally identical. For example, while a SPOT Panchromatic image can be used to sharpen TM bands 1-4, it would be questionable to use it for TM bands 5 and 7 and totally inappropriate for TM band 6 (thermal emission). If the datasets are not spectrally identical, the spectral fidelity of the multispectral dataset will be lost.

6.6.4.3.3. The two images must have no temporally-induced differences

6.6.4.3.4. The algorithm down samples the high spatial resolution input image by a factor of two with each iteration. This produces approximation (a) images with pixel sizes reduced by a factor of two with each iteration. The low (spatial) resolution image will substitute exactly for the "a" image only if the input images have relative pixel sizes differing by a multiple of 2. Any other pixel size ratio will require resampling of the low (spatial) resolution image prior to substitution. Certain ratios can result in a degradation of the substitution image that may not be fully overcome by the subsequent wavelet sharpening. This will result in a less than optimal enhancement

6.6.4.4. Gram Schmidt (From ENVI User Documentation): This algorithm manufactures a high resolution pan image from a coarser resolution multispectral image. Gram-Schmidt Spectral Sharpening pan-sharpens

spectral image data. First, a panchromatic band is simulated from the lower spatial resolution spectral bands. Second, a Gram-Schmidt transformation is performed on the simulated panchromatic band and the spectral bands, where the simulated panchromatic band is employed as the first band. Third, the high spatial resolution panchromatic band is swapped with the first Gram-Schmidt band. Finally, the inverse Gram-Schmidt transform is then applied to form the pan-sharpened spectral bands.

    6.6.5. Re-sampling:
        6.6.5.1. Nearest Neighbor:
            6.6.5.1.1. If the imagery is to undergo a relative edge response assessment, then this re-sampling algorithm cannot be used.
            6.6.5.1.2. This technique is not recommended for use with the Principal Components pan-sharpening algorithm.
            6.6.5.1.3. This technique is the only option currently available for the Normalized Ratio pan-sharpening algorithm.
        6.6.5.2. Bi-linear:
            6.6.5.2.1. If the imagery is to undergo a relative edge response assessment, then this re-sampling algorithm cannot be used
            6.6.5.2.2. This technique is suited for use with the Principal Components pan-sharpening algorithm.
        6.6.5.3. Cubic Convolution
            6.6.5.3.1. This technique is suited for use with the Principal Components pan-sharpening algorithm.
            6.6.5.3.2. This technique is suited for use for relative edge response calculations.
        6.6.5.4. Others
    6.6.6. Compression
        6.6.6.1. [Optional] Data shall not be compressed during ANY PHASE of the production process. The presence of compression artifacts will be cause for rejection.
        6.6.6.2. Software:
            6.6.6.2.1. MrSID
                6.6.6.2.1.1. [Optional] Employ 'Use Maximum Zoom Levels for Image' option.
            6.6.6.2.2. JPEG 2000
            6.6.6.2.3. Enhanced Wavelet Compression (ECW)
            6.6.6.2.4. NITF
        6.6.6.3. Compression Ratio:
            6.6.6.3.1. Lossy
                6.6.6.3.1.1. 1:50 RGB
                6.6.6.3.1.2. 1:20 Single band
            6.6.6.3.2. Lossless
                6.6.6.3.2.1. 1:15 All imagery (Not CIR)
                6.6.6.3.2.2. 1:3 CIR
  6.7. Processing Levels (Need Descriptions from Jon C.)
7. Metadata

7.1. The Contractor shall create a Federal Geographic Data Committee (FGDC) compliant, per the FGDC-STD-001-1998 specification, metadata file using the Government provided template for each image tile generated.

    7.1.1. [OPTIONAL] The metadata must parse cleanly through the latest USGS metadata parser "mp" version without any errors.

    7.1.2. [OPTIONAL] The metadata file shall have the same file name as the data files but with a ".met" extension to prevent the MrSID ® ".txt" from being overwritten.

7.2. [OPTIONAL] Auxiliary File. The Contractor shall provide an ESRI Projection compatible "aux" file for each data file. The file shall use the same naming convention as the data file but with an "aux" extension.

7.3. [OPTIONAL] MrSID Log File. The Contractor shall provide the "text" file created when generating the data files. The file shall use the same naming convention as the data files but with a "txt" extension.

7.4. If a template is not available, metadata at a minimum should contain the following content – italicized items to be filled in by Contractor. (Add FGDC references)

    7.4.1. Project Name:

    7.4.2. Project Code:

    7.4.3. Location:

    7.4.4. Ground Sample Distance:

    7.4.5. Output format:

    7.4.6. Output Media:

    7.4.7. Spectrum: 4 separate, distinct bands (red, blue, green, and near infrared)

    7.4.8. Output:

    7.4.9. Contractor:

    7.4.10. Project acquisition date(s) and, for each day, beginning and ending time of day in local standard time:

    7.4.11. Detector type(s) and manufacturer:

    7.4.12. Spacing between CCD detectors (in micrometers):

    7.4.13. Array size:

    7.4.14. Nominal ground swath or footprint of the detector:

    7.4.15. Spectral sensitivity of the detector (in nanometers):

    7.4.16. Filters used (if any):

    7.4.17. Scene to scene edge-matching accuracy (in pixels):

    7.4.18. Band-to-band registration accuracy (in pixels):

    7.4.19. Horizontal accuracy (in units):

    7.4.20. Image Processing (brief description of processing and data used in processing):

        . FGDC compliant metadata describing the image production process shall be provided for each image tile and at a minimum will include information on flight dates, processing steps, control point locations and positional accuracies. .

