

SAMPLE

SECTION C

DESCRIPTION/SPEC./WORK STATEMENT

PHOTOGRAMMETRIC MAPPING AND AERIAL PHOTOGRAPHY SERVICES

C.1. GENERAL. The contractor, operating as an independent contractor and not as an agent of the government, shall provide all labor, material, and equipment necessary to perform professional photogrammetric mapping, related surveying work and photo interpretation (landuse/landtype) from time to time during the period of service as stated in Section E. The services requested will be in connection with performance of photogrammetric mapping, related surveys, and the preparation of maps as may be required for advance planning, design, and construction for various U.S. Army Corps of Engineers projects. The contractor shall furnish the required personnel, equipment, surveying and photogrammetric reduction/compilation instruments, aircraft, and land transportation as necessary to accomplish the required services and furnish to the government maps, digital terrain data, reports, and other data together with supporting material developed during the field data acquisition process. During the prosecution of the work, the contractor shall provide adequate professional supervision and quality control to assure the accuracy, quality, completeness, and progress of the work.

C.2. LOCATION OF WORK.

C.2.1. Photogrammetric mapping and related surveying services will be performed for U.S. Army Corps of Engineers (District Symbol).

C.2.2. Photogrammetric mapping and related surveying services will be performed in connection with projects located within the boundaries of (District Symbol).

C.3. TECHNICAL CRITERIA AND STANDARDS. The following standards are referenced in this contract. In cases of conflict between these technical specifications and any referenced technical standard, these specifications shall have precedence.

C.3.1. United States Army Corps of Engineers (USACE) Engineering Manual (EM) 1110-1-1000, 31 March 1993, Photogrammetric Mapping.

C.3.2. Tri-Services Spatial Data Standards (TSSDS), Version 1.80.

C.3.3. USACE EM 1110-1-1807, 30 July 1990, Standards Manual for USACE Computer-Aided Design and Drafting (CADD) Systems.

C.3.4. Manual of Photogrammetry, American Society for Photogrammetry and Remote Sensing (ASPRS), March 1990 Edition.

C.3.5. ASPRS Accuracy Standards for Large-Scale Maps, ASPRS, March 1990.

C.3.6. USACE EM 1110-1-1002, 14 September 1990, Survey Markers and Monumentation.

C.3.7. USACE EM 1110-1-1003, December 1994, NAVSTAR Global Positioning System.

C.3.8. USACE EM 1110-1-1005, 31 August 1994, Topographic Surveys.

C.3.9. United States Army Corps of Engineers, St. Louis District Computer Aided Drafting and Design (CADD) Standards Manual.

C.4. WORK TO BE PERFORMED. Professional photogrammetric mapping and related surveying services to be performed under this contract are defined below. All mapping work will be performed using precise photogrammetric data acquisition, mensuration, and compilation procedures, including all quality control associated with these functions. The work will be accomplished in strict accordance with the photogrammetric mapping criteria contained in the technical references (paragraph C.3 above), except as modified or amplified herein or task orders scope of work.

C.4.1. PURPOSE OF WORK. The work to be performed under this contract is to be used as basic site plan mapping. The work may be performed for use in installation master planning, design, construction, operation, maintenance, real estate, regulatory enforcement, and hazardous and toxic waste sites. The projects may include related activities and/or engineering studies covering such pertinent details as reservoir capacities, channel capacities, damage assessment, benefits, project location, design of main structure and appurtenances, relocations, land acquisition, land development and management, encroachment, and construction measurement and payment.

C.4.2. GENERAL MAPPING REQUIREMENTS. Project locations, scales, and accuracy requirements will be stated in each task order. Planimetric feature detail will be compiled based on horizontal mapping standards as stated in task orders. Contours shall be developed at increments in accordance with the vertical accuracy standards as stated in each task order. Sites requiring new aerial photography shall be flown at a photo-negative scale equal to or larger than that specified in EM 1110-1-1000 to meet the required planimetric and topographic accuracy criteria unless otherwise stated in the task orders. Feature and terrain data shall be delivered in digital format and/or hardcopy as described in task orders.

C.4.3. COMPLETION OF WORK. All work must be completed and delivered not later than dates specified in the scope of work for each task order.

C.5. AIRCRAFT FLIGHT OPERATIONS AND EQUIPMENT REQUIREMENTS.

C.5.1. AIRCRAFT AND FLIGHT CREW. The aircraft furnished or utilized under this contract shall be equipped with navigation and photographic instruments and accessories necessary to satisfactorily produce the required photography. Aircraft may be required to have airborne global positioning system (ABGPS) software and hardware capability for real time aircraft positioning and navigation. The ABGPS must also have the capability to capture and store spatial positioning information for determining exterior orientation of the camera and geographic location of the photo center at the instant of exposure. The Contractor's ABGPS hardware and software must incorporate the ability to spot process the airborne data in order to provide a computer derived GPS photo control point at each exposure center to supplement ground surveys in accomplishing aerotriangulation procedures. The aircraft shall be maintained in operational condition during the period of this contract, and shall conform to all governing Federal Aviation Administration and Civil Aeronautics Board regulations over such aircraft. The flight crew and cameraman shall have had a minimum of 400 hours experience in flying precise photogrammetric mapping missions.

C.5.2. CAMERA WINDOWS AND CAMERA MOUNTING. When high-altitude photography is required, camera windows may be needed. Camera windows shall be mounted in vibration-damping material to avoid mechanical stress to the window. Prior to photography, any camera window used shall be checked by the calibration center to ensure that it will not adversely affect lens resolution and distortion and that it is substantially free of veils, striations, and other inhomogeneities. The camera itself shall be installed in a mounting that dampens the effects of aircraft vibration. Aircraft exhaust gases shall be vented away from camera opening.

C.5.3. FLIGHT PLAN. The minimum area(s) to be photographed are as indicated on maps or photographs that will be provided for each photographic task order. Given the specified photo-negative scale criteria herein, the contractor shall design the flight lines for the photography to obtain proper overlap, sidelap, and endlap to assure full stereoscopic photographic coverage, in accordance with the criteria defined in task orders scopes of work. Generally, the flight lines shall be parallel to each other and to the longest boundary lines of the area to be photographed. For single strip photography, the actual flight line shall not vary from the line plotted on the flight map by more than the scale of the photography expressed in feet. For example, the allowable tolerance for photography flown at a scale of 1 in. equals 1000 ft is about 1000 ft. The flight lines shall be submitted to the government for advance approval.

