



Republic of the Philippines  
Department of Agriculture  
**PHILIPPINE RURAL DEVELOPMENT PROJECT**  
National Project Coordinating Office  
Elliptical Road, Diliman, Quezon City

## **TERMS OF REFERENCE**

### **ACQUISITION OF UNMANNED AERIAL VEHICLES (UAV)/DRONES IN PLANNING, MONITORING AND EVALUATION OF FARM-TO-MARKET ROAD AND ENTERPRISE DEVELOPMENT OF THE DEPARTMENT OF AGRICULTURE-PHILIPPINE RURAL DEVELOPMENT PROJECT WITH TECHNICAL TRAINING ON THE APPLICATION**

#### **BACKGROUND**

The Philippine Rural Development Project is a six-year-project of the Department of Agriculture, World Bank and Local Government Unit which focuses on increasing rural incomes and enhance farm and fishery productivity in targeted areas by supporting smallholders and fisherfolk to increase their marketable surpluses and their access to markets.

The Project utilizes following planning tools : VSA, eVSA, PCIP, Applied Geotagging Technology (AGT) and Economic & Financial Analysis (EFA) for review and approval of subprojects and will be later used for basis of impact evaluation. These tools are supplemented with maps for visual by using free available online maps provided by google earth, bing maps, open street map & others.

In rural infrastructure such as roads and potable water systems, elevation data gained from online maps is essential for hydraulic analysis, specifically for tributaries such as river, creek and water impounding/catchment areas for planning and designs. Applied geo tagging technology tool serves as a complementary monitoring tool in the progress of sub projects and operational compliance, specifically for internal operations of the Project. The same tool will be utilized for the conduct of impact evaluation on the ground.

The above stated tools have significantly contributed to the improvement of planning and monitoring investments of the Project. It has also strengthened the transparency and accountability mechanism in project implementation and supervision. These tools have also helped the Project financially as through AGT, it was able to determine overlapping proposed sub projects, absence of road influence area and parallelism of proposed roads.

However, since these tools are free, it has limitations which hinders the Project in maximizing its fullest potential. The online maps do not provide reliable

satellite imagery which is necessary for in-depth analysis. This free maps cannot be used for delineation of agricultural and built up areas and can only be used for jurisdictional boundary presentation of data. This cannot complement to the tool being utilized by the Infrastructure Component which is Automated Computer Aided Design (AutoCAD). Further, the absence of high resolution satellite images and the inability to capture aerial videos for monitoring & analysis purposes, data that can be utilized by the Project is limited to online resources.

With these limitations and the constantly evolving technology in farming, there is a need to collect accurate, reliable georeferenced (GPS coordinates) data. These technologies are essential in crop identification and monitoring, land use classification, typhoon damage assessment, pest incidence, cropping pattern and project survey, monitoring and impact evaluation.

Unmanned Aerial Vehicles (UAVs) are emerging as a cost effective way to collect data with many advantages over the traditional forms listed above. UAVs are as the name suggests an unmanned vehicle which flies over the paddock to collect data. These machines are generally compact, can be cheap, mechanically simple, fly below cloud cover and are on their way to being easy to operate with advanced autopilot systems.

Unmanned Aerial Vehicles (UAVs) can be used safely in the agricultural sector for a range of tasks including monitoring crop health, weed mapping, irrigation/drainage design and farm planning. Where short turnaround time between data capture and delivery/analysis is required the UAV technology provides a valuable tool to assist decision-making.

There is no doubt that UAVs will become a regular tool in the effective management of agricultural production throughout the globe. The integration of rapid data capture and turn-around time meets many of the requirements of broad acre agriculture in an age when precision agriculture and automation are becoming the norm. Whilst at present there is significant research in the use of UAV technology, mainly in the development of agricultural specific cameras, there are commercially available products that are working now. <http://agmapsonline.com/>

## **OBJECTIVES AND EXPECTED DELIVERABLES**

The Unmanned Aerial Vehicles (UAV) units will be delivered within two (2) weeks from the date of the issuance of Purchase Order and the technical training on the application shall be done for a period of five (5) days. The key outputs and deliverables are shown below:

1. Acquisition of Unmanned Aerial Vehicle (UAV) Survey System/drones (fixed-wing type and four-rotor type); and desktop computer for image

- post flight processing, remote sensing and spatial analysis (see equipment and specification);
2. Training Design on Flight Planning, Drones Operation and Image Processing;
  3. Conduct of technical training on the operation (Flight Planning and Drones Operation) and maintenance of UAV;
  4. Conduct of technical training on image processing (remote sensing and geospatial analysis) of the UAV aerial images such as image correction, vegetation classification (crop identification), accuracy assessment, geo-referenced Orthomosaic and Digital Elevation Model aerial images.