7.5. Metadata Table

Metadata	Static	Mission or project name, stated application, method acquired, aircraft type with registration number, crew members, sensor type and serial number, mount: active
(continued)		stabilization etc, For arrays: optics type

		Stated application
		Method acquired
		Aircraft type, with registration number
		Crew members
		Sensor type and serial number
		Mount: active stabilization, etc.
		For arrays: optics type, serial number, CFL, detector size & pitch, array size
		For scanning sensors: optics type, serial number, IFOV, FOR, number of pixels, scanning mechanism
		Filter types
		Calibration data (if applicable) including radiometric gains & biases applied, alignment values, coherent noise characterization, time tag for each datum and instrument temperature, all in engineering units
		Geometric, geodetic, and/or photogrammetric sources, including 1) Control used, 2) Aerotriangulation Reports, 3) GDOP Results, 4) Map series, map sheets, & map editions used
		Description of product level, and general processing methods and algorithms employed to yield that level
	Variable Flt Line Data	Altitude data (required for each image, or if continuous scan, at least each time the aircraft changes altitude)
		Sensor pointing information (ω, Φ, κ)
		Brief description of atmospheric conditions: type of clouds and % cover, haze, smoke,
		Aperture setting
		Shutter speed
		Area covered
		Date of exposure
		Direction of flight
		Geolocation of data – world file
		% forward overlap
		% side lap
		Beginning and ending lines or frame numbers
		Start and stop times (UTC)
		Remarks including: a) Flight line status (complete/incomplete), b) Blank frames, run-off, rejections, and reasons for rejections c) Any unusual situation that occurs during the flight line
		Flight line map index
	Ground Truth	

8. Data Product Format
  8.1. File Formats
    8.1.1. Imagery: The format of the digital imagery shall be as follows:
      8.1.1.1. uncompressed Tagged Image File Format (TIFF) images
      8.1.1.2. uncompressed Band Interleaved by Pixel (BIP) images
      8.1.1.3. uncompressed Band Interleaved by Line (BIL) images
      8.1.1.4. uncompressed Band Sequential (BSQ) images
      8.1.1.5. Compressed Formats (Examples)
        8.1.1.5.1. MrSID MG2   Limited to file sizes <= 2 GB.
        8.1.1.5.2. MrSID MG3 - The MG3 files generated by the MrSID®
                    software (i.e., .sid, .sdw, and .txt).
        8.1.1.5.3. Enhanced Wavelet Compression ECW
        8.1.1.5.4. compressed Joint Photographic Experts Group images (JPG)
        8.1.1.5.5. compressed Joint Photographic Experts Group 2000 images
          8.1.1.5.5.1. Lossless (JP2)
          8.1.1.5.5.2. Lossy (JPF)
      8.1.1.6. Compression Ratios:
        8.1.1.6.1. Lossy
          8.1.1.6.1.1. 1:50 for RGB or CIR imagery
          8.1.1.6.1.2. 1:20 for single band imagery
        8.1.1.6.2. Lossless
          8.1.1.6.2.1. 1:15 for all image types (not CIR)
          8.1.1.6.2.2. 1:3 for CIR
          8.1.1.6.2.3.
      8.1.1.7. National Imagery Transfer Format Standard 2.1 (NITF 2.1) images
      8.1.1.8. [Optional] Tagged Image Files (TIFF). All tagged image files shall be
                submitted in accordance with the GeoTIFF standard and "Baseline
                TIFF 6.0" file format as defined in the GeoTIFF and TIFF 6.0
                Specifications. All baseline TIFF 6.0 files shall store data as
                uncompressed RGB full-color images as defined in the specification
                using the "little-endian" byte order and shall only contain one image
                file directory (IFD).
        8.1.1.8.1.1. [Optional] All TIFF files submitted shall be readable by
                     older applications that assume TIFF 5.0 or an earlier version
                     of the specification. TIFFs that use designated "Extended
                     TIFF 6.0 file" features shall not be acceptable. Features
                     designated as "not recommended for general data
                     interchange" are considered extensions to the Baseline TIFF
                     6.0 specification, and will not be acceptable. This includes
                     TIFFs that use one of the major new extensions such as "tiled
                     images".
        8.1.1.8.1.2. [Optional] In the TIFF 6.0 specification, the term "tag"
                     refers only to the identifying number, the term "field" refers
                     to the entire field, including the value. Tags that are defined
                     by the TIFF specification are called public tags and shall not
                     be modified outside of the parameters given in the latest
                     TIFF specification. Tags numbered 32768 or higher,

sometimes called private tags, are reserved and shall not be acceptable. Enumeration constants numbered 32768 or higher are reserved and shall not be acceptable. Do not choose your own tag numbers, use only those specified in the Baseline TIFF 6.0 Specification for RGB full-color. Tags numbered in the "reusable" 65000-65535 range shall not be acceptable.

8.1.1.8.1.3. [Optional] Upon completion of the project, a final copy of the data shall be delivered on archival quality media in uncompressed, un-tiled, Arc/Info readable, GeoTIFF computer file format with no overviews. GeoTIFF files shall include the following GeoTIFF tags and keys:

8.1.1.8.1.4. ModelTiepointTag

8.1.1.8.1.5. ModelPixelScaleTag

8.1.1.8.1.6. GTModelTypeGeoKey

8.1.1.8.1.7. GTRasterTypeGeoKey

8.1.1.8.1.8. ProjectedCSTypeGeoKey

8.1.1.8.1.9. PCSCitationGeoKey

8.1.1.8.1.10.   ProjLinearUnitsGeoKey]

8.1.1.9. [Optional] BIP format may be used for multiband imagery

8.1.1.10.   [Optional] BIL format may be used for panchromatic imagery

8.1.1.11.   [Optional] BSQ format may be used for either multi-band or panchromatic imagery

8.1.2. Indexes

8.1.2.1. Text-based index. Provide ASCII list of tiles and the media on which they are submitted. Place the text-based file on the first media in the series, after the metadata.