C.5.4. FLYING CONDITIONS. Photography shall be undertaken only when well-defined images can be obtained. Unless otherwise specified, flying shall be limited to the period of 3 hours after local sunrise to 3 hours before local sunset. Photography shall not contain shadows caused by topographic relief or sun angle of less than thirty (30) degrees, whenever such shadows can be avoided during the time of year the photography must be taken. Photography shall not be attempted when the ground is obscured by haze, smoke, or dust, snow or when the clouds or cloud shadows will appear on more than five (5) percent of the area of any one photograph unless specified in the task order.

C.5.5. DATE OF PHOTOGRAPHY. Photography will be flown during the periods represented in task orders placed against this basic contract.

C.5.6. AIRCRAFT UTILIZATION. Total aircraft utilization to, from, between, and over project sites is based on the rates shown in Appendix A. In estimating available aircraft operational time, average weather and cloud cover conditions are assumed for the given site and time of year, consistent with aircraft utilization rates historically developed. Additional crew costs will accrue during deployment at or near the project site, where applicable. Aircraft and flight crew standby at the home base shall be considered as an overhead expense and shall have been properly factored into the unit rate of the aircraft.

C.5.7. FLIGHT LOG. For each flight day, the pilot or cameraman shall prepare a flight log containing the date, project name, aircraft used, and names of crew members. In addition, the following shall be prepared for each flight line: altitude, camera, magazine serial number, f-stop, shutter speed, beginning and ending exposure numbers and times, and any other comments relative to the flight conditions. These flight logs, or copies thereof, may be incorporated into the film report (if required) and will be delivered to the contracting officer as specified in this contract.

C.5.8. SUBCONTRACTED PHOTOGRAPHY. Before commencement of any aerial photography under this contract or task order by a subcontractor, the contractor shall furnish the contracting officer, in writing, the name of such subcontractor, together with a statement as to the extent and character of the work to be done under the subcontract, including applicable camera certifications.

C.6. AERIAL PHOTOGRAPHY SCALE AND RELATED COVERAGE PARAMETERS.

C.6.1. PHOTO-NEGATIVE SCALE AND FLIGHT ALTITUDE. The required negative scale for projects shall be as stated in each task order. The flight height above mean terrain (AMT) will be designed such that the negatives will have an average scale suitable for attaining required photogrammetric measurement, map scale, contour interval, and accuracy, given the required mapping camera focal length, stereoplotter model, and quality control criteria, as defined elsewhere in these specifications. Negatives having a departure from the specified scale of more than 5 percent because of tilt or any changes in the flying height may be cause for rejection of the work. Departures from specified flight height shall not exceed 2 percent low or 5 percent high for all flight heights up to 12,000 ft above ground elevation. Above 12,000 ft, departures from specified flight height should not exceed 2 percent low or 600 ft high. Any proposed variation by the contractor to change either the camera focal length or negative scale as specified in a task order constitutes a major change in scope and therefore must be effected by formal task order modification.

C.6.2. STEREOSCOPIC COVERAGE AND OVERLAP REQUIREMENTS. Unless otherwise modified in task orders the overlap shall be sufficient to provide full stereoscopic coverage of the area to be photographed, as follows:

a. BOUNDARIES. All of the area appearing on the first and last negative in each flight line extending over a boundary shall be outside the boundary of the project area. The principal point of two photographs on both ends of each flight line shall be taken past the boundary line of the project. Each strip of photographs along a boundary shall extend over the boundary not less than fifteen (15) percent of the width of the strip.

b. ENDLAP. Unless otherwise specified in a task order, the forward overlap shall be sixty (60) percent.

c. SIDELAP. The lateral sidelap shall average thirty (30) percent unless specified in a task order. Any negative having sidelap less than fifteen (15) percent or more than fifty (50) percent may be rejected. The foregoing requirement can be varied. Variation may be acceptable in cases where the strip area to be mapped is slightly wider than the area that can be covered by one strip of photographs, where increase in sidelap is required for control densification purposes, or where increase or decrease in sidelap is required to reach established ground control. Any variation must be specified in the task order.

d. CRAB. Absolute crab of any photograph relative to the flight line, or relative crab between any series of two or more consecutive photographs, in excess of 10 degrees, as indicated by displacement of the principal points of the photographs, may be considered cause for rejection of the photography. Average crab for any flight line shall not exceed 5 degrees. For aerotriangulation, no photograph shall be crabbed in excess of five (5) degrees as measured from the line of flight.

e. TILT. Negatives exposed with the optical axis of the aerial camera in a vertical position are desired. Tilt (angular departure of the aerial camera axis from a vertical line at the instant of exposure) in any negative of more than four (4) degrees, or an average of more than two (2) degrees for any ten (10) consecutive frames, or an average tilt of more than one (1) degree for the entire project, or relative tilt between any two successive negatives exceeding six (6) degrees may be cause for rejection.

f. TERRAIN ELEVATION VARIANCES. When ground heights within the area of overlap vary by more than ten (10) percent of the flying height, a reasonable variation in the stated overlaps shall be permitted provided that the fore and aft overlaps do not fall below 55 percent and the lateral sidelap does not fall below 10 percent or exceed 50 percent. In extreme terrain relief where the foregoing overlap conditions are impossible to maintain in straight and parallel flight lines, the gaps created by excessive relief may be filled by short strips flown between the main flight lines and parallel to them.

g. Strips running parallel to a shoreline may be repositioned to reduce the proportion of water covered, provided the coverage extends beyond the limit of any land feature by at least 10 percent of the strip width.

C.6.3. Where the ends of strips of photography join the ends of other strips or blocks flowing in the same general direction, there shall be an overlap of at least two

stereoscopic models. In flight lines rephotographed to obtain substitute photography for rejected photography, all negatives shall be exposed to comply with original flight specifications, including scale and overlap requirements. The joining end negatives in the replacement strip shall have complete stereoscopic coverage of the contiguous area on the portion or portions not rejected.

C.7. AERIAL CAMERA SPECIFICATIONS.

C.7.1. TYPE OF CAMERA. Unless specified otherwise in a task order only a standard 6-in. (153mm + 3mm) focal length single-lens precise aerial mapping camera, equipped with a high resolution, distortion-free lens, and with a between-the-lens shutter with variable speed, shall be used on this contract. The aerial camera used shall be of like/similar quality to a Wild model RC30, Leica RC-30, Zeiss RMK A 153mm, or better. The camera shall function properly at the necessary altitude and under expected climatic conditions, and shall expose a 9 by 9 inch (228 by 228mm) square negative. The lens cone shall be so constructed that the lens, focal plane at calibrated focal length, fiducial markers, and marginal data markers, comprise an integral unit or are otherwise fixed in rigid orientation with one another. When extremely large scale (low altitude) photography is being flown, the camera shall be equipped with forward image motion compensation (FMC). Some projects may require that the camera system be equipped with ABGPS for precise locations of photo exposures. Details will be described in detail in task order scopes of work.

