VERSION 14
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GENERAL SPECIFICATIONS
FOR AERONAUTICAL SURVEYS
VOLUME II
AIRPORT AERIAL PHOTOGRAPHY
NATIONAL GEODETIC SURVEY

NATIONAL OCEAN SERVICE
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION

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GENERAL SPECIFICATIONS
FOR AERONAUTICAL SURVEYS
VOLUME II
AIRPORT AERIAL PHOTOGRAPHY
NATIONAL GEODETIC SURVEY
NOS, NOAA

1. GENERAL

These General Specifications (Volume II) specify requirements for aerial photography needed to support the Aeronautical Survey Program (ASP). The ASP is administered by the National Geodetic Survey (NGS), National Ocean Service (NOS) in accordance with a Federal Aviation Administration (FAA)/National Ocean Service Interagency Agreement.

The following conventions have been adopted for this document. The term "shall" means that compliance is required. The term "should" implies that compliance is not required, but is strongly recommended. All times shall be recorded in Coordinated Universal Time (UTC).

The Contractor shall comply with all applicable laws, ordinances, regulations and procedures (federal, state, county, city, or otherwise) and shall be responsible for obtaining all necessary permits for work performed under this contract.

2. DELIVERABLES

2.1 CONTRACTOR:

A. LABOR, EQUIPMENT AND SUPPLIES - The Contractor shall provide all labor, equipment (including aircraft and metric camera), supplies and material (including film) to produce and deliver exposed film and related products as required under this Volume II.

B. FLIGHT LINE PLANNING AND MAPS - The Project Instructions may require the Contractor to plan flight lines and/or produce maps showing flight lines.

C. FILM - The Contractor shall capture and deliver both an Exposure Test(s) and Regular Production (see Section 3). Note, a separate exposure test is required for each combination of camera, emulsion, and filter planned to be used. Exposure tests will not be accepted as regular production coverage. For both exposure tests and production, the Contractor shall deliver the original, near-vertical, metric quality, undeveloped aerial photography exposed over airports. For the Exposure Test(s), the Contractor shall determine a flight line approximately over the center of a convenient airport and collect at least five photographs. This test should be flown over an airport that has varying terrain and vegetation (preferably trees). For Regular Production, the Contractor shall fly pre-determined flight lines, normally supplied by the Government (see list of

airports with separate Project Instructions). For further film requirements, see Sections 3.1 (Exposure Test), 3.2 (Regular Production), 4.2 (Film), and 12 (Film Shipment and Processing).

D. FLIGHT REPORTS - Submit the original Photographic Flight Reports (NOAA Form 76-15) completed in black ink (except the **word "ORIGINAL" at the top printed in BLUE ink),** with the film, and a copy of the Report directly to NGS**.** For samples see Attachments 1 & 2, and for delivery instructions see Section 12.

E. ELECTRONIC EXPOSURE DATA (EED) FILES - The Contractor shall submit the original, raw navigation data file (which will be used by the Contractor to create the EED file) with the film. The "raw navigation file" is the standard output of the Contractor's flight navigation system. The Contractor shall prepare an EED file, in NGS format, for each roll of film. This EED file shall contain information for all exposures on that roll. The Contractor shall submit this final EED file (on a 3.5" floppy disk) directly to NGS, to arrive at NGS within three working days of shipment of the corresponding roll of film. **The Contractor shall submit the format of the raw navigation file to NGS** and shall explain any and all changes to the raw navigation data in the Final Report. See EED format in Attachment 3, and delivery instructions in Section 12.

F. TRANSMITTAL LETTERS - Send film transmittal letters with each film shipment (see sample in Attachment 6, and further information in Sections 2.1K, 3.1, 3.2, & 12), and a transmittal letter with the Final Report.

G. CAMERA CALIBRATION - Supply the current USGS Camera calibration certificate for each camera planned for use, directly to NGS prior to any photography.

H. CAMERA MAINTENANCE - Provide a preventive maintenance certification for each camera to be used to acquire aerial photography directly to NGS (see Section 4.1).

