

# STATEMENT OF WORK

DELIVERY ORDER NUMBER

CONTRACT NO. DACW43-98-D-0512

**U.S. ARMY, FORT BRAGG, NORTH CAROLINA**

**COLOR DIGITAL ORTHOPHOTOGRAPHY & LIDAR DTM DATA**

**U.S. ARMY CORPS OF ENGINEERS**

## GENERAL

Color digital orthophotography, Light Detection and Ranging (LIDAR) digital terrain model (DTM) data and 2-m contours shall be produced of portions of Fort Bragg, NC. The areas to be photographed for production of color ORTHOPHOTOGRAPHY will be within the cantonment area approximately 14,000 acres. DTM data will be produced from LIDAR ground elevation data. The DTM data will be obtained for production of the digital orthophotos and will be suitable for generation of 5-ft and 2-m contours. The LIDAR DTM data for 2-m contours will be collected over Fort Bragg proper (approximately 152,860 acres) including the cantonment. The final mapping products requested are a digital terrain model (DTM) at a horizontal scale of 1:5000 and 2-m contours of the area covered by the DTM. Additional products for the cantonment area only are color digital orthophotos at a horizontal scale of 1 in = 400 ft, a DTM generated from the same LIDAR data referred to above, and 5-ft contours of the cantonment area generated from the DTM. The digital orthophotos will have a ground pixel resolution of 2 ft. Airborne Global Positioning System (GPS) control will be used in conjunction with minimal ground survey control to perform aerotriangulation (AT), develop digital terrain models (DTM) and digital orthophoto production. All photography will be flown at approximately 12,000 ft Above Mean Terrain (AMT) at a photonegative scale of 1:24000. **The orthophoto maps will fully comply with ASPRS Class I Standards for mapping at a horizontal scale of 1 in = 400 ft with a ground sample distance of 2 ft. The LIDAR DTM data will be obtained with ground post spacing sufficient to produce a DTM at 1:5000 that will support 5-ft and 2-m contours at ASPRS Class I Standards.**

## GOVERNMENT SUPPLIED INFORMATION

- a. Map showing project area.
- b. Available existing ground control within and around the project site.
- c. Existing photo image layout to match newly created DTM files.

## DETAILED STATEMENT OF WORK

Contractor shall provide equipment, supplies, facilities, and personnel to accomplish the following work:

The Contractor will establish aerial photo, and LIDAR missions and a ground survey control network including airborne GPS that will support the aerial photo and LIDAR data capture. The Contractor will fly and photograph (in natural color) the **cantonment area** at an altitude of approximately 12,000 ft AMT with a negative scale of 1 inch = 2,000 ft. The contractor will produce a line index of the aerial flight. The line index will be in hard copy and digital format. The digital format for the line index will be Intergraph format. **The aerial photography will be captured during leaf off conditions in the spring (February 15 - April 1, 1999). The LIDAR data capture will be accomplished from September 1998 through February 1999.** The LIDAR data capture altitude will be set to produce a ground post spacing that will support 5-ft

and 2-m contour generation. The natural color aerial photography and LIDAR data capture will be accomplished with airborne GPS utilizing dual frequency/multi channel receivers. The aerial photography will be flown with 80% forward lap and approximately 40% side lap. GPS data collection and processing will include latitude, longitude and ellipsoid height for each photo center. All airborne GPS planning including survey network layout, benchmarks to be used, etc. shall be approved by CEMVS-ED-S prior to initiation of project. The plan submitted shall include but not be limited to maps indicating proposed GPS network, benchmarks to be used, flight lines, and project area.

b. Additional ground survey data will be collected for use in the mapping process. The plan for additional ground survey control required for mapping and procedures to accomplish the ground survey control will be submitted to CEMVS-ED-SG for approval prior to initiation of the project. **All survey data shall be in the Universal Transverse (UTM) System, Zone 17. Horizontal control shall be in NAD83. Vertical datum will be NGVD88.** All surveys shall be accomplished in accordance with the technical section of Contract DACW43-98-D-0512.

c. Two sets of natural color contact prints will be made in accordance with the technical section of Contract DACW43-98-D-0512. One set of the prints will be used as control photos for mapping. The control prints will have all ground control marked on the back and front of each photo. All photography will include, in the border areas, the GPS latitude/longitude, the negative scale (as a ratio), the dates of photography, flight line and frame numbers and the title "Fort Bragg, NC."

d. The Contractor will produce aerotriangulation quality diapositives and orthophoto quality diapositives for the project.

e. Utilizing GPS survey data along with conventional ground control (panel data and photo identifiable data), the Contractor will perform analytical aerotriangulation to generate sufficient photo control points to accomplish ASPRS Class I Mapping at a horizontal scale of 1:5000 with a DTM suitable for generation of 5-ft and 2-m contours.

f. The Contractor will process the LIDAR data to produce digital terrain model (DTM) data for topographic mapping at a horizontal scale 1:5000 with 2-m contours. The DTM shall also fully support orthophoto production at a horizontal scale of 1 in = 400 ft. The DTM files shall be cut to match the client's existing orthophoto map sheets and shall have the dimensions 4,000 x 5,000 m. DTM data will be delivered in digital ArcInfo format (.eOO) on CD-ROM. **All newly created topographic data shall be in UTM Zone 17 and shall be referenced to NAD83 and NGVD88.**

g. The Contractor shall check and approve processed film. Images required for orthophoto production will be scanned for 2-ft pixel resolution utilizing a Zeis SCAI scanner or equivalent.