C.7.2. CALIBRATION. The aerial camera(s) furnished by the contractor or his designated subcontractors shall have been calibrated by the United States Geological Service (USGS) within three (3) years of award of this contract. The calibration report shall be presented to the contracting officer prior to use on this contract and/or task orders placed against this contract. Certification shall also be provided indicating that preventative maintenance has been performed within the last two (2) years.

C.7.3. SUBSTITUTE CAMERAS. Substitute cameras that do not meet the above specifications may not be used on this contract unless specified in the task order.

C.8. AERIAL FILM SPECIFICATIONS AND PROCESSING REQUIREMENTS.

C.8.1. GENERAL. Film materials and laboratory processing, developing, reproduction, and printing thereof, shall conform with recognized professional photogrammetric industry standards and practices, as outlined in EM 1110-1-1000 and the ASPRS Manual of Photogrammetry unless stated in task orders scope of work.

C.8.2. TYPE OF FILM REQUIRED. The contractor shall use only aerial film of a quality that will produce imagery that is suitable for specific project requirements, as applicable to those types of photography scheduled in individual task orders. Only fresh, fine-grain, high-speed, dimensionally stable, and safety base aerial film emulsions shall be used. Outdated film shall not be used. The thickness of the base shall not be less than 0.1 mm and the dimensional stability shall be such that in any negative the length and width between fiducials shall not vary by more than 0.3 percent

from the same measurements taken on the camera, and that the differential between these measurements shall not exceed 0.04 percent.

C.8.3. UNEXPOSED FILM. Whenever any part of an unexposed roll of film remains in the camera, before such film is used on a subsequent day, a minimum 3-ft section of the roll of film shall be rolled forward, and exposed, immediately preceding the beginning of photography.

C.8.4. QUALITY OF PHOTOGRAPHY. The photographic negatives shall be taken so as to prevent appreciable image movement at the instant of exposure. The negatives shall be free from static marks, shall have uniform color tone, and shall have the proper degree of contrast for all details to show clearly in the dark-tone areas and high-light areas as well as in the halftones between dark and light. Negatives having excessive contrast or negatives low in contrast may be rejected.

C.8.5. PROCESSING OF EXPOSED FILM. The processing, including development and fixation and washing and drying of all exposed photographic film, shall result in negatives free from chemical or other stains, containing normal and uniform density, and fine-grain quality. Before, during, and after processing, the film shall not be rolled tightly on drums or in any way stretched, distorted, scratched, or marked, and shall be free from finger marks, dirt, or blemishes of any kind. Equipment used for processing shall be either rewind spool-tank or continuous processing machine, and must be capable of achieving consistent negative quality specified below without causing distortion of the film. Drying of the film shall be carried out without affecting its dimensional stability.

C.8.6. The camera panel of instruments should be clearly legible on all processed negatives. Failure of instrument illumination during a sortie shall be cause for rejection of the photography. All fiducial marks shall be clearly visible on every negative.

C.8.7. FILM STRIP DOCUMENTATION AND LABELING. At minimum, The following information shall be supplied as leaders at the start and the end of each film strip:

- a. Flight line identification(s).
- b. Dates of photography.
- c. Effective negative numbers and run numbers.
- d. Approximate scale(s) of photography.
- e. The calibrated focal length of the camera.

C.8.8. NEGATIVE NUMBERING AND ANNOTATION. Each negative will be labeled clearly with the identification symbol and numbering convention recommended herein. The numbers will be sequential within each flight line and shall be in the upper

right-hand corner of the negative image edge to be read as one looks northerly along the flight line (or westerly when lines are east to west). All lettering and numbering of negatives shall be approximately 1/5 in. high and shall result in easily read, sharp, and uniform letters and numbers. Numbering of negatives shall be carried out using heat-foil or indelible ink. Each negative shall be provided with the following annotation, which shall also appear on the prints unless otherwise stated in task orders:

- a. Year, month, and day of flight (placed in upper left corner of each frame).
- b. Project-specific location/identification information (placed immediately after date).
- c. Photo scale (ratio) (placed next to project locations/identification information on each frame).
- d. Film roll number (placed in upper right-hand corner of each frame).
- e. Negative number (placed to the left of the roll number for each frame).

C.8.9. FILM STORAGE AND DELIVERIES. All negatives and uncut film positives shall be delivered to the contracting officer on winding spools in plastic or metal canisters. All extra and rejected negatives shall be included in the roll(s). At least 3 ft of clear film shall be left on or spliced to each end of the roll. All splices shall be of a permanent nature. Exposed and unexposed film shall be handled in accordance with manufacturer's recommendations. Each canister should be labeled with the minimum information indicated below:

- a. Name and address of the contracting agency.
- b. Name of the project.
- c. Designated roll number.
- d. Numbers of the first and last numbered negatives of each strip.
- e. Date of each strip.
- f. Approximate scale.
- g. Focal length of lens in millimeters.
- h. Name and address of the contractor performing the photography.
- i. Contract number.

C.9. CONTACT PRINT AND DIAPOSITIVE SPECIFICATIONS.

C.9.1. MATERIAL. All contact prints shall be made on an electronic printer on medium-weight resin-coated stock, upon which a grease pencil, and other commonly employed markers can be used on both sides.

C.9.2. PROCESSING AND QUALITY. The processing, including exposure development, washing, and drying, shall produce fine-grained quality matte or semi-matte finish photographic contact prints with normal uniform density and such color tone and degree of contrast that all photographic details of the negative from which they are printed show clearly in the darktone areas and high-light areas as well as in the halftones between the dark and the high light. Excessive variance in color tone or contrast between individual prints may be cause for their rejection. All prints shall be clear and free of stains, blemishes, uneven spots, air bells, light fog or streaks, creases, scratches, and other defects that would interfere with their use or in any way decrease their usefulness.

C.9.3. TRIMMING. All contact prints shall be trimmed to neat and uniform dimensional lines along image edges (without loss of image) leaving distinctly the camera fiducial marks. Prints lacking fiducial marks shall be rejected.

C.9.4. DELIVERIES. All contact prints shall be delivered to the contracting officer in a smooth, flat, and usable condition. The number of contact prints to be delivered for each exposure will be specified in individual task orders.

