RAND WATER

ANNEXURE 1

Detailed deliverables and specifications of complete UAS operational equipment, software and accessories

FOR BID NUMBER: _____

DESCRIPTION: Purchase of a complete Unmanned Aircraft System (UAS) together with Lidar and Photogrammetry sensors, survey and operational equipment, software and accessories.

1. COMPLETE UNMANNED AIRCRAFT SYSTEM (UAS)/(DRONE)

Deliverables:

1.1. Aircraft (including carry case with wheels, Controller and lanyard/harness, and warranty)
1.2. UAS Intelligent battery station
1.3. UAS Intelligent flight batteries x 4
1.4. UAS Intelligent battery case
1.5. UAS Landing pad
1.6. Photogrammetry/survey processing software
1.7. UAS Commissioning and operations training
1.8. Data Processing training
1.9. Handheld VHF radio
1.10. Ground control points x 10
1.11. Aviation first aid kit
1.12. Fire extinguisher

Specifications:

1.1. Aircraft (including carry case with wheels, controller and controller lanyard and warranty)

Takeoff Weight (without batteries)	5020 ± 20 g
Takeoff Weight (with batteries)	9740 ± 40 g
Max Takeoff Weight	15.8 kg
Dimensions (Unfolded)	980 × 760 × 480 mm (with landing gear)
Dimensions (Folded)	490 × 490 × 480 mm (with landing gear and gimbal)
Carrying Case Dimensions	779 × 363 × 528 mm
Max Payload	6 kg
Propeller Size	25 inches
Diagonal Wheelbase	1070 mm
Max Ascent Speed	10 m/s
Max Descent Speed	8 m/s
Max Horizontal Speed	25 m/s
Max Takeoff Altitude	7000 m
Max Flight Time (no wind)	59 minutes
Max Hover Time (no wind)	53 minutes
Max Flight Distance (no wind)	49 km
Max Wind Resistance	12 m/s
Max Yaw Angular Velocity	100°/s
Max Pitch Angle	35°
Operating Temperature	-20° to 50° C
Ingress Protection	IP55

GNSS & Positioning	
Supported GNSS	GPS + Galileo + BeiDou + GLONASS (with RTK enabled)
Hovering Accuracy (Vision)	Vertical ±0.1 m, Horizontal ±0.3 m
Hovering Accuracy (Satellite)	Vertical ±0.5 m, Horizontal ±0.5 m
Hovering Accuracy (RTK)	Vertical ±0.1 m, Horizontal ±0.1 m
RTK GNSS Accuracy	1 cm + 1 ppm (H), 1.5 cm + 1 ppm (V)
RTK Heading Accuracy	< 2°
Airborne ADS-B In	Equipped, dual antennas, reception up to 20 km

Gimbal	
Max Payload (Single Connector)	1400 g
Max Payload (Dual Connector)	950 g
Max Payload (Third Connector)	3 kg (quick release), 6 kg (screw lock)

Sensing & Obstacle Detection	
Omnidirectional binocular vision system, horizontal rotating LiDAR, upper LiDAR, downward 3D infrared range sensor, and six-direction mmWave radar.	
Forward/Backward FOV	90° × 90°, range up to 200 m
Lateral FOV	90° × 90°, range up to 200 m
Downward Range	0.5 – 19 m, FOV 160°/105°
Rotating LiDAR	0.5–100 m, 360° (H), 58° (V), 520k pts/sec
Upper LiDAR (ToF)	0.5–25 m at night, 60° × 60°
Downward Infrared Sensor	0.3–8 m, 60° × 60°
mmWave Radar	Power line detection up to 50 m, FOV ±45°

FPV & Video Transmission	
Resolution	1080p, 30 fps
Field of View	150° DFOV, 139.6° HFOV, 95.3° VFOV
Night Vision	Starlight grade
Transmission Range	40 km (FCC), 20 km (CE/SRRC/MIC)
Max Download Speed	80 Mbps (standard), 25 MB/s playback
Antennas	8 WLAN, 2 sub2G, 4G × 4, 2T4R mode

Remote Controller	
Screen	7.02 inches, 1920 × 1200, 1400 nits, 60 fps
OS	Android 11
RAM/ROM	8 GB / 128 GB, expandable
Battery	6500 mAh internal + optional WB37 external

