APPENDIX F

SCOPE OF WORK
AERIAL PHOTOGRAPHY, DIGITAL ORTHOPHOTOGRAPHY
AND PLANIMETRIC FEATURE COLLECTION
For National Guard Training Sites
Contractor
Contract No. XXXX

Leaf Off Sites

1. Description of work

a. The contractor will supply all of the necessary faclities, equipment and personnel to provide GPS ground control,digital aerial imagery supplemented with airborne GPS to produce digital orthophotography (DOP) in 24 bit natural color for National Guard training facilities located in the below table (Attachment A). All DOP shall be acquired to allow for production at a later date of digital photogrammetric products that may include the development of a digital terrain model (DTM), topographic mapping (contours) and other real property features.

b. Refer to Attachment A for Site Locations, square mileage of site, required ground sample distance (GSD), and general timeframe of acquisition.

c. The Contractor will acquire GPS field control and aerial photography with airborne GPS for all sites. Boundary information will be shapefile data from NGB provided for each site, plus a buffer beyond the boundary. This buffer is included with each shapefile. All final map products are required to be referenced to the Universal Transverse Mercator (UTM) projection zone appropriate for the area and referenced to NAD83/HARN (Horizontal for each respective State), NAVD88 for the vertical, both units of measurement will be in meters. The final products which will be produced are as follows for all sites:

- map scale 1:1,200 digital orthophotography GSD 15 cm per pixel
- map scale 1:600 digital orthophotography GSD 7 cm per pixel

2. Information supplied by the Government

a. Facility boundaries supplied in digital form in ArcView Shapefile format, to be transmitted electronically to the contractor.

b. Points of contact at the facility to coordinate access for GPS field survey activity, and to assist in obtaining air space clearance for aerial photography.

c. All final products must be fully compliant with the "Mapping" Horizontal Data Accuracy Class of the ASPRS Positional Accuracy Standards for Digital Geospatial Data, previously known as Class 1. The aerial photography for the installations under this task order will be captured according to the timeframe listed in Attachment A, during leaf off conditions at each of the project sites. The contractor will coordinate with NGB POC at each site to determine the best flight window (timeframe) for each installation.

d. All final products must be fully compatible with ESRI products, ARC/INFO and ArcView platforms. Specific file formats required for digital orthophotography are:

> Untiled .TIF format with: TFW header files (RGB only) and in MrSID compressed formats with SDW file. The contractor will create a tiling scheme which fits over the supplied buffered shapefile for each installation (fully covering the shapefile). The acquired imagery shall extend to the limits of the proposed tiling scheme (full imagery tiles). There shall be no void pixels within the produced tiles. The projection information will be defined in the TFW (TIFF world file) as well as the AUX file for the MrSID rendition. Void pixels can occur within the overall mosaic Mr. Sid file. These void pixels shall be rendered in the color of white.

3. Work to be performed by the Contractor

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

Digital Orthophotography

a. The contractor will acquire all of the necessary photo control using GPS. The distribution and number of points will be appropriate to support ASPRS Mapping Class at 1:1,200, or 1:600. A digital file showing the flight acquisition plan for the site shall be submitted to the the NGB GIS manager and USACE St. Louis POC prior to the start of field operations. The contractor will prepare a GPS control report that will include point descriptions and/or photographs for each point as well as a digital file of the coordinate values for each point referenced to the appropriate UTM zone, NAD83/HARN NAVD88; both units of measurment will be in meters.

b. The contractor will acquire digital natural color aerial imagery according to the timeframe outlined in Attachment A, after deciduous foliage has fallen, during leaf off conditions. The imagery will be free of cloud cover, cloud shadows, snow, smoke and visible haze. Aerial imagery will be acquired using a large format digital camera equipped with airborne GPS (ABGPS). The imagery will be captured at an altitude suitable to support digital photgrammetric mapping at a scale of 1:1,200, or 1:600 and digital orthophotography with a 7 or 15 cm per pixel ground sample distance (GSD). Refer to Attachment A for the required GSD per installation. The

nadir (stereo) imagery will be used for the orthophoto production.

c. The aerial photographic acquisition plan must be designed to incorporate sufficient stereoscopic coverage so that production of the digital orthophotography will extend beyond the facility boundary to the proposed tiling scheme.

d. The Contractor will produce a digital flight line index showing the flight lines and ortho tiles for each installation.