8.1.2.2. [Optional] Graphic index. Provide a shapefile or thumbnail image file identifying the tiles in the project, attributed by tile identifier. Place on the first media in the series, after the text index but before the data.

8.1.2.3. [Optional] Graphic index. A softcopy/hardcopy index format by drive shall be delivered, showing the area of coverage. The softcopy index shall be in ArcView shapefile readable format.

8.1.3. Metadata

8.1.3.1. Create an ASCII text-based metadata file and place it on the first media before any other information.

or

8.1.3.2. FGDC Metadata for orthoimage tiles shall be delivered on media in xml format.

Packaging and Marking

This section of the contract provides packaging, packing, preservation, and marking requirements.

1. **Media Specifications**

    Portable hard drives shall be used for deliverables unless otherwise stated in this contract. Other media such as Secure FTP, DVD-ROM, CD-ROM, or DLT may be negotiated depending on feasibility of data transfer and the amount of data under consideration. The Contractor shall maintain a copy of the data until the Government acknowledges receipt and acceptance.

    Portable Hard Drives: All external hard drives shall be "Combo" style drives, at a minimum capable of both USB2.0 and IEEE1394 (Firewire) connections. The drives shall become property of the Government and shall not be returned to the Contractor. The drive shall be shielded during transit by enclosure in an anti-static bag or container and packaged to ensure protection from impact.

    1.1. [Optional] Digital Versatile Disk. Digital Versatile Disks (DVDs) requirements are the same as CDs (see paragraph below) but with the following change: at least 4.7 Gigabyte (120-minutes) instead of the 700 Megabyte size.

    - or –

    1.2. [Optional] Digital Versatile Disks. All digital versatile disks (DVDs) shall be delivered on archival media, at least 4.7 Gigabytes (GB) (120-minute) per disk DVD+/-R, hybrid ISO 9660 Mode 1 format using level 2 interchange with Rockridge and Joliet extensions. The format of the DVD will allow long file names up to 64 characters in length, and will be readable by both Windows and UNIX systems where the file names will appear the same on both systems. The Contractor must insure that each and every copy session has been properly closed. No multi-session enabled DVDs shall be acceptable. The DVD media shall have a label attached identifying the digital contents of the DVD in accordance with Section J, Exhibit 3, Figures 1 and 2 (thermal printed DVDs are acceptable). In addition to the packaging requirements in D-2, all DVD media shall be packaged in standard single DVD jewel cases (5-5/8" x 4-15/16" x 3/8") with a clear front cover. The DVD label should be readable without opening the case or removing the DVD from the case. "Slim" or other non-standard sized jewel cases shall not be accepted.

    1.3. [Optional] Compact Disks. All compact disks (CDs) shall be delivered on archival media, 700 Megabytes (80-minute) per disk CD-R, hybrid ISO 9660 Mode 1 format using level 2 interchange with Rockridge and Joliet extensions. The format of the CD will allow long file names up to 64 characters in length, and will be readable by both Windows and UNIX systems where the file names will appear the same on both systems. The Contractor must insure that each and every copy session has been properly closed. No multi-session enabled CDs

shall be acceptable. The CD media shall have a label attached identifying the digital contents of the CD in accordance with Section J, Exhibit 2, Figures 1 and 2 (thermal printed CDs are acceptable). In addition to the packaging requirements in D-2, all CD media shall be packaged in standard single CD jewel cases (5-5/8" x 4-15/16" x 3/8") with a clear front cover. The CD label should be readable without opening the case or removing the CD from the case. "Slim" or other non-standard sized jewel cases will not be accepted.

1.4. [Optional] Tape Cartridges. All tapes shall be delivered on Super DLT 1 cartridges using the Quantum SDLT 320 Tape Drive set at native capacity (160 gigabytes). Other tape systems or formats, including hardware compression, will not be accepted. Tape media shall be written using GNU tar utility version 1.13 set at fixed block of 512 bytes and a blocking factor of 128, thus creating a physical record size of 65,536 bytes. No other fixed block size or blocking factor shall be accepted. The tape media and case shall be labeled in accordance with Section J, Exhibit 2, Figure 3. All tapes shall be packaged in their appropriate case.

   1.4.1.   Table of Contents. The Contractor shall include an ASCII text file which is a listing of all image tiles included on the tape in the order they appear in the archive file. The content file must be the first file on the tape and named content_<item#>_<state>_<tape#>.txt (i.e., "content_3-04-1_mo_1.txt"). The file should contain, at a minimum, the following attributes:

Description	Number of Characters in Field
File Name	30

   Example: c_3509320_ne_15_1_20040721.tif

2. **Shipments**
   2.1. **Data Shipment Notice**   The Contractor shall notify the CO of each data shipment s contents and date of shipment by transmitting to the CO a paper or digital copy of the Flight Log (marked copy at the top) and a copy of the data transmittal letter via email or facsimile. This shall be done the same day the data is shipped to the data processing contractor.
   2.2. A packing slip is required with each delivery. Packing slip shall include the date shipped and every item in the shipment. The contract number shall be on the packing slip.
   2.3. If more than one container is included in a single shipment, the containers shall be clearly marked on the outside as follows: "1 of 3," "2 of 3," "3 of 3." The packing slip for all containers in the shipment shall be placed in container "1."
   2.4. Receipts from common carriers for shipment of materials shall be retained by the Contractor and be made available to the CO upon request.
   2.5. [Optional] No more than one project item area may be placed on a specific media item.
   2.6. [Optional] Archive File. No other archive members will be allowed on any media. Archive files shall not contain symbolic links, use compression of any

type, be created using GNU extensions, or as the super user (e.g., root). Archive member names must not contain a directory structure.

