Document Title	Specifications – Drone survey equipment and related software and maintenance contract
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1. Definitions

- TP = Transnet Property
- OD = Operational Divisions
- IMU = Inertial measurement Unit
- LCD = Liquid Crystal Display
- LIDAR = Light Detection and Ranging. Remote sensing method
- DRONE = UAV = Unmanned aerial Vehicle
- EIRP = Equivalent Isotropic Radiated Power
- FCC = Federal Communications Commission
- CE = Certification Mark of products marketed in European countries
- SRRC = Square Root Raised Cosine filter (signal filter)
- GNSS = Global Navigation satellite system
- GPS + GLONASS + BeiDou + Galileo
- PPK = Post Processed Kinematic
- RTK = Real Time Kinematic
- VTOL = Vertical Takeoff and Landing
- Geospatial relates to data that can be used to identify and locate positions of physical objects/assets on the earth's surface.

2. BACKGROUND

2.1. Transnet Property (TP), Geo-Spatial uses various survey equipment, including but not limited to Total stations and GPS's , to execute surveys (topographical, engineering etc.) for Transnet Property, other Transnet OD's to verify geospatial data for the drawing office.

2.2. Drone survey is new technology and the future for survey existing infrastructure and topographical surveys. Being electronic/computerized the equipment needs to be well maintained and constant software upgrades are required.

2.3. Transnet Property (TP), Geo-Spatial intends to enter the market for the purpose to procure six (6) systems for the Drone survey equipment along with the related software and accessories required for the six (6) Geo-Spatial offices as specified in Section 3 below.

3. DRONE SURVEY EQUIPMENT REQUIREMENTS

The supplier is required to supply Transnet Property (Geo-Spatial) with six (6) complete Drone (multi-rotor VTOL) technology systems and related software, hardware and maintenance contracts as specified in Table 1 below.

Regional Offices	**QTY**	**Product Description**
Cape Town	1	Complete Drone technology, Software, Hardware, Maintenance contract, accessories
Gqeberha (PE)	1	Complete Drone technology, Software, Hardware, Maintenance contract, accessories
Durban	1	Complete Drone technology, Software, Hardware, Maintenance contract, accessories
Pretoria	1	Complete Drone technology, Software, Hardware, Maintenance contract, accessories
Bloemfontein	1	Complete Drone technology, Software, Hardware, Maintenance contract, accessories
Johannesburg	1	Complete Drone technology, Software, Hardware, Maintenance contract, accessories
	6	

Table 1: Drone technology systems, Software, Hardware, Maintenance contract survey equipment requirements for Transnet Property

4. Technical and functional requirements

4.1. DRONE/AIRCRAFT

- Dimensions (unfolded, without propellers), 900×700×500 mm (L×W×H)
- Dimensions (folded, with propellers), 450×450×450 mm (L×W×H)
- Diagonal Wheelbase, 900 mm
- Weight (with single downward gimbal)
    - Without batteries: Approx. 4 kg
    - With two batteries: Approx. 7 kg
    - Single Gimbal Damper's Max Payload, 1kg
    - Max Take-off Weight, 10 kg

- Transmitter Power (EIRP)
    - 2.4000-2.4835 GHz:
      < 33 dBm (FCC)
      < 20 dBm (CE/SRRC/MIC)
    - 5.150-5.250 GHz (CE: 5.170-5.250 GHz):
      < 23 dBm (CE)
    - 5.725-5.850 GHz:
      < 33 dBm (FCC/SRRC)
      < 14 dBm (CE)
- Hovering Accuracy (with moderate or no wind)
    - Vertical:
      ±0.1 m (with vision positioning)
      ±0.5 m (with GNSS positioning)
      ±0.1 m (with RTK positioning)
    - Horizontal:
      ±0.3 m (with vision positioning)
      ±1.5 m (with GNSS positioning)
      ±0.1 m (with RTK positioning)
- RTK Positioning Accuracy (RTK FIX)
    - 1 cm + 1 ppm (horizontal)
    - 1.5 cm + 1 ppm (vertical)
- Max Angular Velocity
    - Pitch: 300°/s
    - Yaw: 100°/s
- Max Pitch Angle, 30°
- Max Ascent Speed, 6 m/s
- Max Descent Speed (vertical), 5 m/s
- Max Tilted Descent Speed, 7 m/s
- Max Horizontal Speed, 23 m/s
- Max Flight Altitude 5000 – 7000m
- Max Wind Speed Resistance, 12 m/s
- Max Flight Time, 55 minutes.
- Supported Gimbals
    - Third-Party Payload
- Supported Gimbal Configurations

    - Single downward gimbal
    - Single upward gimbal
    - Dual downward gimbals
    - Single downward gimbal + single upward gimbal
    - Dual downward gimbals + single upward gimbal
- Ingress Protection Rating, IP55.
- Global Navigation Satellite System, GPS + GLONASS + BeiDou + Galileo
- Operating Temperature, -20° to 50° C (-4° to 122° F)