e. The Contractor will develop a fully analytical aerotriangulation adjustment for the GPS control and aerial imagery/airborne GPS. The contractor may use soft copy instrumentation for point selection and measurement. The final adjusted control network must reference the Universal Transverse Mercator (UTM) system appropriate zone, NAD83/HARN, NAVD88, with both units of measurement in meters. The contractor will prepare a report and will submit copies of the completed report to the National Guard GIS manager and USACE St. Louis POC.

f. The Contractor will utilize the digital imagery to produce a surface model for rectification of the digital orthophotography. The surface model will be three dimensional and accurate to ensure the rectifcation of the corresponding orthoimagery to the required specifications, but will not include breaklines nor verification of its vertical accuracy for contour or other 3D modeling applications. The surface model created in this process and used for ortho rectification is not a required deliverable of this task order.

g. The Contractor will produce natural color digital orthophotography to the appropriate map scale and GSD, referred to in Attachment A. For installations with a GSD of 7 cm, the tile size will be 420 X 525 meters. For installations with GSD of 15 cm, the tile size will be 900 X 1,050 meters. The completed map tiles will reference the Universal Transverse Mercator (UTM) system in the appropriate zone, NAD83/HARN, NAVD88, both units in meters. The digital orthophoto map tiles will be written to an external hard drive in numerical sequence and will be identified by an alphanumeric name assigned using the following process:

The tile layout for each installation will originate at the northwest corner of the grid and will assign the northwestern most tile the designation of ***A1***. Letter designation will increase alphabetically moving south and numerical designation will increase moving east.

The completed digital orthophotos will be radiometrically processed to ensure maximum tone and contrast balance between adjacent tiles. The final digital orthophoto map tiles will be delivered in uncompressed TIF/TFW format.

h. The completed orthophotos will also be delivered in MrSID Generation 3 compressed format. A compressed mosaic will be assembled with a white background. The Contractor will prepare a separate .AUX file containing the datum, projection and units of measurement to accompany the compressed mosaic. Compression ratio for the Mr. Sid will be 20:1.

i. Project level FGDC compliant metadata for each installation.

Planimetric Feature Collection

a. The Contractor will develop high resolution planimetric mapping across the Camp Gruber Oklahoma site. Features to be collected are outlined in Attachment B, which is included with this task order. Planimetric features will be collected and formatted in accordance with SDSFIE standards version 2.6 and all planimetric features will be delivered in the ESRI Personal Geodatabase format, version 10.0. For linear layers, all features should be snapped together so a continuous network is maintained. Point, linear and polygon features (within and across feature classes) which share a common boundary/edge, will have coincident geometry (e.g. will not overlap or have gaps between features). The coincident geometry will be defined by a cluster tolerance that is appropriate for the scale and accuracy of the data.

b. Planimetric mapping will end at the installation boundary line. The boundary limits for Camp Gruber shall be supplied by the Government.

c. The contractor will supply DRAFT mapping for review by the government and will be supplied in an agreed upon format. The Government will have 21 calendar days after receipt of the DRAFT mapping to provide comments and/or redline edits back to the Contractor.

d. Contractor will also perform an ‘in-house’ Quality Control (QC) check of the data by having an independent review of the imagery to insure that all required features are collected and processed correctly.

4. Delivery Items

All deliverables for the task order are listed below. Two copies of all official deliverables are required.

a. Aerial imagery is not a deliverable and shall be maintained at the contractors facility for a period of 2 years at no additional cost to the government.

b. Digital ESRI compatible files for each installation showing the project plan will include the flight line locations, flight line start and stop points, digital map tile layout and GPS control point locations.

c. GPS control report including point description forms with sketches and photographs as well as an ASCII file containing coordinate values referenced to UTM zone, NAD83/HARN, NAVD88 both units in meters.

d. Analytical aerotriangulation adjument including an ASCII file of the completed aerotriangulation adjustment with a report detailing the process used. The adjusted control network must reference the Universal Transverse Mercator (UTM) and appropriate zone, NAD83/HARN, NAVD88 both units in meters.

e. Final full resolution orthophotography 24 bit natural color (RGB), will be delivered in TIF/TFW format and in MrSID (with .AUX file) compressed format MrSid Generation 3 with null pixels rendered in white. The Mr. Sid file will be an overall mosaic of each installation site.

f. Final digital planimetric mapping in ESRI Personal Geodatabase, version 10.0 depicting all features listed in Attachment B.

g. The contractor shall provide FGDC Compliant project level metadata per installation for all digital products created and delivered under this contract. Project level metatdata is sufficient.