I. CAMERA WINDOW - Report the physical characteristics of any camera window to NGS prior to use (see Section 4.3).

J. FILM SHIPMENT - See Sections 3 and 12 for instructions.

K. FILM SHIPMENT REPORTING - The Contractor shall notify NGS of each film shipment's contents and date of shipment by transmitting to NGS a paper or digital copy of the Photographic Flight Report (marked "copy" at the top) and a copy of the film transmittal letter via email or facsimile. This shall be done the same day the film is shipped to the film processing contractor. See Section 12.

L. UNUSUAL CIRCUMSTANCES - The Contractor shall also notify NGS of any unusual circumstances that occur during the performance of this Volume II, which might affect the deliverables or their quality and especially of any deviation from this Volume II. This may be included in the weekly email required below, unless urgent.

M. STATUS REPORTS - After award, the Contractor shall submit project status reports via email to the Points of Contact (POCs) in Section 16 every week, until the work is complete**. These reports are due at NGS by 2:00 P.M. EST each Monday afternoon**. These reports shall include a list of airports where photography is completed, with dates completed; film shipped, and dates; and any unusual circumstances, deviations from this Volume II, equipment malfunctions, and/or any disturbance of the camera. **A Weekly Status Report is required even if no progress has been made.**

N. FINAL REPORT - The Contractor shall supply to NGS a Final Report including, at least, these sections:

1. Work performed under this Volume II, discuss each deliverable including: the mean overlap, the mean tilt, the mean crab, and an explanation of the photograph labeling;
2. Equipment used to perform this work, including hardware models and serial numbers, and software names and versions;
3. Flight planning, if performed;
4. Discussion of exposure settings used, filters used;
5. Discussion of the Contractor's Quality Control Plan, and film quality;
6. Aircraft navigation;
7. Weather, solar altitude, and time of year;
8. Any unusual circumstances or problems, including equipment malfunctions, (including those already reported);
9. Any deviations from this Volume II (including those already reported); and
10. Any recommendations for changes in the Volume II for future work.

Requests to exceed or deviate from this Volume II or the Project Instructions will be considered when written justification is provided to NGS in advance. No deviation is permitted until written approval is received from NGS.

This Volume II does not require ground-survey field work, cartographic data compilation, aero-triangulation, or establishing/photo-identifying ground control.

All original aerial negatives, from the instant of exposure, and other deliverables obtained through this Volume II, are and shall remain the property of the United States Government. This includes exposures outside the project area. These items include the 5 7/8 inch Contractor-furnished film containers, 5 3/16 inch film spools, and 3 ½ inch floppy disks. However, film integrity is the responsibility of the contractor until it is received at its destination.

2.2 GOVERNMENT:
The government will provide to the Contractor:

A. PROJECT INSTRUCTIONS - Project Instructions (a separate document) provide specific project information containing any unique project requirements and have the following attachments:

i. a listing of airports to be photographed.
ii. flight maps, showing the labeled flight lines
iii. digital waypoint files, indicating the two end-points of the required flight lines for each airport (Attachment 4 details the required waypoint file format).
iv. Blank film processing instruction labels, "Do Not Expose To" labels, and address labels, see Section 12 and Attachment 5.

B. GENERAL SPECIFICATIONS - Volume II, Airport Aerial Photography (this document)

C. CAMERA DESIGNATORS - The government will assign unique camera designators (see Section 4.1).

D. REJECTED FILM - If photography is rejected by NGS, NGS will have sample scans and/or prints made showing the problem areas and will have these items sent to the Contractor as soon as possible.