C.9.5. PRELIMINARY CHECK PRINTS. Preliminary check prints may be requested in a task order. Unless stated otherwise in the task orders the quality and processing shall be as stated in paragraphs C.9.1 through C.9.5.

C.9.6. MARKED CONTROL PRINTS. Marked control prints may be requested in a task order scope of work. Unless stated otherwise in the task orders the quality and processing shall be as stated in paragraphs C.9.1. through C.9.5.

C.9.7. DIAPOSITIVE and TRANSPARENCIES. All black and white and color diapositive transparencies used for photogrammetric measurements, including map compilation, shall be of a quality that will produce the imagery that is suitable for specific project requirements, as applicable to those types of photogrammetry scheduled in individual task orders. Outdated diapositives or transparencies shall not be used.

C.10. PHOTOGRAPHIC INDEX REQUIREMENTS.

C.10.1. GENERAL. Photographic indexes may be requested in task orders scopes of work. The requirement for horizontal scale, base map type, type of media (hardcopy and/or softcopy) shall be stated in the task orders. A flight line index shall generally show all flight line and photo center locations. Each flight line shall be labeled with the identifying flight line number at each end of the flight line along with beginning and ending photograph numbers respectively.

C.11. PHOTO CONTROL SURVEY REQUIREMENTS.

C.11.1. GENERAL. All horizontal and vertical control surveys required for photogrammetric mapping shall, unless otherwise indicated herein, be performed using procedures and/or accuracy standards consistent with professional surveying practices. Ground control may be minimized by the use of ABGPS technology. Details for utilization of ABGPS technology will be described in task order scopes of work. All surveying and photo mapping work shall be referenced to horizontal and vertical datums as stated in task orders scopes of work. The contractor shall provide survey crews with professional survey personnel and equipment capable of performing observations and measurements that meet the required accuracy needed for the work.

Mapping personnel will provide properly marked control photos to survey crews indicating control points to be surveyed. All ground control points required shall be noted on control photos and the survey data shall be obtained by ground survey crews.

All field observational data shall be performed in accordance with standard engineering survey practices, as specified in reference C.3. Survey data shall be recorded in bound survey books or digital format that will subsequently be delivered to the government as specified in each task order. All survey work will be performed under the supervision and control of a licensed professional land surveyor. All survey work, including office computations and adjustments, is subject to government review and approval for conformance with prescribed accuracy standards.

C.11.2. PHOTO CONTROL SURVEYS. Surveys performed to control horizontal or vertical locations of points used in controlling stereoscopic models shall be performed using recognized engineering and construction control survey methods, as necessary to meet the ultimate mapping standards required in paragraph C.15. This usually requires, at minimum, third-order procedures performed relative to existing network or project control using standard engineering survey traverse, differential leveling, global positioning system (GPS), or electronic total station measurement techniques.

a. Unless otherwise indicated, photo control points or panelled points may be temporarily marked (2 by 2 in. stakes, nails, etc.). These temporary marks should remain in place for at least the duration of the contract, and may be used for performing quality control or assurance surveys.

b. EXISTING PROJECT/NETWORK CONTROL. A tabulation and/or description of existing project/network control points may be provided with each task order request or may be a deliverable in a task order. The source agency, coordinates, datum, and estimated accuracy of each point is indicated on the description. Prior to using any control points, the monuments should be checked to ensure that they have not been moved or disturbed.

c. The contractor shall perform surveys connecting existing project control to assure that such control has sufficient relative accuracy to control the overall project. Should these surveys indicate deficiencies in the existing control, the contractor shall advise the contracting officer, and appropriate modification may be made to the contract to perform resurveys of the existing network.

d. All horizontal and vertical control points will be occupied as a station within a closed traverse or closed level loop. If it is not possible to occupy an individual control point or photo target, thus requiring spur shots, all angles shall be read at least three times and averaged, and all distances measured twice and averaged.

C.11.3. FULL PHOTO MODEL CONTROL. The contractor shall establish the minimum horizontal and vertical control points required for each stereoscopic model by field survey methods. Each point shall be an image of an existing object or be a finite photographic pattern that is clearly identifiable both on the ground and on the photographs, or be the photographic target. The accuracy of all supplemental control surveys shall be the same as that stipulated for all control surveys required under this contract

C.11.4. CONTROL PHOTOGRAPHS. All horizontal and vertical control points including supplemental control points shall be marked and labeled with appropriate point identification numbers. All control points not premarked shall be neatly pin-pricked and clearly identified and briefly described on the back of the photograph. Coordinates and brief descriptions of marked control points shall be written on the back of each photo. Full station descriptions will be written for newly set, permanently monumented points. The marked-up control prints will be delivered to the Government.

C.11.5. CERTIFIED SURVEYOR. All surveying will be directed, approved and certified by a Professional Engineer or Registered Land Surveyor.

C.11.6. COORDINATE SYSTEM. The horizontal control shall be tied to the North American 1983 Datum Network and to the appropriate State Plane Coordinate System by a survey connection to existing triangulation station(s) as established by the National Geodetic Survey unless otherwise stated in each task order. In areas where the spacing of these triangulation stations are so wide that a survey connection would not be practicable, the horizontal control will be surveyed by observing satellite stations using a Global Positioning System (or equivalent). Global Positioning System (GPS) technology may be employed to acquire horizontal point location data providing accuracies obtained are within those obtained by conventional traversing methods described above. GPS equipment, planning techniques, and anticipated accuracies are noted in the reference text noted in C.3.7. Plans and GPS equipment specifications for GPS implementation shall be reviewed by the COR during task order negotiations.

C.11.7. ELEVATIONS. The Contractor shall be responsible for all elevations necessary for satisfactory completion of all work. The Contractor will be responsible for checking bench marks and level lines for accuracy. Global Positioning System (GPS) may be used for elevation data providing the equipment and techniques to be used provide data at accuracies required by conventional level loops. The use of GPS acquired elevation data is at the discretion of the COR. Conventional level loops may be required exclusively. Use of GPS technology for acquiring elevation data will require a review, by the COR, of the plans proposed during negotiations for a task

order. Some conventional level loops may be required in addition to GPS acquired data. GPS equipment, planning techniques, and anticipated accuracies are noted in the reference text noted in C.3.7.

C.11.8. FIELD NOTES. Field notes shall be neat, complete, numbered, indexed and accurate; and every page shall be appropriately identified. Only original field notes will be accepted. Field note books must be kept in good condition and sent to the Corps of Engineers at the end of the project.