5. SCHEDULE AND SUBMITTAL

a. All final products and deliverables must be delivered on or before **Date.**

b. All materials furnished to the Government shall be delivered at the Contractor's expense to: Contact Names, Shipping Addresses, e-mail, phone #

6. UNAUTHORIZED DIRECTION

Reference Contract Clause 52.243-1 Changes-Fixed Price (August 1987) Alternate III (1984): Only the Contracting Officer has authority to change the contract or issue a task order. No price or completion date changes can be made without approval from the Contracting Officer in advance of commencing work. The Contractor shall not accept directions from any Government employee or otherwise, other than the Contracting Officer, that would involve a change to the contract cost or final completion date.

7. TIME EXTENSIONS

a. Reference Contract Clause Section H Special Contract Requirements Item 2: If the schedules indicated in section 7, Deliveries and Performance, are exceeded due to causes beyond the control and without the fault or negligence of the A-E, as determined by the Contracting Officer, this task order will be modified in writing and the completion date will be extended one calendar day for each calendar day of delay. The A-E shall notify the Government of such delays.

b. Requests for time extensions for an individual task order should be forwarded to the Contracting Officer no later than fourteen (14) days preceding the completion date shown on the task order.

c. Points of contact:

Contact Names, Shipping Addresses, e-mail, phone #

8. GOVERNMENT PRICING ANALYSIS

Attachment C shows the format for the Government's pricing analysis for this example SOW. The contractor will submit a cost proposal in this format which the Government will compare with its independent cost estimate. Government independent cost estimates, when completed, are confidential, for Government use only.

ATTACHMENT A

Installation Name	State	GIS File	Buffer Distance (Meters)	GIS Square Miles (w/ buffer)	Ortho GSD	Timeframe	Notes
CAMP GRUBER	OK	Camp_Gruber_Buff_500	500	9.5	3 inch + Planimetric	Fall 2012	
CAMP JOSEPH T ROBINSON	AR	Camp_Robinson_Buff_1000	1000	75.2	6 inch	Spring 2013	
FORT CHAFFEE TRAINING CENTER	AR	Fort_Chaffee_Buff_1000	1000	143	6 inch	Spring 2013	
CAMP WILLIAMS	UT	Camp_williams_Buff_1000	1000	58.3	6 inch	Spring 2013	
PELHAM RANGE	AL	Pelham_Range_Buff_1000	1000	51.8	6 inch	Spring 2013	
FORT MCCLELLAN	AL	McCellan_Cantonment_and_MOUT_Buff_500	500	2.9	3 inch	Spring 2013	
RIVER ROAD TRAINING	DE	River_Road_Training_Site_Buff_500	500	1.3	3 inch	Spring 2013	
NEW CASTLE	DE	New_Castle_Buff_500	500	0.7	3 inch	Spring 2013	Late Spring
TS BBTS	DE	ts_bbts_Buff_500	500	1	3 inch	Spring 2013	
MCENTIRE	SC	McEntireBoundaryt_Buff_500	500	6.9	3 inch	Spring 2013	
CAMP LINCOLN	IL	Lincoln_Buff_500	500	1.3	3 inch	Spring 2013	
CHEYENNE	WY	WY_Cheyenne_UTM_13_Buff_1000_Ds	1000	6.3	3 inch	Spring 2013	
CAMP GUERNSEY	WY	2012_Guernsey_Bndy_6_Inch_Ds	1000	190	6 inch	Spring 2013	
MARSEILLES MTA	IL	Marseilles_Buff_500	500	7.8	Lidar 1'	Spring 2013	