3. DELIVERY SCHEDULE

3.1 EXPOSURE TEST - An exposure test(s) is required prior to beginning the project. A separate exposure test is required for each combination of camera, emulsion, and filter planned to be used. This test should be flown over an airport that has varying terrain and vegetation (preferably trees). The test is a test and will not be used as anything other. After test flight(s) over the approximate center of a convenient airport, the Contractor shall cut the film and ship the exposed sections with their corresponding original Photographic Flight Report, original raw navigation file, and transmittal letter directly to the NOAA film-processing contract laboratory. The 3.5 inch floppy disk containing the original raw navigation file shall be taped to the outside of the film canister lid for shipment. The Contractor shall notify NGS when the film is shipped, see Section 12.2. The Contractor shall prepare and submit the final EED file (on a 3.5" floppy disk) directly to NGS within three working days of film shipment. The film will be processed by the NOAA film processing contract laboratory and then forwarded to NGS for review. NGS will review all of this data as soon as possible and notify the Contractor of the results of the processing and the review. The Contractor shall not proceed with production until they have received approval from NGS. If NGS rejects the exposure test, a repeat exposure test is required.

3.2 REGULAR PRODUCTION - Exposed film, with its corresponding, original Photographic Flight Report, original raw navigation file, and transmittal letter shall be shipped directly to the NOAA film-processing contract laboratory within 30 days of exposure. If necessary to meet this time constraint, the Contractor may cut the film and ship the exposed section. Normally FULL exposed rolls should be shipped to the NOAA film processing contract laboratory. However, rolls approximately 2/3 full will be acceptable, if necessary, to allow for faster turn-around for review. The 3.5 inch floppy disk containing the original raw navigation file shall be taped to the outside of the film canister lid for shipment. The Contractor shall notify NGS when the film is shipped, see Section 12.2. The Contractor shall prepare and submit the final EED file (on a 3.5" floppy disk)

directly to NGS within three working days of film shipment. The film will be processed by the NOAA film processing contract laboratory and then forwarded to NGS for review. NGS will review all of this data as soon as possible and notify the Contractor of the results of the processing and the review. See Section 12, FILM SHIPMENT AND PROCESSING, for shipping address and additional requirements.

3.3 ORIGINAL DATA - Reports and other original records generated during this project are legal records, which will be retained for data accountability and stored in the National Archives. It is very important that these logs be original, legible, neat, clear, and fully completed in indelible black ink. Original data shall be saved, unmodified, whether in hand-written or computer-recorded form. In the original records (paper or digital), nothing is to be erased or obliterated. All available spaces on the recording forms should be completed. If a mistake is made on a form, draw a single line through the mistake and write the correction above or to the side. The person making the change shall initial all corrections. If space is too limited to permit a field correction, restart with a new sheet, however, do not recopy the form in the office in order to make a "clean" copy. An explanatory note should be made for all corrections to the original recorded figures. It is essential that all recorded information be neat and legible. All editing of computer recorded data shall be done on a copy of the original. Always submit the original version of the data, not a hand-made copy, a photo-copy, nor a digital copy.

3.4 COMPLETION DATE - All deliverables shall be received by the film processing contract laboratory and/or NGS, as specified, no later than the date in the Project Instructions .

4. EQUIPMENT AND MATERIAL

4.1 CAMERA

The aerial camera used for this Volume II shall meet the following specifications:

- Single lens metric camera with quality equivalent to or better than a Wild RC 20/30 or Zeiss RMK-A 15/23, with Forward Motion Compensation.

- 9 inch x 9 inch format

- Between-the-lens, variable speed shutter

- Six inch (153 ±3 mm) focal length lens having a usable angular field not less than 90 degrees.

- Minimum resolution of 15 lines/mm with an Area Weighted Average Resolution (AWAR) not less than 55 lines/mm.

- Decentering (formerly called tangential) distortion must not exceed 0.008 mm and radial distortion must not exceed 0.010 mm.

- Model Flatness; total difference, +/- 0.019mm

- The indicated principal points - fiducial centers - must fall within a 0.030mm radius circle around the principal point of autocollimation.

- The calibrated principal point - point of symmetry - must fall within a 0.015mm radius circle around the principal point of autocollimation for 153mm focal length lenses and 0.030 for all others.