Remote Controller

- Screen, 170-200mm LCD touchscreen; resolution: 1920×1200; max brightness: 1200 nits (for visibility in the sun)
- Weight
    - Approx. 1.25 kg (without battery)
    - Approx. 1.50 kg (with battery)
- Global Navigation Satellite System, GPS + Galileo + BeiDou
- Built-in Battery Charging Type: Use the battery station or USB-C fast charger with a max power of 65 W (max voltage of 20 V).
    - Type: Li-ion (6500 mAh@7.2 V)
    - Charging Time: 2 hours
- External Battery
    - Capacity: 4920 mAh
    - Voltage: 7.6 V
    - Type: Li-ion
    - Energy: 38 Wh
    - Chemical System: LiCoO2
- Ingress Protection Rating IP54
- Operating Time
    - Built-in Battery: approx. 3.3 hours
    - Built-in Battery + External Battery: approx. 6 hours
- Operating Temperature -20° to 50° C (-4° to 122° F)
- Operating Frequency
    - 2.4000-2.4835 GHz
    - 5.725-5.850 GHz

- Transmitter Power (EIRP)
    - 2.4000-2.4835 GHz: < 33 dBm (FCC) < 20 dBm (CE/SRRC/MIC)
    - 5.725-5.850 GHz: < 33 dBm (FCC), < 14 dBm (CE), < 23 dBm (SRRC)
- Wi-Fi Protocol - Wi-Fi 6
- Wi-Fi Operating Frequency
    - 2.4000-2.4835 GHz
    - 5.150-5.250 GHz
    - 5.725-5.850 GHz
- Bluetooth Protocol Bluetooth greater than 5.1
- Bluetooth Operating Frequency 2.4000-2.4835 GHz

Video Transmission

- Video Transmission System
- Enterprise Transmission
    - Antenna
    - 4 video transmission antennas, 2T4R
- Max Transmission Distance (unobstructed, free of interference)
    - 20 km (FCC)
    - 8 km (CE/SRRC/MIC)
- Max Transmission Distance (with interference)
    - Low Interference and Obstructed by Buildings: approx. 0-0.5 km
    - Low Interference and Obstructed by Trees: approx. 0.5-3 km
    - Strong Interference and Unobstructed: urban landscape, approx. 1.5-3 km
    - Medium Interference and Unobstructed: suburban landscape, approx. 3-9 km
    - Low Interference and Unobstructed: suburb/seaside, approx. 9-20 km

Vision System

- Obstacle Sensing Range
    - Forward/Backward/Left/Right: 0.7-40m.
    - Upward/Downward: 0.6-30m.
- Field of View (FOV)

- Forward/Backward/Downward: 65° (horizontal), 50° (vertical)
- Left/Right/Upward: 75° (horizontal), 60° (vertical)

- Operating Environment,
    - Surfaces with discernible patterns and adequate lighting (lux > 15)

Infrared Sensing System

- Obstacle Sensing Range 0.1-8 m
- FOV 30° (±15°)
- Operating Environment Large, diffuse, and reflective obstacles (reflectivity > 10%)

LED Auxiliary Light

- Effective Illumination Distance 5 m
- Illumination Type 60 Hz, solid glow

FPV Camera

- Resolution 1080p
- FOV 142°
- Frame Rate 30fps

Intelligent Flight Battery

- Capacity 5880 mAh
- Voltage 44.76 V
- Type Li-ion
- Energy 263.2 Wh
- Weight Approx. 1.35 kg
- Operating Temperature -20° to 50° C (-4° to 122° F)
- Ideal Storage Temperature 22° to 30° C (71.6° to 86° F)
- Charging Temperature -20° to 40° C (-4° to 104° F)
- Charging Time, with a 220V power supply, 60 minutes to fully charge two Intelligent Flight Batteries

Intelligent Battery Station

- Dimensions 600×400×300 mm (L×W×H)
- Net Weight Approx. 9 kg
- Compatible Stored Items
    - Eight Intelligent Flight Batteries
    - Four Intelligent Batteries

- Input Voltage
    - 100-120 VAC, 50-60 Hz
    - 220-240 VAC, 50-60 Hz
- Max Input Power 1070 W
- Output Power
    - 100-120 V: 750 W
    - 220-240 V: 992 W
    - Operating Temperature -20° to 40° C

4.2. Specifications Camera

- **Dimensions, 200**×200×150 mm
- **Weight,** Approx. 800 g
- **Power,** 20W
- **IP Rating,** IP4X
- **Operating Temperature Range,** -20° to 50° C (-4° to 122° F)
- **Storage Temperature Range,** -20° to 60° C (-4° to 140° F)
- **Absolute Accuracy,** Horizontal: 3 cm, Vertical: 5 cm *
  * Using Mapping Mission at a GSD of 3 cm and flight speed of 15 m/s, with an 75% front overlap rate and a 55% side overlap rate.