C.11.9. MINIMUM ACCURACY.

a. The survey traverse established by the Contractor within the Project Area used to provide horizontal control shall have a minimum closure before adjustments of 1:10,000, and the survey traverse shall be tied to the North American 1983 Datum network and the appropriate State Plan Coordinate System unless otherwise noted in each task order. The final traverse adjustment will include sea level and grid correction factors applied to measured distances before adjustments. The Contractor shall provide copies of the traverse closures.

b. Level circuits used for primary vertical control within the project area will originate and end on bench marks established by National Geodetic Vertical Datum of 1929 unless otherwise noted in each task order. All level circuits used to establish basic project control will close within .05 feet times m , where m is the distance in miles. Levels to establish supplementary photogrammetric controls shall originate from a primary level bench mark and close on a primary level line bench mark, and shall establish elevations with maximum errors no greater than 1/10 of the contour interval of the map being prepared. No side shots to the vertical control points will be allowed; either turn through the point or establish elevation on point from two (2) setups. Preference shall be given to taking off one (1) primary benchmark and closing on a second (2nd) primary bench mark. If, in order to comply with this, level loops are several miles in length, discussions with Contracting Officers Representative (COR) shall determine the appropriate route for level loops.

C.11.10. STADIA ELEVATIONS. No stadia work or trigonometric levels will be permitted in ground control work.

C.11.11. TRANSFER OF RECORDS AND MATERIALS. All data compiled for the completion of ground control will be given to Corps of Engineers. All original manuscripts will be delivered to Corps of Engineers upon completion of the project.

C.11.12. CONTROL LOCATION MAP. Contractor shall provide Corps of Engineers with a location map showing the physical location of all required horizontal and vertical points on or adjacent to the project area.

C.11.13. BENCH MARKS. Permanent bench marks may be required as per specifications in a task order. When this is the case the number and location parameters will be specified in the task order. Level lines shall be run along routes that have the least fluctuation in elevation and in as direct a line as possible compatible with

the area to be mapped. When possible, bench marks shall be established no more than one U.S. mile apart. Reference drawings shall also be prepared showing locations of all bench marks set.

C.12. IMAGE SCANNING

C.12.1. GENERAL. Scanning may be required under this contract. Uses of scanning may include creating digital files of existing hardcopy map data, scanning of aerial photographs into raster images for utilization in softcopy workstations for development of topographic and planimetric mapping and orthophoto development. Resolutions expected and processes required for scanning projects will be specified in each task order. All projects will require "high resolution" scanners unless otherwise stated in task orders.

C.12.2. HIGH RESOLUTION SCANNERS. High resolution scanners will be of a quality that will meet the photogrammetry requirements stated in task orders. The level of precision shall be +/- 2 microns. All scanners must be capable of pixel size of 10 x 10 microns for black and white images and transparencies and 15-20 microns for color photographs and transparencies. All scanners must be able to scan color and black and white photographs.

C.13. SOFTCOPY PHOTOGRAMMETRY.

C.13.1. GENERAL. Softcopy photogrammetry is the use of digital raster images and softcopy mapping systems instead of photographs and analytical stereoplotters for map production. The sources of digital images can range from digitized photographs, to digital cameras, to electro-optical scanners. Systems required under this contract must be capable of performing all the tasks of a fully analytical first order stereo-plotter, automated generation of digital terrain models, computation of digital orthophotos (for subsequent output on a raster plotter), preparation of perspective views (singly or in a series of fly-throughs) and capture of data for direct entry into a geographic information system. The system also must provide linkages to image processing software, making it amendable to the analysis of virtually any source of digital image data (e.g., Landsat or SPOT satellite data).

C.13.2. SOFTCOPY TOPOGRAPHIC/PLANIMETRIC AND ORTHOPHOTO MAPPING. Softcopy data requests under this contract may require the development of topographic, planimetric and/or orthophoto mapping. The specifications and accuracies are the same as stated in paragraphs C.13 and C.14.

C.14. STEREOCOMPILATION, DRAFTING, AND CADD SPECIFICATIONS.

C.14.1. Analytical aerotriangulation specifications. When authorized within this contract and/or task order, the x-, y-, and z-coordinates for supplemental photo control points may be derived using fully analytical, simultaneous block aerotriangulation adjustment methods. Industry-standard adjustment software, or that supplied with analytical plotters or softcopy workstations, must be used to perform the computations.

Use of different altitude photography is not allowed. The photography specified in paragraph C.6 shall be used to perform all measurements.

a. **EQUIPMENT.** The photogrammetric mensuration instruments shall have sufficient accuracy and utility for measuring the x and y photographic coordinates of the fiducial or other photographic reference marks, targets, photographic images, and artificially marked points to achieve the required accuracies.

b. **GROUND CONTROL REQUIREMENTS.** The contractor shall be responsible for determining the optimum location, quality, and accuracy of all ground surveyed control points used for controlling the aerotriangulation adjustment. Ground control requirements are dependent upon many factors specific to each individual project. The number and spacing of horizontal and vertical ground control points for a project shall be within general industry standards and shall be approved by the Contracting Officers Representative for each task order.

c. **RESULTANT ACCURACY OF AEROTRIANGULATION ADJUSTMENT.** For class 1 maps, the root mean square (RMS) error for the x, y, and z coordinates of all supplemental control points determined by analytical aerotriangulation shall not be in error by more than 1:10,000 in horizontal position (x and y) and 1:8,000 in elevation (z), when expressed as a ratio fraction of the flying height. These adjustment statistics must be clearly identified on the adjustment software output that shall be delivered to the government prior to commencement of stereoplotting. A short written report submitted to the contracting officer prior to compilation explaining any analytical control problems encountered shall accompany this printout. Aerotriangulation accuracy criteria for other map classes are contained in EM1110-1-1000.

d. **CONTROL PRINTS.** The image of all ground control and supplemental control points shall be appropriately marked and identified on a set of contact prints (control prints). The identifying number for each supplemental control point shall be related to the photograph on which it appears.

e. **DELIVERIES.** All materials, including the x-y-z coordinate listing of supplemental control points, final adjustment computations with error of closure, control prints, the marked/drilled diapositives, and any rolls of film negatives used by the contractor, shall be provided to the government.

C.14.2. STEREOPLOTTER SPECIFICATIONS. Topographic and/or planimetric feature line maps are to be developed/generated on a softcopy workstation (as specified in section C.13 or equivalent) or an analytical stereoplotter. The plotter system must be capable of automatically performing/adjusting interior, relative, and absolute orientations, and output statistical data thereof, and generating digital data of observed topographic/feature information into spatial layers directly compatible with three-dimensional design file criteria (standards manual for USACE COMPUTER-AIDED DESIGN AND DRAFTING (CADD) SYSTEMS EM 1110-1-1807 (Reference C.3.3). Stereoplotter operators should have demonstrated experience on the machine and in the type of terrain being compiled.