## **SCOPE OF WORK**

The Technical Training on the UAV Application shall undertake the following works:

1. Conduct of technical training course on the operation and maintenance of UAV; Course topic includes:
  - i. Philippine Air Law, Rules & Regulations
  - ii. Aeronautical Safety
  - iii. Safety and precaution of radio control electric power UAV system
  - iv. Introduction to basic radio control and Auto Pilot, flight control
  - v. Aeronautical Communications
  - vi. Theory of Flight and Aerodynamics
  - vii. Aeronautical Knowledge
  - viii. Meteorological Aeronautics
  - ix. Air Turbulence
  - x. Navigation
  - xi. Human Factors
  - xii. Basic Radio control set up
  - xiii. Assembly and Calibration
  - xiv. Repairs and Settings
  - xv. Power Management
  - xvi. Principles of Radio Transmissions
  - xvii. Basic Computer Simulation Training
  - xviii. Introduction to Mission Planning
  - xix. Ground Control Station Monitoring
  - xx. Traffic pattern flight training
  - xxi. Standard Flight Maneuvers
  - xxii. Line of Sight Flight
  - xxiii. Pilot SOP Flight Logging
  - xxiv. Pre/Post Flight Checks
  - xxv. Supervised Flight Exercises
  - xxvi. Take off and landing practice
  - xxvii. Data link and retrieval
2. Conduct of technical training on remote sensing and geospatial analysis (image post processing) of the UAV images such as image correction/rectification, vegetation classification (crop identification), accuracy assessment, generating geo-referenced Orthomosaic and

Digital Elevation Model aerial images (preferably using open source software).

- i. Image Processing
  - 1. Image correction
  - 2. 2D & 3D maps
  - 3. Digital Elevation Model (DEM)
- ii. Image analysis
  - 1. Plant identification/classification
  - 2. Differentiating plant species
  - 3. Plant area estimation
  - 4. Land Use classification
  - 5. Plant count, plant health
  - 6. Change detection
  - 7. Etc.

**DURATION OF UAV ACQUISITION AND TECHNICAL TRAINING**

The acquisition of UAV with technical training shall be engaged for a period of twenty (20) calendar days. The total number of working days is computed as follows:

Scope of Works/Activities	Time Frame	Outputs
Procurement of goods	15 calendar days	Logistic equipment (UAV & desktop) purchased.
Technical training on UAV operator for aerial survey, post-flight image processing, remote sensing and geospatial analysis.	5 calendar days	PRDP Geomapping & Governance Unit (National Project Coordinating Office (NPCO) and Project Support Office (PSO)) technical staff trained on UAV flight operation, maintenance, post-flight image processing, remote sensing and geospatial analysis.
Presentation of post-flight image processing from aerial images, remote sensing and geospatial analysis.		Geo-referenced Orthomosaic and Digital Elevation Model from aerial images, vegetation classification (crop identification), landuse

**Equipment and Specification**

The winning bidder shall have the following equipment and its specification required in the performance of this engagement:

- 1. Installation and Training ----- Php 350,000.00
- 2. Equipment acquisitions----- Php 2,900,000.00
  - 2 units fixed Wing UAV with accessories
  - Four (4) extra batteries with charger
  - Extra pair of wings

- Land based battery system for communication post
  - Annual maintenance
  - Flight Plan software
  - Post Flight image processing software (1 license)
  - Multispectral Camera
  - Minimum of forty-five (45) minutes battery life per flight
- 1 Unit Desktop Personal Computer
    - 3.2 Ghz Dual Processors (2 CPU/processors motherboard) system or current equivalent CPU
    - 32 GB Ram
    - 256 SSD Drive or PCI based SSD, and 1 TB hard drive
    - 16 GB video card PCI-E
    - 23" slim LED HD Monitor HDMI
    - Bluetooth keyboard and mouse
    - 1200-1500 mAh UPS
- 2 units Four-Rotor UAV with accessories
    - Twelve (12) extra batteries with charger
    - With collision avoidance sensor
    - 4 units of extra rotor wings
    - Annual maintenance
    - Flight Plan software (beta if available)
    - 1 unit Multispectral Camera and 1 unit Visible Light Camera
    - Minimum of twenty-five (25) minutes battery life per flight

All hardware and spare parts be delivered as package, and ensure that it is available at the local market.

The UAV and equipment shall be turned over to DA at the end of the contract engagement.

### **ADMINISTRATIVE ARRANGEMENTS**

The technical personnel will be coordinating and working under the supervision of DA-PRDP National Project Coordinating Office-Geomapping and Governance Unit. The NPCO will be responsible to review and approve all deliverables made by the Team following the DA-PRDP's technical criteria/guidelines for acceptance.

All deliverables will be subject to approval and acceptance by NPCO before any payment is made following the usual accounting and auditing rules and regulations.

## SCHEDULE OF PAYMENTS

Scope of Works/Activities	Amount(Php)	Outputs
Procurement of goods	3,250,000.00	All logistic equipment (UAV & desktop)purchased.
Submission of Inception Report		Inception Report
Training of UAV operator for aerial survey, post-flight image processing, remote sensing and geospatial analysis.		PRDP Geomapping & Governance Unit (National Project Coordinating Office (NPCO) and Project Support Office(PSO)) technical staff trained on UAV flight operation, maintenance, post-flight image processing, remote sensing and geospatial analysis.
Presentation of post-flight image processing from aerial images, remote sensing and geospatial analysis.		Geo-referenced Orthomosaic and Digital Elevation Model from aerial images, vegetation classification (crop identification), landuse
Submission of Completion Report		Completion Report
TOTAL	3,250,000.00	