Camera Sensor

- Sensor size (Still): 35.9×24 mm (Full frame)
  Sensor size (Max video recording area): 34×19 mm
  Effective Pixels: 45MP
  Pixel size: 4.4 μm

- **Supported Lenses**
    - DJI DL 24mm F2.8 LS ASPH (with lens hood and balancing ring/filter), FOV 84°
      DJI DL 35mm F2.8 LS ASPH (with lens hood and balancing ring/filter), FOV 63.5°
      DJI DL 50mm F2.8 LS ASPH (with lens hood and balancing ring/filter), FOV 46.8°
- **Supported SD Cards,** SD: UHS-I rating or above; Max capacity: 512 GB
- **Storage Files,** Photo / GNSS Raw Observation Data/ Image Log File

- **Photo Size,** 3:2 (8192×5460)
- **Operation Modes,** Photo, Video, Playback
- **Minimum photo interval,** 0.7 s
- **Shutter Speed,**
    - Mechanical Shutter Speed: 1/2000-1 s
    - Electronic Shutter Speed: 1/8000-1 s
    - Aperture value no larger than f/5.6
- **Aperture Range,** f/2.8-f/16
- **ISO Range,**
    - Photo: 100-25600
    - Video: 100-25600

Video

- **Video Format, (**MP4, MOV)
- **Video Resolution**
    - 16:9 (1920×1080)
    - 16:9 (3840×2160)*Only 35mm lens supported
- **Frame Rate,** 60fps

Gimbal

- **Stabilized System,** 3-axis (tilt, roll, pan)
- **Angular Vibration Range,** ±0.01°
- **Mount,** Detachable third party
- **Mechanical Range**
    - Tilt: -130° to +40°;
    - Roll: -55° to +55°;
    - Pan: ±320°

4.3 Lidar Specifications

- GNSS RTK system with built in IMU
- User friendly mounting
- Multiple platforms

- Easy to use processing software
- System Platform
    - ±1kg
    - Power supply/voltage : DC9 ~ 36V
    - Power consumption : 17W without camera/ 24W with camera
    - Operating temperature : -10°C ~ +40°C
    - Dust & Waterproof : IP64
    - Data storage : 256GB ~ 1TB USB
- Scanner Performance
    - Laser class : Class 1 Eye safe
    - Wavelength : 905nm
    - Measurement Range : 0,5m ~ 300m
    - Field of View : 360°
    - Horizontal Resolution : 0.09° ~ 0.36°
    - Vertical resolution : 1.3°
    - Returns supported : Single, Dual & Triple
    - Max Effective Measurement rate : 640000 pts/sec/Single Return, 1280000 pts/sec/Dual return, 1920000 pts/sec/triple return
    - Lidar Accuracy/Precision : 10mm/5mm
    - Point Cloud Precision : ±2,5cm
- GNSS/IMU Performance
    - Positioning Accuracy : 0.5cm +1ppm (PPK) / 1cm+1ppm (RTK)
    - GNSS data rate : up to 100Hz
    - IMU data rate : up to 2000Hz
    - Roll & Pitch Accuracy : <0.01°
    - Heading Accuracy : <0.05°

4.4 Accessories

- Industry standard associated UAV accessories

4.4 Data Transfer

Data transfer to be as simplistic as possible to avoid time delays in sending data to processor. Data transfer should be compatible to industry standard formats.

4.5 Software upgrade/maintenance

Should there be any software upgrade during the maintenance period of three years it should be updated to the latest software version. Maintenance and servicing to be done by local supplier. All support and training to be done by the supplier and proof that the supplier is qualified to provide support and training. Software updates usually

comes with new tools and functionality that were not part of the previous version. The service provider will always make the latest software version available on a physical data storage device or through their website. Upgrade installation guidelines should be provided.

4.6 Telephonic technical support/Training

Telephonic technical assistance to be offered to the end user when they experience challenges with the use of the software and operation of the equipment. The service provider should be available during the office hours stated in the agreement. Training to be provided on receipt of the Drone survey equipment, software and accessories.

4.7 Warranty (Mandatory items)

- No grey products will be considered.
- Minimum warranty of 3 years. (May be a combination of Supplier and Manufacturer warranty).
- Maintenance period of 3 years.

5. Supplier support conditions

The service provider must specify the nature of the support that is outside the normal software annual maintenance service and the related rate per hour. Supplier should be reachable from 7:30 to 17:00 weekdays.

6. Deliverables

The survey Drone systems and all accessories as listed in Table 1 above above to be delivered to the six (6) Geo-Spatial Transnet offices in Cape Town, Gqeberha, Durban, Bloemfontein, Johannesburg and Pretoria on receipt of payment.

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Terence Stiles

Date: 18/03/2024