C.14.3. MAP COMPILATION SCALE. The contractor shall furnish to the contracting officer stereoplotter-derived manuscripts and/or finished maps at scales referenced in task orders scope of work.

C.14.4. Manuscript plotting media. **RESERVED.**

C.14.5. MODEL SETUP AND ORIENTATION DATA. The stereoplotter orientation parameters and statistical outputs for each model setup may be requested for specific task orders. These sheets shall be fully annotated by date, time, operator name, compilation dates/times, photo numbers, and other data that confirm that the mapping was compiled from the required negative scale.

C.14.6. PLANIMETRIC FEATURE DATA DETAILING. Mapping data shall contain all the planimetric features visible or identifiable on or interpretable from the aerial photographs, and compatible with type of project involved (i.e., military master planning, detailed site plan mapping, etc.) These shall include, but not be limited to, buildings, roads, farm lanes, trails, driveways, sidewalks, catch basins, rivers, shorelines, ditches, drainage lines, erosion areas, ponds, marshes, lakes, reservoirs, railroads, fence lines, power poles, pipelines, wooded areas, timber lines, tree clumps, orchards, vineyards, individual trees that can be recognized as such, bridges, culverts, piers, spillways, tunnels, dams, rock outcrops, quarries, recreation areas, and cemeteries. The level of detail required for each project will be provided in detailed specifications for the task order.

a. Features such as quarries, gravel pits, log piles, coal piles, sand piles, slag piles, open pit mines, etc., shall be shown by symbols identified in USGS Photogrammetric Compilation Symbols -- Chapter 3F1, Preliminary Edition, March 1981, unless otherwise specified.

b. Surface Utility Data. Locate and identify all utilities such as culverts (pipes or box drains); water systems including valves and meters; catch basins; manholes (storm, sanitary, telephone, gas, and electric); meter/valve boxes; overhead electrical pole location and type; low wire elevations; towers; and transformers. Except in urban or heavy industrial areas, locate only main trunk aerial and surface lines; identify size and capacities and measure invert elevations as applicable to project as requested in task orders scopes of work.

c. Underground Utilities. For designated subsurface utilities, provide pipe/conduit alignment, type, size, nomenclature, depth below surface, junction points, etc. as requested in task orders scopes of work.

d. Highways, Roads, and Streets. Obtain names, descriptions, classifications; center-line profiles or sections as designated; route classification; pavement width and construction as requested in task orders scopes of work.

e. Railroads. Obtain names, locations (and stationing) of mileposts, bridges, culverts, semaphores, culverts, yard limits, etc. Obtain center-line profiles or sections as designated as requested in task orders scopes of work.

f. **RESERVED.**

g. Buildings and Other Structures. Obtain proper names of all buildings or landmarks; proper names, installation numbering, and/or descriptions of all buildings and other structures affected or possibly affected by the project; foundation and first-floor elevations of those structures within designated limits and/or elevations.

h. Boundary and Right-of-Way Data. Locate all right-of-way markers/monuments for existing roads/projects/structures. Connect any prominent property corners, installation boundaries, or section corners encountered.

i. Vegetation. Obtain general identification and description of clusters, as would be of interest in preliminary value appraisals or in clearing operations.

C.14.7. Topographic Data Detailing. The map shall contain all representable and specified topographic features visible or identifiable on or interpretable from the aerial photography. Topographic data may be generated by contour tracing or digital terrain modeling (mass points and breaklines) techniques.

a. Contour tracking/tracing. The contour interval for each project will be stated in each task order. Each contour shall be drawn sharp and clear as a solid line, except through densely wooded areas where the ground cannot be seen and where it is obscured by an overhanging bluff or ledge. In such ground hidden places, the contours shall be shown as dashed (broken) lines. Every fifth contour (index contour) shall be accentuated as a heavier line than the intermediate four and shall be numbered according to its actual elevation above mean sea level. Whenever index contours are closer than one-quarter (1/4) inch, and the ground slope is uniform, the intermediate four may be omitted.

(1) Half-interval contours shall be added in all sizeable flat areas where general slopes are 1 percent or less. Labeling or numbering of contours shall be placed so that the elevation is readily discernable. Labeling of intermediate contours may be required in areas of low relief.

(2) The turning points of contours that define drainage channels, ditches, rapids, falls, dams, swamps, sloughs, etc., shall be consistent in depicting the correct alignment of the channel and in reflecting the continuation of the drainage.

(3) Particular care must be taken to show the Outline of shorelines or other water limits at the time photography is taken. Where the water demarcation line cannot be definitely established, the approximate position shall be shown by a broken line so as to indicate the continuity of drainage.

b. Terrain Model Generation. Terrain model generation is accomplished using a softcopy workstation or analytical stereoplottter to derive accurate ground point (horizontal and vertical) location data. Digital elevation models

(DEM) consist of a preset grid interval of ground points specified in a task order. A Digital Terrain Model (DTM) shall consist of a network of random points supplemented with break-line points to properly establish the Hypsography of the terrain. Intermediate break, highs, lows, etc., are added independently. Triangulated irregular networks (TIN) and contours will be generated off-line using standard DTM/CADD software as specified in task orders.

c. Spot elevations. Spot elevations determined photogrammetrically shall be shown on the maps in proper position at water level on the shoreline of lakes, reservoirs, ponds, and the like; on hilltops; in saddles; at the bottom of depressions; at intersections and along center lines of well traveled roads; at principal streets in cities, railroads, levees, and highways; at tops and bottoms of vertical walls and other structures; and at center line of end of bridges. In areas where the contours are more than 3 in. apart at hardcopy map scale, spot elevations shall also be shown and the horizontal distance between the contours and such spot elevations or between the spot elevations shall not exceed 2 in. at scale of delivered maps. Spot elevations shall be measured to an accuracy consistent the accuracies stated in C.3.1 or with the accuracy standards stated in each task order.

d. When the contract stipulates the delineation of specified features (planimetry and contours) and the specified features are not visible from or obscured on the aerial photography and on stereoscopic models formed therefrom, the contractor shall attempt to compile the features and note the obscured areas with a predetermined line code denoting obscured areas unless otherwise stated in the task order. Areas marked as such will not be required to meet the accuracy standard specified in the task order.

e. Dashed contours. When the ground is obscured by vegetation to the degree that standard accuracy is not obtainable, contours shall be shown by dashed lines.