- Equipped with a vacuum or pressure device for holding film flat against a platen at the instant of exposure. Platen departure from a true plane must not exceed +/- 0.0005 in. (0.013 mm) when the camera/magazine vacuum is applied.

- Record on each exposure at least 8 fiducial marks. Marks must be located in each corner of the format and at the center of each side. The fiducial marks must be clearly visible and sharp on every negative.

- TIMES AND DATES - Record on each exposure a clock displaying correct Coordinated Universal Time (UTC), and the correct date, if data recording is available. Note, the time is also recorded in the EED file and on the Photographic Flight Report. **ALL THREE SHALL AGREE WITH EACH OTHER AND SHALL BE ACCURATE WITHIN TWO MINUTES OF UTC TIME (SAME AS GMT).** See: http://www.time.gov. A daily time check for all clocks is recommended. Also ensure that all dates recorded are correct (double check that the clocks are not set 12 hours off so that the date cycles incorrectly at noon).

- Record on each exposure the lens identification number and focal length, see also Section 11.

- Record a level bubble on each exposure, if possible.

- Record a film title on each exposure, if camera capable (see Section 11). Note, any label(s) on the photographs must conform to the specifications in Section 11.

The camera shall be installed in a mounting which attenuates the effects of aircraft vibration.

The camera's Forward Motion Compensation feature shall be used for all photography under this Volume II.

In addition to the specific camera requirements, a valid certificate of calibration (no older than three years) from the Optical Science Laboratory of the U.S. Geological Survey (USGS) shall be submitted to NGS for each camera to be used during this contract. The fee for the tests and the arrangements to have the tests performed are the responsibility of the Contractor. The calibration certificate(s) shall be submitted to and **approved by NGS prior to camera use under this contract**. Upon approval of a calibration certificate, NGS will assign a unique camera designator for the camera and notify the Contractor. The Contractor shall ensure that the correct camera designator appears on each exposure (see Section 11 and Attachment 3).

Also, the Contractor shall supply certification to NGS that preventive maintenance has been satisfactorily completed within the last two years for each camera to be used for this Volume II.

All camera system malfunctions shall be recorded, and NGS notified. A malfunction is defined as a failure anywhere in the camera system that causes an interruption to the normal operation of the camera. Also, record and report any malfunctions in the EED collection system.

After any disturbance of the camera that might affect its calibration, or when there is any reason to believe the dimensional relationship of the lens, fiducial marks, and film plane have been disturbed by partial disassembly or unusual mechanical shock, the Contractor shall notify NGS, the camera shall be recalibrated before further use, at the Contractor's expense, and the Contractor shall submit the new certificate of calibration to NGS.

- (*A PROVISION FOR THE THE USE OF DIGITAL SENSORS SUCH AS THE LICA GEOSYSTEMS ADS 40, Z/I DCM, EMERGE DSS AND SPACE BORNE SENSORS)*

4.2. FILM

The Contractor should submit only full (or nearly full) rolls of film, unless meeting the 30 day deadline discussed in Section 3. However, rolls approximately 2/3 full will be acceptable, if necessary, to allow for faster turn-around for review.

The film used for the Volume II shall be AGFA Pan 80, or equivalent, and shall be purchased by the Contractor. Note, AGFA 200 PE will also be considered. A proposal for the use of "equivalent" film shall be submitted to NGS prior to use. NGS will notify the Contractor if the "equivalent" film is approved, and also the appropriate gamma for that film. A roll of film shall not be exposed after its expiration date.

Only optical filters provided by the lens manufacturer or meeting the same optical specifications shall be used. An antivignetting filter shall be used during all photography under this Volume II.

AGFA Pan 80 has an extended red layer in the emulsion allowing the use of a 420 Nanometer (Color) filter. The contractor shall use a 420 nanometer filter with either AGFA film. This filter will facilitate photography of yellow, red, and orange leaves in autumn. All filters used under this Volume II should have been mounted and calibrated as part of the camera system during the most recent camera calibration.