Runtime	3.8 h internal, 3.2 h external
Weight	1.15 kg (without external battery)
GNSS	GPS + Galileo + BeiDou
Interfaces	HDMI 1.4, USB-C, USB-A, SD 3.0

1.2. Intelligent Battery Station

Model	BS100
Weight	11.8 kg
Dimensions	605 × 410 × 250 mm
Input	100-240 V AC, 50/60 Hz, 10 A
Output	Up to 2184 W depending on voltage
Charging Channels	3 × TB100, 2 × WB37
Charging Time (220V)	45 min fast, 110 min silent

1.3. UAS Intelligent Flight Battery (4 number off)

Battery Model	TB100
Capacity	20,254 mAh (977 Wh)
Voltage	48.23 V (Max 54.6 V)
Weight	4720 ± 20 g
Operating Temp	-20° to 75° C
Charging Temp	5° to 45° C
Cycle Count	400
Heating	Supported (single, onboard, station)

1.4. UAS Intelligent Flight Battery Carry Case

- Flight Case
- Aluminium rigidized
- Case must fit minimum 4x TB100 intelligent flight batteries and 2-3 WB37 batteries
- Case must have wheels and handles
- Custom foam interior for batteries

1.5. UAS Landing Pad

- Size: 1200mm
- Carry case
- Holding down pegs

1.6. Photogrammetry/Survey processing software (1 Seat annually)

The software shall be a professional-grade geospatial and survey office processing suite, designed for handling complex datasets from multiple survey sensors. It must provide an integrated environment for data processing, adjustment, visualization, and deliverable creation from sources such as UAV LiDAR, aerial photogrammetry, GNSS, total stations, mobile mapping, and terrestrial laser scanning. The system shall enable engineering-accurate results with full interoperability with industry-standard CAD, GIS, and BIM platforms.

The processing software licenses shall be capable of installation on the Company's servers or network infrastructure and shall permit access for up to two authorized users, with any one of the two able to utilize the license at a given time for the processing of data.

1.6.1. Functional Requirements

a) Data Integration:

- Import, process, and manage raw measurements from GNSS, total stations, levels, UAVs, LiDAR sensors, terrestrial and mobile laser scanners in a unified environment.
- Provide traceability of metadata including sensor calibration, rod heights, prism constants, timestamps, and survey notes.
- Support synchronization with field data collection systems and machine control systems.

b) Photogrammetry Processing:

- Ingest UAV imagery and generate calibrated tie-points and ground control point adjustments.
- Produce high-resolution orthophotos, photogrammetric point clouds, and elevation raster models.
- Automate aerial triangulation workflows and deliver georeferenced raster datasets.

c) LiDAR & Point Cloud Management:

- Import and register aerial, mobile, and terrestrial LiDAR datasets with survey control.
- Perform automated and semi-automated classification using machine learning/deep learning.
- Extract vector features, cross-sections, and surfaces directly from point cloud data.
- Compare as-built point clouds to design meshes and generate heat maps for tolerance checks.

d) Survey Computations & Adjustments:

- Perform least-squares network adjustments integrating GNSS, total station, and levelling data.
- Compute traverse closures, misclosures, and adjustment statistics with full reporting.
- Support cadastral computations including parcel boundaries, nested parcels, and COGO routines.

e) CAD, Drafting & Deliverables:

- Full 2D/3D drafting environment including points, polylines, splines, alignments, and surfaces.
- Automated plan/profile sheet generation, cross-sections, and dynamic labelling.

- Export deliverables in formats including DWG, DXF, DGN, LandXML, IFC, PDF (2D/3D), LAS/LAZ.
- Generate construction-ready models, tunnel sections, roadway corridors, and utility networks.

f) Surface & Volume Computations:

- Create triangulated surfaces (TIN), gridded cut/fill maps, stockpile volumes, and earthworks.
- Apply parametric surface design including slopes, subgrades, and material properties.
- Provide customizable volumetric reporting for construction and mining projects.

g) Compatibility & Interoperability:

- Must support seamless import/export with Autodesk, Bentley, and Esri ecosystems.
- Directly handle GIS data formats including SHP, GeoDatabase, and integration with ArcGIS Pro.
- Ensure BIM workflow support with IFC, LandXML, and machine control models.