C.14.8. ORTHOPHOTOS AND ORTHOPHOTO MAPS. Orthophotos are orthographic photographs. They do not contain scale, tilt and relief distortions. Orthophotographs within the purview of this contract will be generated from overlapping conventional photos or digital images in a process called differential rectification. The result of this process is the elimination of photo scale variation and image displacement resulting from relief and tilt. Orthophotos and orthophoto maps will be prepared by digital softcopy methods within this contract and will be specified in task orders. Digital orthophotographs and maps will be generated by utilizing software and hardware that will support image scanning, rectification of scans and digital rectified images. Raster scans will be produced of the images required. The digital imagery will be set up on a softcopy workstation and the image file oriented using the camera calibration parameters and ground control. A spatial resection will be performed to re-establish the focal plane of the camera in space at the instant of exposure. A coordinate transformation based on the camera fiducial corners will be undertaken. This transformation will allow the conversion of every pixel in the image from a sample/line location to an x,y, position. Then a differential rectification will be performed. This procedure will place each pixel into the correct coordinate space as defined. Digital orthophoto files will be delivered in TIFF format on CDROM unless

otherwise specified in task orders. Hardcopy may be required from this type data and will involve hardware and software that will produce a film negative of the digital files suitable for positive production on paper and mylar (Black and White orthophotos only). All orthophotographs and maps shall be compiled on instruments with software capable of making direct enlargements up to eight diameters between original negative scale and compilation scale. All orthophotos and orthophoto maps will meet the accuracy stated in C.3.1 unless specified otherwise in a task order.

C.14.9. MANUSCRIPT DRAFTING. All drafting on the manuscripts shall be sufficiently neat and complete as to eliminate or minimize errors of misinterpretation on the part of the draftsman preparing the finished line maps. Manuscript drafting shall be sufficiently dark and adequately edited so as to afford good and usable prints, if required. Either pencil or ink will be specified in each task order.

C.14.10. COMPILATION HISTORY. A compilation history (model diagram or model setup sheet) may be requested in a task order for each stereoscopic model used to accomplish the mapping. History shall include but not be limited to the final photographic fit to x-, y-, and z-coordinates of ground and supplemental control points and any other problems encountered in the model orientation and compilation process. History shall also include the project name, flight date, photo scale, map scale, stereoplotter system used, and the operator name.

C.14.11. FINAL SITE PLAN MAPS AND/OR DIGITAL DATA BASE CONTENTS.

a. Coordinate Grid. Unless otherwise specified, grid ticks of the applicable coordinate system (SPCS) shall be properly annotated at the top and right edge of each manuscript sheet. Spacing of the grid ticks shall be approximately five (5)in. The coordinate system to be used will be noted in each task order.

b. Control. All horizontal and vertical ground control and all supplemental control determined by either field or aerotriangulation methods shall be included in the final mapping data.

c. Sheet layout and match lines. The Government will provide the sheet layout for each task order. Match lines shall be provided and properly labeled so that each sheet may be joined accurately to adjacent sheets.

d. Symbols and Names. The symbols to be used for major planimetric and topographic features shall be in accordance with symbols provided in reference C.3.3 unless stated otherwise in each task order. The names of cities, towns, villages, rivers, streams, roads, streets, highways, and other features of importance shall be obtained by the contractor. All names and numbers shall be legible and clear in meaning and shall not interfere with map features. Names of towns, rivers, streams, etc., will generally be those appearing on the existing USGS, National Imagery and Mapping Agency (NIMA), or state highway published maps unless other data is furnished by the Government as per task orders.

e. Title and Sheet Index. A title shall be placed on each map manuscript to the size and arrangement directed by the Contracting Officer, and shall include the name of the contracting agency, the project name, the date of photography used, the strip and photograph numbers, the map scale, the date of the mapping, manuscript number, and the name of the contractor. If more than one (1) manuscript/map sheet is prepared, a small-scale sheet index shall be drawn on each manuscript/map sheet showing the position and the relationship of all map sheets to each other. The title block contents and sheet index requirements for finished maps will be furnished by the Contracting Officer. The contractor's name/address, contract/task order number, and logo will be placed on each map sheet.

f. Vertical datum. Vertical data required will be specified in each task order.

C.14.12. FINAL PLOTTING MEDIA. The finished line maps shall be electrostatically printed from the CADD database on dimensionally stable, static-free polyester drafting film, of at least 0.004-in. thickness to a final map size specified in each task order unless otherwise specified in each task order. The sheets will be oriented north-south, unless otherwise specified. Locations of title blocks, revision blocks, border detail, line weights, etc., are contained in reference C.3.3 unless otherwise stated in each task order.

C.14.13. DRAFTING QUALITY. The professional standards of draftsmanship and scribing shall be maintained throughout the mapping process. All symbols, lines, letters, and numbers shall be clear and legible and conform with the District drafting standards specified in reference C.3.3 unless otherwise noted in each task order.

C.14.14. MAP EDITING. All map products will be reviewed by an experienced editor during applicable stages of production.

C.14.15. DIGITAL DATA DESIGN FILE SUBMITTALS.

a. Products. Digital data products to be furnished by the contractor shall include, but not be limited to, topographic drawings, cross sections, profiles, and digital elevation/terrain models.

b. Accuracies. The horizontal and vertical accuracies for digital products shall be as stipulated in section C.15 of this contract unless stated otherwise in each task order.

c. Format. The completed drawings, digital files, etc., shall be fully operational, by translation or other process, on the operating system stated in each task order at the time the drawings are delivered.

d. All design files, including drawings and/or models, shall be furnished on 3-1/2 in. Floppy Diskettes, 8 mm tapes, CDROM or optical rewritable disks formatted as stated in each task order. The contractor shall furnish a copy of the cell library used in preparing these drawings and compilation history as described above.

All data shall become the property of the Government upon submittal.

C.14.16. DELIVERIES. All completed manuscripts, maps, and any reproductions thereof, diapositives, model diagrams, compilation histories, and digital data shall be delivered to the Contracting Officer in accordance with task order requirements.

C.15. QUALITY CONTROL AND QUALITY ASSURANCE STANDARDS.

C.15.1. Contractor Quality Control.

a. General. All photogrammetric mapping data submitted under this contract shall conform to the accuracy standards outlined in EM 1110-1-1000 unless modified in each task order or supplemented below. The contractor shall be responsible for internal quality control functions involved with field surveying, photography and laboratory processing, stereo compilation, drafting, field checking, and editing of the photogrammetrically made measurements and compiled maps to ascertain their completeness and accuracy. Also the contractor shall make the additions and corrections necessary to complete the maps and photogrammetrically made measurements.

b. Materials. All materials, supplies, or articles required for work that are not covered herein, or by work order specifications, shall be standard products of reputable manufacturers and entirely suitable for the intended purpose. Unless otherwise specified, they shall be new, unused, and Subject to the approval of the contracting officer.