2.7. Upon completion of the project, a final copy of the data shall be delivered on archival quality media.

Section E
Inspection and Acceptance

This section of the contract includes inspection, acceptance, quality assurance, and reliability requirements.

1. Quality Assurance   Government Responsibilities
    1.1. **Inspection And Acceptance:** The Contracting Officer or the Contracting Officer's duly authorized representative will inspect and accept/or reject the supplies and/or services to be provided under this contract.
        1.1.1. Inspection Procedure
            1.1.1.1. Inspection of the deliverables will be performed utilizing a comprehensive method of quality assurance inspection procedures. All materials will be inspected, either 100% or a random sample, to determine conformance to all contract requirements and specifications. (Refer to FAR 52.246-2, Inspection of Supplies-Fixed Price and FAR 52.246-4, Inspection of Services-Fixed Price.) (Consider inclusion/deletion of FAR references)
            1.1.1.2. 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:
                1.1.1.2.1.   Require the Contractor to take necessary action to ensure that future performance conforms to contract requirements and
                1.1.1.2.2.   Reduce the contract price to reflect the reduced value of services performed.
            1.1.1.3.**Quality Performance Requirements**: This table provides examples of the deliverable properties that may be evaluated, the basis of the evaluation, the threshold value for acceptable quality, and the means by which the property is evaluated. Users should **only** use this table as a template. **The actual properties, standards, threshold values, and inspection means should be determined on a per-task basis by the Contracting Officer**.

Table E-1 QA Sample Specifications

Task	Quality Performance Standard	Acceptable Quality Level	Means of Measurement
Label final product	BLM standard	100% compliance	Visual inspection
Maintain required coverage	2000 feet wide, river endpoints	+/- 150 feet to either side of river.	Visual inspection

		completely covered	No gaps in coverage.	
Geospatial horizontal accuracy	NSSDA, 10-meter DEM	95% of pixels ≤ 10 meters of actual geographic position	Comparison with at least 4 - 20 ground control points
Band-to-band registration accuracy	ASPRS standards currently in development stage	≤ 1 pixel	Visual Inspection
Scene-to-scene edge-matching accuracy	ASPRS standards currently in development stage	≤ 3 pixels and no data gaps	Visual inspection
Sun angle	Time of year plus latitude	≥ 50° (Normally)	Time at beginning/end of flight lines compared with government furnished sun angle chart
Frame to frame overlap	BLM standard: Endlap 60%, Sidelap 30rty%	+/- 10%	Measurement of raw image files
Environmental conditions	BLM standard	No ground obscurance	Visual review
Index	BLM standard	Both Digital and text indexes 10% complete	Visual review
Metadata	BLM standard	100% complete	Visual review

1.1.2. Inspection Schedule

1.1.2.1. The Government will inspect the imagery and related data materials within X calendar days after they are received at the point designated. Should the inspection procedure be delayed longer than X 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.

1.1.2.2. The Contractor will be notified in writing via email whether the materials are satisfactory and what materials, if any, shall be remade because of non-conformance with contract requirements.

1.1.3. **[Optional] Preliminary Inspection:** The Government will perform a comprehensive inspection of all contract materials submitted to determine compliance to contract requirements. A preliminary inspection of the digital imagery and related data materials submitted will be prioritized to expedite delivery to users. Based on this preliminary inspection, a contract status report will be generated recording all acceptable imagery as well as rejected imagery and the deficiencies discovered. Final acceptance will be

determined from the combined inspection results covering all contract materials submitted.

1.1.4. **[Optional] Partial Coverage**: If the Contractor obtains only partial coverage for any project item area during the season, all partial imagery shall be processed and delivered according to the requirements specified for completed imagery. The requirement for processing partial coverage may be waived only by the Contracting Officer.

1.1.5. Acceptance

1.1.5.1. Final acceptance will be made after inspection by the Government of all required materials delivered at the specified destination. Delivery dates for individual products by project item areas are specified. 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.

1.1.5.2. Partial acceptance on any fully completed project due to rejection of deficient or non-compliant material will be made based on both preliminary inspection results of the digital imagery and the final inspection results of all remaining materials. A partial acceptance will result in a contract price reduction based on the final determination of contract material compliance to contract requirements and specifications.

1.1.5.3. [Optional] Partial acceptance on any uncompleted area will be made only after the photographic season has ended and all materials required for the partial 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 referring the Contractor to the Contracting Officer.

1.1.6. 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.

1.1.6.1. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES:

1.1.6.1.1.   52.246-02 Inspection of Supplies - Fixed Price (AUG 1996)

1.1.6.1.2.   52.246-04 Inspection of Services - Fixed Price (AUG 1996)

1.1.6.1.3.   52.246-16 Responsibility for Supplies (APR 1984)

1.1.7.   52.246-4   Inspection Of Services-Fixed-Price   (AUG 1996)

1.1.7.1. The Government has the right to inspect and test all services called for by the contract, to the extent practicable at all times and places during the term of the contract. The Government shall perform inspections and tests in a manner that will not unduly delay the work.

1.1.7.2. If the Government performs inspections or tests on the premises of the Contractor or a subcontractor, the Contractor shall furnish, and shall require subcontractors to furnish, at no increase in contract price, all

reasonable facilities and assistance for the safe and convenient performance of these duties.

