

## STATEMENT OF WORK

DELIVERY ORDER NO. 23

CONTRACT NO. DACW43-96-D-0525

**ITAM, HAWAII**

**COLOR AND COLOR INFRARED DIGITAL ORTHOPHOTOGRAPHY**

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

**PHOTO SCIENCE, INC.**

## DESCRIPTION OF WORK

Mapping of portions of military training areas in the state of Hawaii on the island of Oahu has been requested by ITAM. The areas to be mapped are portions of Makua Military Reservation, Schofield Military Reservation, and Schofield East Range. The areas to be mapped are shown on maps previously provided. The final mapping products requested are color infrared (CIR) photography, digital elevation models (DEM), 2-m contour files (over selected portions of the sites) and color infrared digital 1:2500 with a ground pixel resolution of 0.25 m and orthophotos at photo scale of 1:14400 and map scale of resample files at 1-m and 5-m pixel resolution (over entire project site). Selected portions of areas within the overall project areas as defined on maps previously provided shall have Digital Terrain Models (DTM), Triangulated Irregular Network (TIN) files and 2-m contour files generated. Necessary ground control will be planned, established and utilized to perform aerotriangulation (AT), and develop DEM, and DTM files from the color (IR) aerial photography for digital orthophoto production. The maps will fully comply with ASPRS Class I Standards for mapping at a horizontal scale of 1:2500 with 2-m contours.

## INFORMATION SUPPLIED BY THE GOVERNMENT:

a. Map showing project area. Maps indicate the overall digital orthophoto mapping areas and the selected areas within the overall mapping areas where contours will be generated ("East Range", "portion of Schofield Barracks", and portion of "Makua Range").

b. Available existing ground control within and around the project site.

## WORK TO BE PERFORMED BY THE CONTRACTOR

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

a. Contractor will establish a ground survey control network, fly and photograph in color (IR) the Military Reservation areas at a negative scale of 1:14400 for a map scale of 1:2500 for color (IR) orthophotos. Photography will be flown with 80% forward lap and approximately 45% side lap.

b. Ground survey data will be collected to be used in the mapping process. Approximately 23 horizontal/vertical points will be established. The plan for additional ground survey control required for mapping and procedures to accomplish the ground survey control will be submitted to CEMVS-ED-HG for approval before initiation of the project. All survey data shall be in the Universal Transverse Mercator (UTM) System, and shall be referenced to WGS 84. The vertical datum will be referenced to NGVD29. All surveys shall be accomplished in accordance with the technical section of Contract DACW43-96-D-0525.

c. Two sets of color IR prints will be made in accordance with the technical section of Contract of the color (IR) prints will be used as control photos for DACW43-96-D-0525. One set mapping. The control prints will have all ground control marked on the back and front of each photo. All color (IR) photography will include in the border areas, the negative scale (as a ratio), the dates of photography, flight line and frame numbers and the title "ITAM, HAWAII (SCHOFIELD, MAKUA, SCHOFIELD EAST RANGE RESPECTIVELY) ."

d. Utilizing control survey data (panel data and photo identifiable data) perform analytical aerotriangulation to generate sufficient photo control points to accomplish ASPRS Class I Mapping at a horizontal scale of 1:2500 with 2 meter contours.

e. Color (IR) diapositives will be prepared for aerotriangulation procedures and DEM/DTM development. Simultaneously along with aerotriangulation and analytical diapositives, orthophoto diapositives will be prepared and control transferred for digital orthophoto rectification. Before transfer, diapositives will be checked for diapositives will be attached to a quality check form indicating the location and type of abnormality and will be returned to the photographic laboratory. Upon acceptable completion of diapositive check, control points will be transferred from the analytical diapositive to the orthophoto diapositive using a Wild Pug IV point transfer instrument or equivalent.

f. Two meter contour data is requested for selected areas within the total project boundaries. The areas include all of the "East Range," one portion of "Schofield Barracks," and one portion of "Makua Range." The areas and approximate acreages are shown on maps previously furnished. The Contractor shall develop DEM, and DTM in areas where contours are to be produced. The contractor will develop Digital Elevation Models (DEM's) for digital ortho-rectification. The following procedure will be used:

DEM data will be captured using analytical stereo data capture systems by means of single point elevations (X, Y and Z). Digital Terrain Models (DTM) will then be generated in areas where contours are to be produced that will include mass points and breaklines sufficient to produce 1:2500 horizontal scale mapping with 2-m contours.

DEM data will be collected for each map sheet and on completion of each area, all data will be merged into one data set. The data set will then be processed, reviewed and edited for completeness and correctness. The checked and approved orthophoto diapositives will be scanned utilizing an Optronics Pixelgetter scanner or equivalent. The scanner must be capable of scanning color data in one pass.

Digital imagery will be set up and oriented on an International Imaging System IVAS 600 or equivalent and spatial resection to perform coordinate transformation. As a quality control check the following will be performed before ortho-rectification:

Each fiducial mark will be visited with the system cursor to obtain its sample/line location in the image. 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 resectioned image will be visually checked for pixel drop out and/or other artifacts, which may degrade the final orthophoto image.

DEM will be in ASCII format and will be checked to verify that each point or breakline has a feature code. The coordinate/projection system will also be verified at this stage. Scaled and hillshade DEM images will be inspected for missing or poor data. Rectification of all required imagery will be performed and checked. All control panels or visible photo identifiable points 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 an image histogram analysis (linear contrast) stretch, user selected contrast stretch, histogram normalization and histogram clipping.

The Contractor shall scan all necessary photography and create 1:2500 horizontal scale digital orthophotos. The 1:2500 orthophotography will have 0.25-m ground pixel resolution. Orthophotography will then be resampled for 1-m and 5-m ground pixel resolution. Orthophotography will be in raster file form in TIF and ARC/INFO format (World files included). All digital orthophoto data should come with a Federal Geographic Data Committee (FGDC) compliant metadata file.

g. The Contractor shall utilize the DEM and DTM files to produce Triangulated Irregular Network (TIN) data files and 2- m contour files in selected areas as shown on maps previously furnished. Selected areas include all of "East Range," one portion of "Schofield Barracks" and one portion of "Makua Range." The DTM, TIN and contour files will comply with ASPRS Class I Standards for 1:2500 scale mapping with 2-m contours.  
horizontal

h. The Contractor will incorporate a TIFF image data viewer with the orthophoto data files on CD-ROM.

## DELIVERY ITEMS

- a. Copy of computer printout of aerotriangulation solution. Aerotriangulation report as defined in 3.c.
- b. Copy of each stereomodel orientation report.
- c. One copy of digital Color (IR) orthophoto files (including .25 m, 1.0 m and 5.0 m ground pixel resolution files) on CD-ROM. The digital ortho files will be in TIF and ARC/INFO formats. Digital ortho CD-ROM disks will include operational TIFF image viewer.
- d. One copy of the DTM, TIN and 2 meter contour files on CD-ROM disks.
- e. One set of paper color (IR) paper prints of Color (IR) orthophotos (.25 m ground pixel resolution

files).

f. All survey data including raw GPS files, any other survey information developed and or collected for the project.

g. Two sets of color (IR) prints, and two sets of all necessary color IR diapositives.

h. Flight line index for the project on paper maps indicating the flight lines, beginning, and ending frames for each flight line along with altitude and negative scale of the photography.

i. Return all manuscript copies, horizontal & 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 remaining final products including CD ROM digital data files by:

b. All material to be furnished by the contractor shall be delivered at the Contractors expense to : **U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT, 1222 SPRUCE STREET, ST. LOUIS, MO., 63103-2833.**

6. 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.