ATTACHMENT B

Feature List

Army National Guard (ARNG) – Planimetric Feature Collection

Feature	Geometry	SDSFIE Entity Type	Feature Description	Additional Comments
paved road	Poly	road_area	Designated as traffic routes within the built-up or cantonment areas and training areas. Roads include the driveways leading from roadways to parking areas. Roads do not include internal vehicular circulation associated with another facility, such as an organizational vehicle parking area in a maintenance facility. Paved roads are those with surface treatment such as bituminous material, concrete, paving block, cobblestone, or gravel/tar.	Include shoulder area. Distinguish surface type by paved_d attribute (paved, unpaved) .
unimproved road	Poly	road_area	Definition per paved road. Unimproved roads are those without surface treatments described in the pave road definition.	Include shoulder area. Distinguish surface type by paved_d attribute (paved, unpaved) .
road centerline	Line	road_centerline	Road centerlines depict the center of the road area extent (from pavement edge to pavement edge). In cases where a physical barrier separates the directions of travel and restricts turning ability, such as concrete barriers or medians, two centerlines will be used to represent the directions of travel.	Populate d_rodtyp. Capture number of lanes within num_lanes. Continue centerlines over bridges and attribute tunnel_d, bridge_d, ramp_d as approperiate.
bridge, overpass, tunnel port	Poly	bridge_area	Bridge and overpass, a structure designed to carry vehicular traffic on roads in cantonment/built-up areas or training areas. Bridges are erected over a depression or an obstruction (such as water, a highway, or a railway); has a passageway for vehicles; and has an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of the openings for multiple boxes. The bridge may include multiple pipes where the distance between the pipes is less than half of the diameter/width of the smallest pipe opening. If the bridge opening is less than 20 feet or the distance between the pipes exceeds half the dimension of the smallest pipe, this structure is considered a culvert and is simply part of the roadway length and not accounted for separately.	
parking (paved)	Poly	vehicle_parking_area	An improved area that is paved with bitumen, concrete, paving block, cobblestone, or gravel/tar treatment, etc, and is used for parking of civilian, TOE/TDA military and commercial vehicles, trailers, and generators.	Distinguish surface type by paved_d attribute (paved, unpaved). Populate num_lanes.
parking (unpaved)	Poly	vehicle_parking_area	A semi-improved, unpaved area that is surfaced with sand, clay, gravel, or cinders and is used for parking civilian vehicles, TOE/TDA military and commercial vehicles, trailers, and generators.	Distinguish surface type by paved_d attribute (paved, unpaved). Populate num_lanes.
drive (paved)	Poly	road_area	Include within roads (road_area) feature class above.	Include within roads (road_area) feature class above.

drive (unpaved)	Poly	road_area	Include within roads (road_area) feature class above.	Include within roads (road_area) feature class above.
railroad signal	Point	railroad_feature_point	Signal located at intersections between rail and motor vehicle roads that have high-volume traffic.	
railroad	Line	railroad_centerline	Rail road tracks. Depict centerline of each rail line, spur, yard track, etc.	
building	Poly	structure_existing_area	A real property facility constructed on a space of land that is completely enclosed by a roof, walls, and usually flooring. It normally serves the purpose of occupancy, such as a headquarters, dwelling, office, storehouse, factory, laboratory, or hospital.	
building ruin	Poly	structure_existing_area	Same as building.	Include within building (structure_existing_area) above. Populate structhght.
shed	Poly	structure_existing_area	Same as building.	Include within building (structure_existing_area) above. Populate structhght.
swimming pool	Poly	swimming_pool_area	A fenced area specifically designed for an outdoor swimming pool that is used for aquatic recreation and athletic conditioning.	
sidewalk (public)	Poly	pedistrian_sidewalk_area	Pedestrian sidewalks and walkways either paved with concrete, paving blocks, bituminous material, etc, or with other surface materials (such as gravel).	
tank (unkown)	Poly	undefined_tank_area	Aboveground storage tank storing unkown substances.	
tank (water)	Poly	water_tank_area	A tank, either elevated or on-ground used to store potable or non-potable water.	Populate top_elv and elv_u_d. Use feet.
tank (fuel)	Poly	aboveground_storage_tank_area	Tanks for bulk or operational storage of liquid fuels or gases.	Populate top_elv and elv_u_d. Use feet.
tank (fuel)	Pointe	aboveground_storage_tank_point	Tanks for bulk or operational storage of liquid fuels or gases.	Use point geometry for tanks below miniumum mapping unit for polygon capture. Populate top_elv and elv_u_d. Use feet.
transmission tower	Point	comm_antena_point	A metallic aerial, antenna, or communications tower for sending and receiving electromagnetic waves (including telephone transmissions).	Populate elevation, elev_u_d, height and height_u_d.
pipeline	Line	undefined_utility_line	A pipe for which it's use and utility association is not currently known or defined (e.g., location identified by aerial photography but not yet verified by follow-up investigation).	Only above ground pipelines.
airport features	Poly	airfield_surface_area	Pavements, such as runways and rotary wing landing pads (facilities that are used for the takeoff and landing of fixed and rotary wing aircraft), taxiways (facilities used for the powered ground movement of aircraft between runway systems and other airfield facilities), and, aircraft aprons (facilities where aircraft are parked or moved about the airfield).	Populate sur_use_d and pave_typ.