1.1.7.3. If any of the services do not conform to contract requirements, the Government may require the Contractor to perform the services again in conformity with contract requirements, at no increase in contract amount.

1.1.7.4. When the defects in services cannot be corrected by re-performance, the Government may-

    1.1.7.4.1.   Require the Contractor to take necessary action to ensure that future performance conforms to contract requirements;

    1.1.7.4.2.   Reduce the contract price to reflect the reduced value of the services performed.

1.1.7.5. If the Contractor fails to promptly perform the services again or to take the necessary action to ensure future performance in conformity with contract requirements, the Government may-

    1.1.7.5.1.   By contract or otherwise, perform the services and charge to the Contractor any cost incurred by the Government that is directly related to the performance of such service; or

    1.1.7.5.2.   Terminate the contract for default.

1.1.8.   Government Inspection Schedule

    [Please include a schedule and/or contractor-derived schedule]

1.2. **Certification** – This table is intended to show how spatial, spectral, radiometric, and geopositional parameters in a calibration report should be documented based on the type of product being evaluated. For example, the calibration report for a precision product should document both laboratory and in situ calculation of spatial and radiometric parameters. It should provide documentation of laboratory analysis for spectral parameters.

Table E-2 Calibration Matrix 1

Item		Standard	Enhanced	Precision
Calibration Report	Spatial calibration	By Analysis	Laboratory	Laboratory/In Flight
	Spectral calibration	Manufacturer Specifications	Laboratory	Laboratory
	Radiometric calibration	Manufacturer Specifications	Laboratory	Laboratory/In Flight
	Geolocation	TBD	TBD	TBD

Deliveries or Performance

This section of the contract specifies the time, place, and method of delivery or performance. Solicitations specifying shipment Free-on-Board (F.o.b.) origin must state that offers will be evaluated on the basis of the proposed price plus proposed transportation costs from point of origin to the designated destination.

1. **Deliverables**
    1.1. Digital Image Collection and Survey Plan as specified in Section C.
    1.2. [Optional] Raw imagery on separate media from other deliverables as specified in Section C.
    1.3. [Optional] Processed Digital Imagery Products as specified in Section C.
    1.4. [Optional] Aerotriangulation data used in the orthorectification process shall be submitted as a deliverable.
    1.5. [Optional] Elevation data used in the orthorectification process shall be submitted as a deliverable in a non-proprietary format.
    1.6. Airborne Positioning And Orientation
        1.6.1. Raw GPS and IMU data files
        1.6.2. Processed trajectory files
        1.6.3. [Optional] If IMU geo-referencing is employed, submit the exterior orientation file with the EO parameters
    1.7. Supplemental Ground Control data
    1.8. Project Data Files
        1.8.1.   Production Process File as specified in Section C.
        1.8.2.   Project Data Files as specified in Section C.
        1.8.3.   [Optional] Image Frame-Center Data File as specified in Section C.
         NOTE This file is not applicable to line scanning (push-broom) sensors.
    1.9. Indexes
        1.9.1. Text-based index. Provide ASCII list of tiles and the DVD on which they are submitted. Place the text-based file on the first DVD in the series, after the metadata.
        1.9.2. Graphic index. Provide a shapefile or thumbnail image file identifying the tiles in the project, attributed by tile identifier. Place on the first DVD in the series, after the text index but before the data.
            1.9.2.1. Attributes in the shapefile should, at a minimum, include:

Attribute Data	Column name	Example
Image Tile name	ITName	Fort Douglas NE
Image date(YYYYMMDD)	IDAT	20040822, 20040830
Color Type	BCON	NC
Image tile identifier	ITID	n4210337.nw
Southeast IT corner	QKEY	422615N1032615W

            1.9.2.2. Accepted naming convention for the shapefile can be found in Section D paragraph 1.4.5
    1.10. GPS ground control point list

    1.11. **Reports**

1.11.1. Airborne GPS adjustment statistical report.

1.11.2. Accuracy and Quality Control Reports

1.11.3. **Flight Reports**   Submit the completed, original Flight Logs with the data, and a copy directly to the CO.

1.11.4. **Imagery Supplemental Report**: A report of all imagery flown shall be produced for and included with each flight line. The report shall show the flight line numbers and flight track.

1.11.5. **Aerotriangulation data:** A statistical report summarizing the results of the aerotriangulation adjustment shall also be included with the aerotriangulation data.

1.11.6. **Calibration Reports**   The calibration reports shall contain, at a minimum, the following information:

1.11.6.1.   The date the calibration was performed.

1.11.6.2.   The name of the person, company, or organization responsible for performing the calibration.

1.11.6.3.   The methods used to perform the calibration.

1.11.6.4.   The final calibration parameters or corrections, including any boresight calibration values, determined through the calibration procedures.

1.11.7. **Sensor Maintenance**   Provide maintenance history of the sensor to be used for acquiring images to the CO before completing project.

1.11.8. **Unusual Circumstances**   The Contractor shall also notify the CO of any unusual circumstances that occur during the performance of this project which might affect the deliverables or their quality and especially of any deviation from this project. This may be included in the status reports emailed weekly as required below, unless urgent.

1.11.9. **Status Reports**   The Contractor shall submit project status reports via email to the Contractor Officer s (CO) every week, until the work is complete. These reports shall include a summary of completed data acquisition, with dates completed; data shipped, and dates; and any unusual circumstances, equipment malfunctions, and/or any disturbance of the sensor. **A weekly status report is required even if no progress has been made**, starting from when the task order is received and ending when the Agency accepts all deliverables for that task order.

1.11.10.   **Final Report** -- The Contractor shall supply to the Government a Final Report incorporating all of the information in this Deliverables section including, at least, the sections suggested below: This report shall be delivered with the final data shipment.