Film shall be stored, handled, and shipped in accordance with manufacturers recommendations, especially regarding the storage temperature and humidity. Film shall be treated with extreme care both before and after photography, especially with regard to temperature and humidity. Keep film in its original container until as close to flight time as possible to reduce moisture transfer once the container is opened. Photographic film containers shall not be exposed to direct sunlight or other sources of heat. At the end of each flying day, film (including loaded film magazines and cassettes) shall be removed from the aircraft if the inside temperature of the aircraft is expected to exceed 85 degrees Fahrenheit. Likewise remove the film if the temperature may go below freezing.

The beginning of each roll of film should have a 7 foot leader of blank film, and a 3 foot trailer at the end. Note, unexposed film that exceeds 10 feet in length should be cut from a roll of film before shipping for processing. A roll of aerial film shall consist only of exposures made with the same camera system (lens, cone, and magazine). **Standard film spools having a flange diameter of approximately 5 3/16 inches (13.3 cm) shall be used**, and only that length of film which can be wound on a spool without strain, leaving at least 1/8 inch (3 mm) of flange exposed, shall be placed on each spool. Standard film canisters approximately 5 7/8" in diameter shall be used.

Accompanying each roll of film shall be a filled-in film processing instruction label defining the characteristics of the film (wrap inside/outside, leader lengths, etc.), a “DO NOT EXPOSE TO” label, and an address label. Instructions for using these labels and the shipping address are included in Section 12.1, and samples in Attachment 5.

4.3 AIRCRAFT

The type of aircraft and the aircraft tail number shall be stated on the Photographic Flight Report (Attachment 2, Item #12 and #13) all aircraft used in the performance of this Volume II 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 Volume II which results in missed photographic weather will 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, camera, film, and other required equipment), of not less than the highest altitude required to acquire the exposures.

The design of the camera opening in the aircraft shall be such that the field of view is unobstructed when a camera 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 gases and oil.

NGS recommends that a camera port window not be used. If a camera port window is used, it shall be: (1) optical quality; (2) mounted in material eliminating mechanical stress to the window; (3) free of blemishes, dirt, significant scratches, etc.; (4) and shall not degrade the resolution or the accuracy of the camera (see Section 4.1). The physical characteristics of the window (such as size, thickness, smoothness, flatness, parallelism, glass quality, and optical transmissivity) shall be reported to NGS prior to use. Any window should meet the ASPRS Aerial Photography Standards, 1995, which states, "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 1975, C-1 optical quality or better."

5. FLYING HEIGHT

The flying height above the airport elevation should be calculated from the scale provided in the waypoint files. Normally the flying height is between 14,700 feet and 15,500 feet above the airport elevation. Departures from the specified flying height shall not exceed 2 percent low or 5 percent high for all flying heights up to 12,000 feet above mean ground elevation. Above 12,000 feet, departures from specified flying height shall not exceed 2 percent low or 600 feet high. Note, the altitudes entered into the Photographic Flight Report (see Attachment 2) and the EED file (see Attachment 3) are the altitudes above mean sea level (MSL), both in feet.

Note, altimeter corrections for barometric pressure, temperature, etc. may be required in order to meet the above tolerances. NGS will verify the flying height by multiplying the focal length of the camera (in feet) by the denominator of the calculated scale of the aerial film. The photographic scale is calculated by dividing the distance between two identifiable points as measured on one of the photographs (as near as possible at the mean ground elevation) by the actual ground distance as measured from the best available map or from known ground coordinates.

FLIGHT CLEARANCES - The Contractor shall comply with all required Federal Aviation Administration Regulations, including obtaining all required clearances.

6. WEATHER, SOLAR ALTITUDE, AND TIME OF YEAR

6.1 CLOUDS - No clouds or cloud shadows may appear on the photographs. High, thin overcast 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. Under no circumstances shall Black & White Panchromatic (B/W Pan) films be exposed under a solid overcast sky.