C.15.2. ASPRS ACCURACY STANDARDS FOR LARGE-SCALE MAPS.

a. Vertical Accuracy. Vertical map accuracy is defined as the 1 sigma (RMS) error in elevation in terms of the project's evaluation datum for well-defined points only. The limiting RMS error shall be one-third (1/3) the contour interval for well-defined points and one-sixth the indicated contour interval for spot heights placed on the map/manuscript. The map position of the ground point may be shifted in any direction by an amount equal to twice the limiting RMS error in position (defined below). Statistical tests shall be made in accordance with ASPRS procedures.

b. Horizontal Accuracy. Horizontal map accuracy is defined as the 1-sigma RMS error in terms of the project's planimetric survey coordinates (x-y) for checked well-defined points as determined by full (ground) scale of the Map/manuscript. The limiting RMS errors in x or y (feet) for each scale (in feet/inch) are as follows:

Error ft	Scale ft/in.
0.2	20
0.3	30

0.4	40
0.5	50
1.0	100
2.0	200
4.0	400

c. Blunders. Discrepancies between the x-, y-, or z-coordinates of the ground point, as determined from the map by the check survey, that exceed three (3) times the limiting root mean square error shall be interpreted as blunders and will be corrected.

C.15.3. RESERVED.

C.15.4. USACE PHOTOGRAMMETRIC MAPPING ACCURACY STANDARDS. Unless specified otherwise, all photogrammetric mapping will meet the horizontal and vertical accuracy requirements specified for the "Class" mapping stated in each task order, in Chapter 2 of EM 1110-1-1000.

C.15.5. SMALL-SCALE ACCURACY REQUIREMENTS. For line maps of scales smaller than 1 in. Per 400 ft (1:4,800), The United States National Map Accuracy Standards shall be followed.

C.15.6. NATIONAL MAP ACCURACY STANDARDS (LARGE-SCALE MAPS). Unless specified otherwise, all photogrammetric mapping will meet the following horizontal and vertical accuracy requirements for scales of 40, 50, 100, 200, and 400 ft to 1-in.

a. Contours. Not more than 10 percent of the elevations tested shall be in error more than one-half contour interval. In checking elevations taken from the map, the apparent vertical error may be decreased by assuming a horizontal displacement of 1/30 in.

b. Planimetric features. Not more than 10 percent of well-defined points or features tested shall be in error by more than one-thirtieth (1/30) of an inch, measured at the map/manuscript publication scale. Well-defined features are those that may be plotted within 1/100 in. at the map/manuscript scale.

C.15.7. METHODS FOR EVALUATING MAP ACCURACY. All maps compiled may be subject to map testing by the government, by independent third-party forces, or by contractor forces working under direct government review, to ensure that they comply with the applicable accuracy requirements listed above. The map test results will be statistically evaluated relative to the defined accuracy criteria, and pass/fail determination made accordingly. The decision of whether or not to perform rigid map testing on any project, task order, or portion of a project rests with the contracting officer.

a. Office and Field Checks. The party responsible for map testing may, during the course of the project, inspect map compilation in the Contractor's facility by

comparison with aerial photographs. However, the final map compilation shall be checked by field inspection and a horizontal and vertical accuracy check by conventional field survey checks, using traverse, triangulation, and differential leveling methods to test selected points or features on the completed drawings.

b. Test Profiles for Topography. In order to check for compliance with the vertical contour accuracy requirements, test profile traverses may be made in the field. Profiles to check contours and spot elevations should be at least five (5) in. long at the map scale, and should cross at least ten (10) contour lines. Profiles should start and close upon map features or previously established control points. In flat areas and at principal road and rail intersections, spot elevations shall be checked. In general, one profile per map sheet is sufficient.

c. Spot elevation tests. Testing for vertical accuracy may also be performed by comparing the elevations at well-defined points as determined from the map to corresponding elevations determined by a survey of higher accuracy. A minimum of 20 points shall be checked and shall be distributed throughout the sheet, or concentrated in critical areas.

d. Test Points for Planimetric Features. The accuracy of the planimetric map feature compilation shall be tested by comparing the ground coordinates (x and y) of at least 20 points (well-defined map features) per test per map sheet, as determined from measurements on the map at publication scale, to those for the same points, as provided by a check survey of higher accuracy. The check survey shall have an order of accuracy equal to or exceeding that specified for establishing the mapping control. Maps will also be examined for errors and/or omissions in defining features, structures, utilities, and other nomenclature, or for total gaps in compilation/coverage. A minimum of 20 points shall be distributed throughout the sheet or concentrated in critical areas.

e. Selection of Well-Defined Test Points. The term "well-defined map features" pertains to features that can be sharply defined as discrete points. Points that are not well-defined are excluded from the accuracy test. The selection of well-defined points shall be made through agreement between the contracting officer and the contractor. Generally, it may be more desirable to distribute the points more densely in the vicinity of important structures or drainage features and more sparsely in areas that are of lesser interest. Further definitions and requirements for selection of well-defined photo/map points are found in the reference standard used. The locations and numbers of map test points and/or test profiles shall be mutually agreed to by the Contractor and Contracting Officer's Representative (COR).

C.15.8. CORRECTION OF UNSATISFACTORY WORK. Failure to meet map test criteria will require recompilation of the project at the Contractor's expense. When a series of sheets are involved in a mapping project, the existence of errors (i.e., map test failure) on any individual sheet will constitute prima facie evidence of deficiencies throughout the project (i.e., all other sheets are assumed to have similar deficiencies), and field map testing will cease. After correction of the work, the contractor will be responsible for payment of map testing required on the corrected drawings. When

such efforts are performed by government survey forces, these costs will be deducted from contract/task order payment estimates.

C.16. SUBMITTAL REQUIREMENTS.

C.16.1. SUBMITTAL SCHEDULE. The completed work, maps, and reports shall be delivered by calendar date specified in each task order.

C.16.2. PACKAGING AND MARKING. Packaging of completed work shall be accomplished such that the materials will be protected from handling damage. Each package shall contain a transmittal letter or shipping form, in duplicate, listing the materials being transmitted, being properly numbered, dated, and signed. Shipping labels shall be marked as shown in Section D.

C.17. PROGRESS SCHEDULES AND WRITTEN REPORTS. Progress schedules and written report requirements will be stipulated in each task order.

SAMPLE