1.11.10.1. Work performed under this contract, discuss each deliverable including: the maximum range from the base station, standard deviation and residuals in GPS trajectories, and an explanation of product labeling;

1.11.10.2. Equipment used to perform this work, including hardware models and serial numbers, calibration reports, and software names and versions (include aircraft and digital imaging system info);

1.11.10.3. Flight line map(s), and project coverage area;

1.11.10.4. Discussion of data quality including quality assurance (QA)/quality control (QC) procedures;

1.11.10.5. Ground Control Report, including a station list in table format;
1.11.10.6. Airborne navigation and kinematic GPS Report;
1.11.10.7. Weather, solar altitude, and time of year;
1.11.10.8. [Optional] Tide Coordination Report and Table;
1.11.10.9. Any unusual circumstances or problems, including equipment malfunctions (including those already reported);
1.11.10.10. Any deviations from this Digital Imaging SOW, including those already reported;
1.11.10.11. Any recommendations for changes in the Digital Imaging SOW for future work.

2. Product Formats

2.1. MOSAIC PRODUCTS

Item	Requirement
Format	[MrSID (MG2/MG3);JPEG (JPG/JP2/JPF); ECW]
Media	Disk (see Section D-1.2(a) **or (b)**)
Naming Convention	See Section J, Exhibit 1 (i.e. naip_1-1_1n_s _mo137_2004_1.sid)
Quantity	Three (3)
Date of First Submittal	No later than thirty (30) calendar days after acquisition period. **Early and/or incremental delivery is highly encouraged.**
Submittal Frequency	Once
Government Approval Required	Yes (see Section E)
Required Metadata	Yes (see Section C-6.3(a))

2.2. IMAGE TILES

Item	Requirement
Format	[GeoTIFF,BIL,BIP,BSQ,JPG,JP2,JPF,NITF2.1]
Media	Tape (see Section D-1.2(**c**))
Naming Convention	See Section J, Exhibit 1 (i.e. "c_3509320_ne_15_1_20040721.tif")
Quantity	One (1)
Date of First Submittal	No later than 90 calendar days after acquisition period

2.3. RMSE ACCURACY AND QUALITY CONTROL REPORTS (1 METER ONLY)

Item	Requirement
Format	ASCII preferred
Media	Disk (see Section D-1. 2(a))
Naming Convention	None
Quantity	One (1)

Date of First Submittal	Delivered with Production Process (see Section F-1.6(a))
Submittal Frequency	Once
Government Approval Required	No
Required Metadata	None

2.4. <u>PROGRESS REPORTS</u>

Item	Requirement
Format	See Exhibit 3
Media	Electronic mail
Quantity	One per day per crew
Date of First Submittal	Daily (as required in accordance with Section C- 7.1)
Submittal Frequency	Daily (only required for days that aerial acquisition was accomplished)
Government Approval Required	No
Required Metadata	None

2.5. PROJECT DATA FILES
PRODUCTION PROCESS DESCRIPTION

Item	Requirement
Format	ASCII text file
Media	Disk (see Section D-1.2(a))
Naming Convention	See Section J, Exhibit 1
Quantity	One (1) for each Image Tile and one (1) for each Mosaic per project item area
Date of First Submittal	No later than 90 calendar days after acquisition period
Submittal Frequency	Once
Government Approval Required	No
Required Metadata	None

2.5.1.1. PROJECT DATA FILE DESCRIPTION

Item	Requirement
Format	ASCII comma delimited text file
Media	Disk (see Section D-1.2(a))
Naming Convention	See Section J, Exhibit 1
Quantity	One (1) per project item area
Date of First Submittal	Delivered with Production Process (see

	Section F-1.6(a))
Submittal Frequency	Once
Government Approval Required	No
Required Metadata	None

2.5.1.2. IMAGE-CENTER DATA FILE DESCRIPTION (If Applicable)

Item	Requirement
Format	ASCII comma delimited text file
Media	Disk (see Section D-1. 2(a))
Naming Convention	See Section J, Exhibit 1
Quantity	One (1) per project item area
Date of First Submittal	Delivered with film (see F-1.4) for film-based acquisition or Production Process (see Section F-1.6(a)).
Submittal Frequency	Once
Government Approval Required	No
Required Metadata	None

3. Warranty: A product warranty shall be provided on all deliverables.

Section G
Contract Administration Data

This section of the contract will include any required accounting and appropriation data, and any required contract administration information, such as whether individual task orders will be issued against the contract, or instructions other than those on the solicitation form. It will also include a statement that the contractor must provide the payment address in the offer, if it is different from that shown for the contractor.

Special Contract Requirements

This section of the contract contains any special contract requirements that are not in other sections, including clauses that are specially written for the procurement. This section will alert potential contractors to specially written clauses that must be given close attention.

Section I
Contract Clauses

This section of the contract contains most of the standard clauses for the proposed contract. The CO must include the clauses required by law and any additional clauses expected to be included in any resulting contract, if these clauses are not required in any other section of the General Contract Guideline.

List of Attachments

This section of the contract contains a list of all attachments and exhibits to the contract are included here. The CO must list the title, date, and number of pages for each attached document, exhibit, and other attachment. Cross-references to material in other sections may be inserted, as appropriate.