6.2 TREE LEAVES - Note, all photography under this Volume II is to show full tree leaf coverage to facilitate photogrammetric tree height determination.

6.3 WELL DEFINED IMAGES - Photography shall be undertaken only when well-defined images can be obtained. In addition to no clouds, photography shall not be attempted where the ground is obscured by haze, smoke, smog, dust, or falling: snow, sleet, rain, etc. Also, photography shall not be conducted when the airport ground area is covered by water (flood), snow, or ice.

6.4 VISIBILITY - The minimum visibility at the time of exposure is 10 miles. 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 will be clearly defined at the edge of the view through the drift sight.

6.5 SUN ANGLE - Sun angle shall never be less than 30 degrees above the horizon at the time of exposure. Ideally, the sun angle should be between 40 and 60 degrees above the horizon because of the intermediate-size shadows produced. In mountainous areas with steep terrain and/or areas with tall trees, the minimum sun angle shall be increased. The Project Instructions may contain additional information about sun angle requirements for each project. See also Section 13 and "Manual of Photogrammetry", Fourth Edition, Section 5.8.3.

Sun angle for a given day can be determined from a "Solar Altitude Diagram" or from appropriate computer software. See the U.S. Naval Observatory's WWW site: http://aa.usno.navy.mil/data/docs/AltAz.html which computes sun altitudes and sun azimuths for U.S. locations and world-wide positions.

7. NAVIGATION

The aircraft shall be navigated using pseudo-range GPS, or another system with equivalent accuracy or better. The cross-track flight-line deviation from the lines specified in the waypoint files shall not exceed 5% of the flying height (750 feet for normal flying height of 15,000 feet). Changes in the course of the aircraft between successive overlapping photographs within a flight line shall not exceed three (3) degrees.

Exposure stations shall be positioned to approximately the absolute accuracy of +/- 20 meters, or better. An electronic pulse shall be used to accurately mark the mid-point of the exposure. These exposure station positions and other information shall be recorded in the EED file (see Attachment 3).

The NGS supplied waypoint files will automatically center one photograph over (or near) the center of the airport.

Note that flight lines may be flown in either direction, but adjacent lines should be flown in opposite directions.

All flight lines shall be continuous. No flight lines may be broken or patched. Note, a line reflown shall have the original flight line number.

The datum for the horizontal positions is the North American Datum of 1983 (NAD 83). The vertical datum is the North American Vertical Datum of 1988 (NAVD 88).

8. TILT

Care shall be taken to keep tilt (departure from the vertical) of the camera to a minimum. Tilt shall not exceed +/- three (3) degrees for any photographic frame. The average tilt for the entire project shall not exceed +/- one (1) degree.

9. CRAB

While exposing aerial photography, the camera shall be compensated for crab of the aircraft, with a resultant error not exceeding +/- five (5) degrees, as measured from the average line of flight, and the differential between any two successive exposure shall not exceed +/- five (5) degrees.

10. OVERLAP AND SIDELAP

Forward overlap shall be 60 percent, plus 5% to minus 2% percent between consecutive exposures.

Sidelap is defined by the flight line, waypoint files (normally about 50%).

11. PHOTOGRAPH LABELING

When the camera is equipped for titling, each usable frame shall be titled within, or adjacent to, the image area between 1/16 and 1/4 inch from the format border using machine lettering approximately 1/5 inch high. Each title shall consist of the agency initials (NOAA), date of photography, UTC time of exposure, Contractor camera designator (see Section 4.1 and Attachment 3), film type (P for panchromatic or CN for color negative), lens serial number, and exposure number. Also, including the latitude, longitude, height, aperture, shutter speed, etc. in the labeling is desirable (and in the same format as in the EED file, if possible). Note, any label(s) on the photographs shall conform to the above specifications.

Example: NOAA 06-23-99 GMT-18:14:27 XXP UAG332 No 2501

The title may be along any edge of the frame but the preferred location is along the leading edge. See also Section 4.1.