obscured area, unknown object	Poly	obscured/unknown	Catch all layer for infrastructure objects/entities that cannot be identified through aerial imagery.	
cemetery	Poly	cemetary_area	A human remains cemetery or burial ground.	
golf course	Poly	golf_course_area	An golf course that is a grassy, turf-covered tract of land with tees, fairways, hazards, and greens providing for recreational golf.	
area under construction	Poly	construction_site	Area associated the development/construction/maintenance of a road, building, structure or facility.	
quarry	Poly	quarry site	Excavation site for the the removal of building stone, gravel, etc.	
sport field	Poly	athletic_field_area	A outdoor area for playing baseball, softball, football, etc.	
fence	Line	fence_line	A protective barrier to define the physical limits of an installation, activity, or area and to restrict, channel, or impede access.	
gate	Line	gate_line	The frame, gate, or other apparatus that allows or restricts access through the perimeter fences or walls of an installation.	
substation	Point	electrical_substation_point	A substation to step down the voltage of the electric power supply before it enters the distribution network. Normally a substation consists of incoming power lines (higher voltage), transformers to step down the incoming voltage, switchgear to distribute the stepped down power, and necessary safety and security equipment.	
transformer	Point	electrical_transformer_bank_point	Pole or pad mounted transformer banks. Transformers are electrical system components that convert the supplied power (incoming) voltage before transmitting it further (outgoing) in the electrical distribution network.	
transmission line	Line	electrical_cable_line	Electrical power lines that distribute electrical power by means of an aboveground network.	
utility pole, power light pole	Point	utility_pole_tower_site	Supports for poles for electrical power lines.	Populate polehieght and dim_u_d.
concrete slab	Poly	slab_area	A load-bearing pad, base, apron, or platform upon which various types of equipment are positioned. Missile systems, radar, generators, and transformers are equipment frequently placed on such pads. These structures are also used for the placement of refuse/garbage collection receptacles and other similar items.	
culvert	Poly	culvert_centerline	The centerline of a pipe or strucutre, the purpose of which is for the interception and conveyance of surface water transported in open drainage lines and ditches.	
doc/pier	Poly	mooring_facility_area	A structure extending outward from the shoreline into navigable waters that is used for the loading and unloading of ammunition or supplies from boats and ships or the berthing, fueling, or repair of boats and ships. These structures may be open or covererd.	

Attachment C – Form used for Contractor and Government Cost Estimates

National Guard Training Sites
Contractor
Contract #
Task Order #

DIRECT LABOR	HOURS	HOURLY RATE	LABOR COST
Project Manager	_____	$____.__	$_____.__
Quality Manager	_____	$____.__	$_____.__
Supervisory Photogrammetrist	_____	$____.__	$_____.__
Photogrammetric Tech (AT)	_____	$____.__	$_____.__
Aerial Photography Pilot	_____	$____.__	$_____.__
Aerial Photographer	_____	$____.__	$_____.__
Airborne GPS Ground Engineer	_____	$____.__	$_____.__
Ortho Technician	_____	$____.__	$_____.__
GIS Technician	_____	$____.__	$_____.__
Stereo Technician	_____	$____.__	$_____.__
Survey Office Engineer (PLS)	_____	$____.__	$_____.__
Survey Supervisor (Party Chief)	_____	$____.__	$_____.__
Survey Instrument Technician	_____	$____.__	$_____.__
Survey Technician	_____	$____.__	$_____.__
Subtotal--Direct Labor	**Use hourly contract rates**		$_____**A**_.__
Overhead on Direct Labor and General and Admin. Overhead Combined	____% **Use contract OH, G&A**		$_____**B**_.__

OTHER DIRECT COST	UNIT	UNIT RATE	ODC COST
Aircraft (twin engine piston) w/ABGPS/hour	_____	$_____.__	$_____.__
Aircraft (twin engine turbine) w/ABGPS/hour	_____	$_____.__	$_____.__
LIDAR sensor/hour	_____	$_____.__	$_____.__
Large Format Digital sensor/hour	_____	$_____.__	$_____.__
Lodging/Per Diem/day	_____	$_____.__	$_____.__
Vehicle Rental/day	_____	$_____.__	$_____.__
Hard Drive/each	_____	$_____.__	$_____.__
Subtotal—Other Direct Costs	**Use unit contract rates**		$_____**C**_.__
Subtotal--DL, OH & Other Direct Costs			**$A + $B + $C**
Profit (negotiated for individual task orders)		___%	$_____**D**_.__
(SUBCONTRACT) Flight (if not performed by prime contractor)			$_____**E**_.__
(SUBCONTRACT) Ground Control (if not performed by prime contractor)			$_____**F**_.__
PROJECT GRAND TOTAL			**$A + $B + $C + $D + $E + $F**

Prepared By: _____ Date: _____

Reviewed By: _____ Date: _____

Approved By: _____ Date: _____