8.1.4. Appropriate Label Formats

EXHIBIT 1
Figure 1
Project Data Files
Disk Labeling Requirements
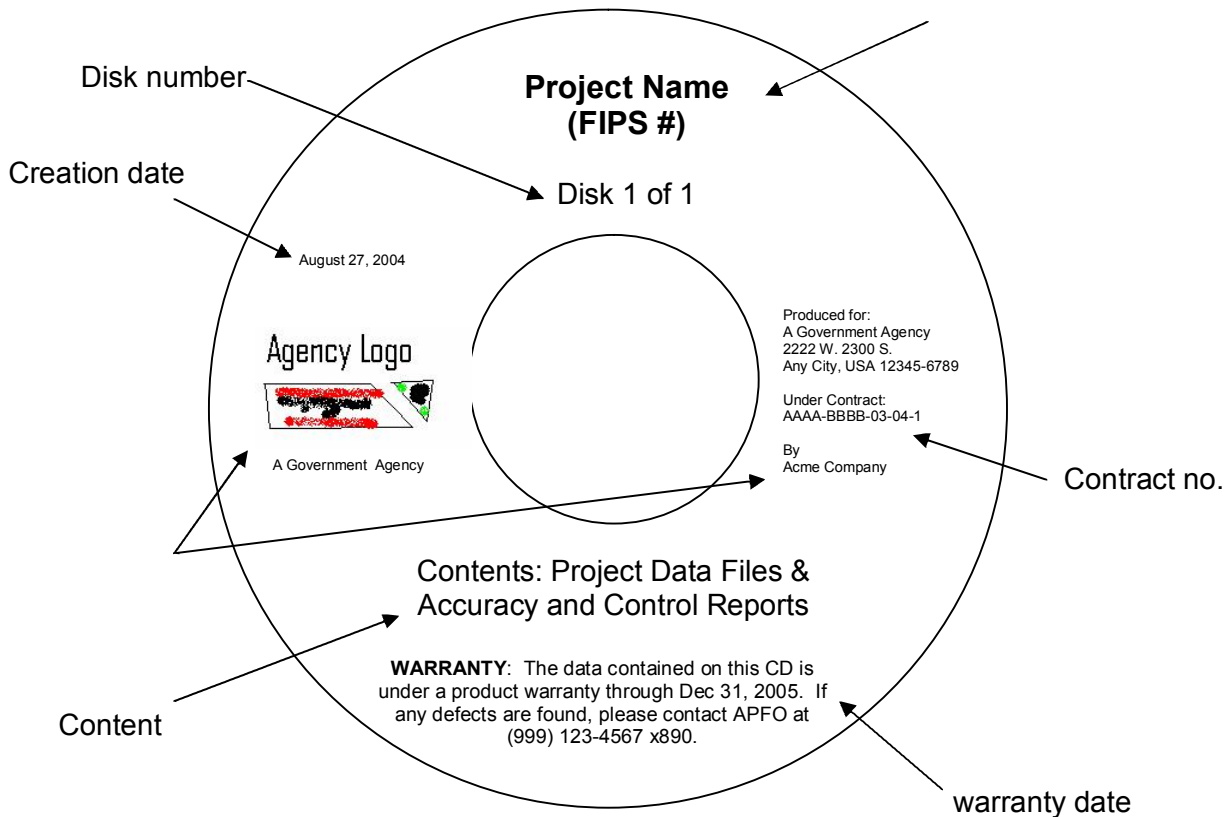
ELEMENT	EXAMPLE
Disk Number	Disk 1 of 1