For each lens system used, usable exposures shall be numbered in an unbroken sequence starting at 0001 for the first exposure and continuing through the last exposure by that lens system, in a

given year. The numbering sequence shall not be broken even though more than one airport is photographed, or more than one roll of film is used.

Splicing should not be performed.

Blanks and test exposures should not be included in the exposure numbering sequence and shall not be labeled. Rejected exposures shall keep their numbering.

12. FILM SHIPMENT AND PROCESSING

12.1 SHIPMENT - The Contractor shall ship: (1) completed (normally full) film rolls, (2) the original Photographic Flight Reports (one Report per roll) completed in black ink (but marked "ORIGINAL" in BLUE ink at the top) and filled-in front and back, (3) original raw navigation files, and (4) the transmittal letters via next-day air freight directly to the NOAA film processing contract laboratory. For an explanation of "completed film rolls" see Section 3.2, REGULAR PRODUCTION.

The Contractor shall ship final, **checked** EED files, in NGS format (on a 3.5" floppy disk) , directly to NGS, to arrive at NGS within three working days from the date the film was shipped. Copies of the Photographic Flight Report and the raw navigation files may be made and used by the Contractor to produce and check the final deliverables.

The Contractor shall ship (1), (2), (3), and (4) to:

HAS Inc.
136 North Clair Street
Suite 300
Dayton, OH 45402
937-222-3856
hasimage@ix.netcom.com

The following labels shall be typed or neatly lettered by the Contractor with the required data and securely affixed to each film container:

(1) Commercial or HAS, Inc. shipping label
(2) Film processing instruction label (see Attachment 5)
(3) "DO NOT EXPOSE TO" label (see Attachment 5)

All rolls of aerial film shall be shipped in sturdy, cylindrical containers (approximately 5 7/8" in diameter) in such a manner that shall ensure acceptance by common carrier and safe delivery at destination. Containers and closures shall comply with the Interstate Commerce Commission Regulations, Uniform Freight Classification Rules, or regulations of other carriers as applicable to the mode of transportation.

The Contractor should not ship film on a Friday. The photographic processing Contractor does not

receive film on Saturdays or Sundays, so the film could be subject to excessive environmental conditions during temporary storage.

12.2 NGS NOTIFICATION - The same day as shipping, the Contractor shall notify NGS of each film shipment's contents and date of shipment by transmitting to NGS a paper or digital copy of the Photographic Flight Report (marked "COPY" at the top) and a copy of the film transmittal letter via email or facsimile.

12.3 REJECTED FILM - If photography is rejected by NGS, NGS will have sample scans or prints made showing the problem areas and will have these scans or prints sent to the Contractor as soon as possible.

13. IMAGE QUALITY

Image quality on the original negative film shall meet the highest professional standards. Dark areas shall not bleed together and individual objects shall be readily discernable. Detail shall be sufficiently sharp to allow photogrammetric measurement of tree heights, compilation of runway/taxiway edges and other fine map features, and accomplishment of other intended uses for the film. Photographic products shall also be free of abrasions, blemishes, scratches, tears, and irregularities. Fiducial marks shall be clearly visible and sharp on every negative. The camera panel of instruments and titling recorded on the film shall be clearly legible on all processed negatives.

14. EXPOSURE

Extreme care shall be exercised to insure proper exposure. Use an ASA of 40 with the AGFA Pan 80 film.

The film exposure settings normally will be controlled from the camera's Photographic Exposure Meter (PEM) and should produce a gamma at processing time of, 0.90 +/- 0.05. Base fog density shall not exceed 0.10 with a minimum density above base fog of 0.30 and maximum density above base fog of 1.35. For those areas where abnormal exposure objects exist, such as snow, water, etc., the PEM shall be manually overridden to produce an equivalent exposure without the abnormality. A shutter speed shall be chosen that meets the requirements of minimal image movement, at an adequate lens aperture for the prevailing lighting conditions.

15. REVIEW

Photography and other deliverables not meeting these specifications may be rejected.

16. POINTS OF CONTACT:

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