Digital imagery will be set up and oriented on an Autometric Softplotter System or equivalent and spatial resection and coordinate transformation will be performed. As a quality control check the following will be performed prior to ortho rectification:

The RMSE of the fiducial will be calculated and examined for accuracy.

RMSE for each control point used in the resection will be reported. Any unacceptable RMSE will be discarded.

The newly re-sectioned image will be visually checked for pixel drop out and/or other artifacts that may degrade the final orthophoto image.

DTM data will be in ArcInfo (.eOO) format and will be checked to verify that each point has a feature code. The coordinate/projection system will also be verified at this stage in the process.

Scaled and hillshade DTM images will be inspected for missing or poor data.

Rectification of all required imagery will be performed and checked. All control panels or photo identifiable points visible will be visited on the screen and the X and Y of the location will be displayed. This information will be checked against the ground survey data. Visual checks of the image quality will be performed. Radiometric variation will be checked with image histogram analysis including linear contrast stretch, user selected contrast stretch, histogram normalization and histogram clipping.

h. Produce digital orthophotos of the site at 1 in = 400 ft with a pixel resolution of 2 ft. Digital orthophoto data will be produced as raster files in TIFF format. The orthophotos will cover the cantonment and will have dimensions of 10,000 x 10,000 ft. **The orthophoto files will be referenced to North Carolina State Plane Coordinate System (SPCS) and NAD83. The spatial units of measurement shall be feet.**

i. The contractor will utilize the DTM data set and produce 2-m contour files over the entire 153,860 acres at Fort Bragg. The contractor will ensure that the DTM points are of sufficient density to adequately generate 2-m contours that will meet or exceed ASPRS Class I Standards for 2-m contours. The contours will be generated with topology. Contours will not be broken and will be based on the NGVD88 vertical datum. The contours will be delivered as a continuous coverage in ArcInfo (.eOO) format on CD-ROM.

j. The Contractor will produce an additional set of DTM files for the cantonment area covered by the orthophotos. The DTM will be referenced to the same datum and map projection as the orthophotos described above. The DTM files will be provided in Intergraph compatible format, cut to the same 10,000 x 10,000 ft sheets. In addition, contours will be generated at 5-ft intervals.

k. The Contractor will produce a digital mosaic of the cantonment area from the orthophoto data. The mosaic file will be compressed using the MrSid compression algorithm. The mosaic file will be written to CD-ROM. The contractor will produce five hard copy plots of the digital mosaic on E-size glossy bond suitable for framing.

## DELIVERY ITEMS

a. Copy of computer printout of aerotriangulation solution. Aerotriangulation report as defined in 3 c.

b. Copy of camera calibration reports.

c. One copy of the DTM data files in UTM, **Zone 17 Coordinate System and referenced to NAD83 and NGVD88**. All digital files will be in Arc/INFO compatible format on CD-ROMs.

d. One digital copy of the 2-m contour file in UTM, **Zone 17 Coordinate System and referenced to NAD83 and NGVD88**. in ArcInfo (.eOO) format on CD-ROM.

e. One copy of the DTM files **for the cantonment area only** referenced to NAD83 State Plane Coordinate feet and the NGVD88 vertical datum. The DTM file will be delivered in Intergraph compatible format, cut into sheets of 10,000 x 10,000 ft dimensions.

f. One set of 5-ft contour files **for the cantonment area only** referenced to NAD83 State Plane Coordinate feet and the NGVD88 vertical datum. The contours will be delivered in Intergraph-compatible format, cut into sheets of 10,000 x 10,000 ft dimensions.

g. One copy of digital orthophoto files at a horizontal scale of 1 in = 400 ft. The orthophotos will have a 2-ft ground pixel resolution. **The orthophoto files will be referenced to North Carolina State Plane Coordinate System (SPCS) and NAD83.** The digital orthophoto files will be delivered in two formats: one set as Intergraph geo-referenced .COT files and the second set as Arc/Info compatible .TIF/.TFW. All digital files will be on CD-ROM.

h. All survey data (including ground surveys and airborne GPS surveys), raw GPS files (airborne and ground), and any other survey information developed and or collected for the project.

i. Two sets of prints, and two sets of diapositives (one A/T set and one Ortho set).

j. Flight line index for the project on paper and digital format (Intergraph), indicating the flight lines and beginning and ending frames for each flight line along with altitude and negative scale of the photography.

k. One copy of the compressed (MrSid compression) digital orthophoto mosaic and five copies (paper) of the hardcopy mosaics of the cantonment area.

l. Return all manuscript copies, horizontal and vertical control information, aerial photographs, pugged diapositives, and aerial film to the government when the project is completed.

## SCHEDULE AND SUBMITTAL

a. The contractor will deliver all final products including CD-ROM digital data files by August 30, 1999.

b. All material to be furnished by the contractor shall be delivered at the Contractor's expense to:

## TIME EXTENSIONS

In the event, these schedules are exceeded due to causes beyond the control and without fault or negligence of the Contractor, this delivery order will be modified in writing and the delivery order completion date will be extended one calendar day for each calendar day of delay.