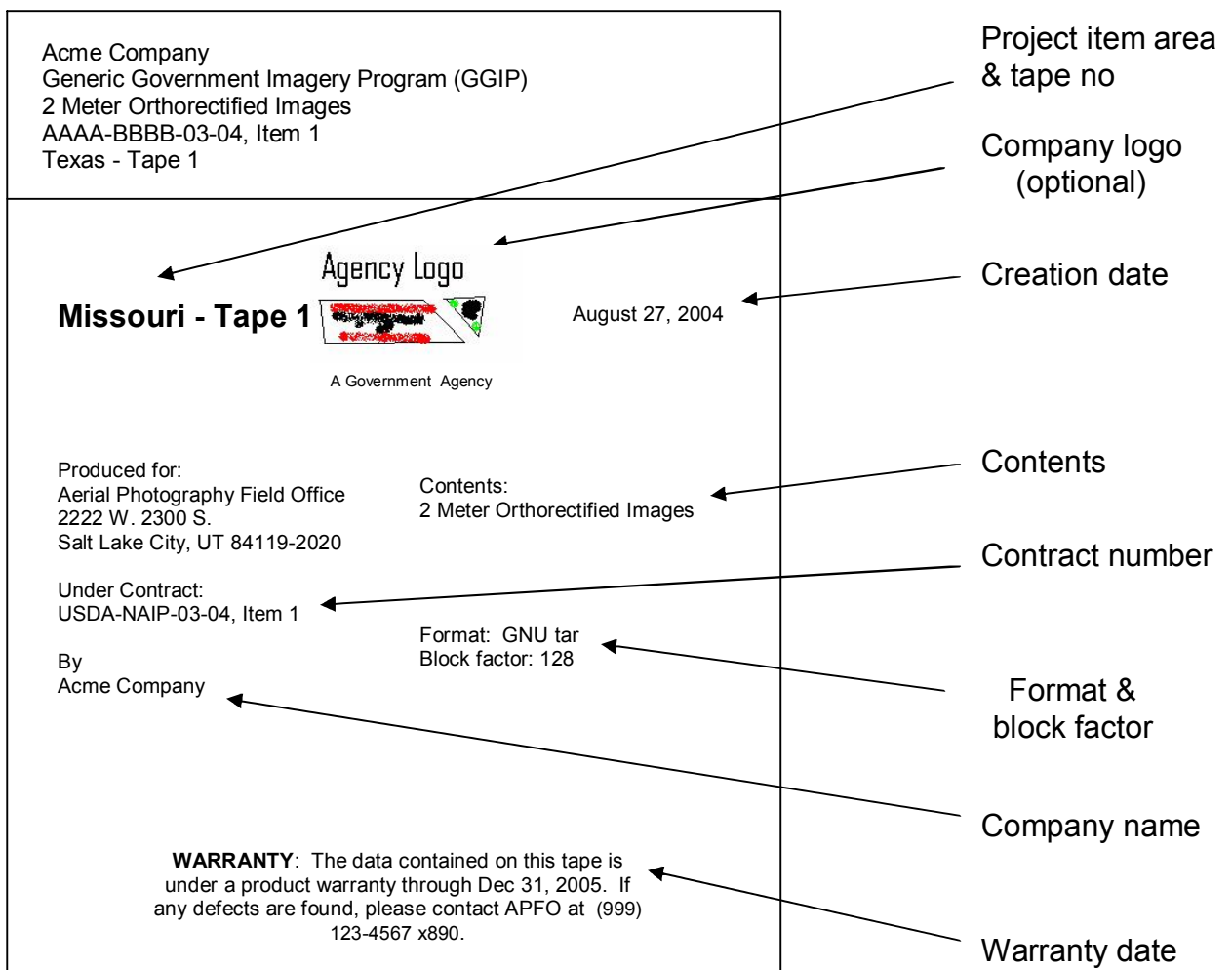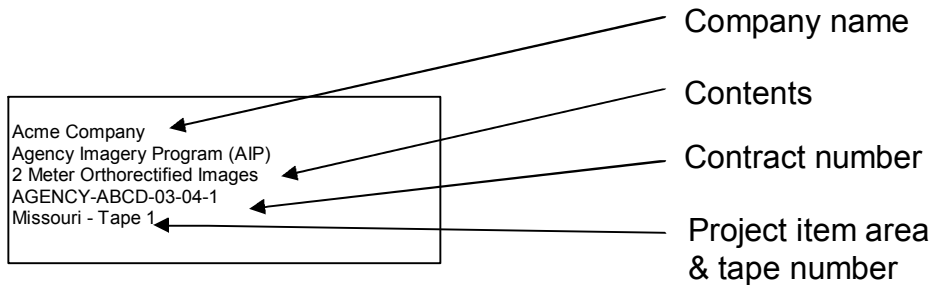|	
Company name & logo	Acme Company
Content	Project Data Files & Accuracy and Control Reports
Contract number	AGENCY-ABCD-3-04-1
Creation date	August 27, 2004
Project item area & FIPS code	Missouri (FIPS 29000)
Warranty date	Dec 31, 2005

EXHIBIT 1
Figure 2
IMAGE TILE
DLT Tape Cartridge Case Labeling Requirements

Acme Company
Generic Government Imagery Program (GGIP)
2 Meter Orthorectified Images
AAAA-BBBB-03-04, Item 1
Texas - Tape 1

Project item area & tape no

Company logo (optional)

Agency Logo

Missouri - Tape 1

August 27, 2004

Creation date

A Government Agency

Produced for:
Aerial Photography Field Office
2222 W. 2300 S.
Salt Lake City, UT 84119-2020

Contents:
2 Meter Orthorectified Images

Contents

Under Contract:
USDA-NAIP-03-04, Item 1

Contract number

Format: GNU tar
Block factor: 128

By
Acme Company

Format & block factor

Company name

WARRANTY: The data contained on this tape is under a product warranty through Dec 31, 2005. If any defects are found, please contact APFO at (999) 123-4567 x890.

Warranty date

Figure 3 (con t)
IMAGE TILE
DLT Tape Cartridge Labeling Requirements

```
Acme Company                          ──────────────▶  Company name
Agency Imagery Program (AIP)
2 Meter Orthorectified Images  ─────▶              Contents
AGENCY-ABCD-03-04-1  ─────────▶
Missouri - Tape 1  ◀─────                          Contract number

                                                    Project item area
                                                    & tape number
```

Label dimensions: 2-1/4" (width) x 13/16" (height)
NOTE: Cartridge label must fit securely in tape slot to prevent falling out.

ELEMENT	EXAMPLE
Company name & logo	Acme Company
Contents	2 Meter Orthorectified Images
Contract number	AGENCY-ABCD-3-04-1
Creation date	August 27, 2004
Format & block factor	Format: tar Block factor: 128
Project item area & tape number	Missouri – Tape 1
Warranty date	Dec 31, 2005

Representations and Certifications, and Other Statements of Contractors

This section of the contract contains solicitation provisions that require representations, certifications, or the submission of other information by contractors.

Instructions, Conditions, and Notice to Contractors

This section of the contract contains solicitation provisions and other information and instructions not required elsewhere to guide contractors or respondents in preparing offers or responses to requests for information. Prospective contractors or respondents may be instructed to submit offers or information in a specific format or severable parts to facilitate evaluation. The instructions may specify further organization of offer or response parts, such as:

      (1) administrative;
      (2) management;
      (3) technical;
      (4) past performance; and
      (5) cost or pricing data or information other than cost or pricing data.

Proposed digital sensor systems will be evaluated to determine if they meet the contract specifications, based on current technical descriptions and samples.

Section M
Evaluation Factors for Award

This section of the contract contains all evaluation factors, including price or cost, and any significant sub-factors that will be considered in making award. The CO will include the relative importance of the evaluation factors and sub-factors, and their relation to price or cost. Numerical weights or scoring systems, which may be used to rank offers, need not be disclosed in solicitations. Any minimum requirements should be described which may apply to particular evaluation factors or sub-factors. Any Government costs or charges other than proposed prices to be considered in the evaluation of offers should be identified.