1.6.2. System Requirements

The software shall meet the following minimum system requirements to support large-scale UAV LiDAR and photogrammetry projects:

- Operating System: Microsoft Windows 10/11 (64-bit)
- Processor: Quad-core Intel 2.8 GHz or better (multi-core strongly recommended)
- RAM: 32 GB or more recommended for LiDAR/Photogrammetry workflows
- Storage: 500 GB SSD or larger with minimum 100 GB free
- Graphics: DirectX 11 / OpenGL 3.2 compatible GPU, 8 GB VRAM minimum (NVIDIA Quadro class)
- Monitor: 1920 x 1080 resolution or higher
- USB Port: Required for licensing dongle if hardware licensing is used

1.6.3. Deliverables

The software must be capable of producing engineering-grade deliverables including:

- CAD design drawings and construction plans
- Orthophotos and elevation models
- Point cloud datasets (classified/unclassified)
- Digital terrain models (DTMs) and digital surface models (DSMs)
- Volumetric analysis reports (earthworks, stockpiles)
- 3D PDFs and visualization outputs for client communication
- GIS-compatible datasets for asset management and planning

The solution shall serve as a comprehensive survey data processing platform that unifies LiDAR, photogrammetry, and traditional survey data into a single workflow. It must ensure high accuracy, traceability, and efficiency for survey, construction, and engineering projects while maintaining compatibility with leading CAD, BIM, and GIS systems.

1.7. UAS Commissioning and Operations Training (2 Pax.)

- Commissioning and Training for the functions and operation of the UAS (for 2 persons) including but not limited to all UAS components and accessories (listed in Annexure 1), assembly, flight planning, connecting of GNNS components, launching, data, field data acquisition utilising the various payloads, downloading of data etc.
- Technical operational support as and when required for a min. period of 24months.
- UAV operation and data processing – 1 day on site

1.8. Data processing Training (2 Pax)

- Training for processing data from GNSS devices and into the photogrammetry/survey processing software.
- Technical operational support as and when required for a min. period of 24months.
- UAV operation and data processing – 1 day on site

1.9. Hand Held VHF Radio

Features:

- VOR navigation with CDI760 COM channels and 200 NAV channels
- 10 weather channels
- 100 memory channels
- 121.5MHz emergency frequency recall
- Semi-duplex operation
- Scanning of COM and NAV bands
- Dual watch function
- One touch selection of active and standby frequency
- Side tone function
- LCD back light
- Optional Bluetooth
- Optional VOR

Specifications:

General	
D.C. Supply Voltage	7.5V
Frequency range	TX 118.000MHz~136.975MHz(143.975 optional)
	RX 108.000MHz~136.975MHz
	Weather channels: FM
	161.650~163.275MHz(USA Only)
Type of Emission	6K00A3E(AM), 16K0G3E(FM)
Channel Spacing	25KHz + 8.33KHz
Temperature range	O.P. -22℃～＋55℃
Frequency Stability	+/-2.0ppm
Relative Humidity	70%~90%
Battery Life(With BP-17L)	Without power save≧ 8hr
	With 1/2 duty cycle ≧ 16hr

	With 1/3 duty cycle ≧ 18hr
Power Off Current Drain	≤ 75uA
External microphone impedance	150 Ohm
Speaker impedance	4 Ohm
Antenna impedance	50 Ohm
Dimensions	60.5*140*44.5mm
Weight	0.38Kg
Shock Resistance	Meet MIL STD 810 C/D/E/F
Moisture & Dust Resistance	According to IEC529 & IP54
Transmitter	
RF Output Power	1.5W(CW), 5.0W(PEP) Typical
Adjacent Channel Power	≤ 60dB
Current Drain	≤ 950mA
Modulation Type	Low level Modulation
Modulation Limiting	70~100%
Conducted Spurious Emission	<1GHz ≤ -46dBm, >1GHz≤ -40dBm
Audio Harmonic Distortion	≤ 10% (@85%+/-3dB Modulation)
Hum and Noise	≧40dB @30% Modulation
Receiver	
Configuration	Double Conversion Super heterodyne
	1st IF (46MHz), 2nd IF(455KHz)
Sensitivity	AM ≤ 0.55uV@6dB S/N 1KHz
	≤ 0.65uV@12dB Sinadwith CCITT
	FM ≤ 0.5uV (@12dB SINAD)
Squelch Sensitivity	AM ≤ 0.25uV
	FM ≤ 0.3uV
Adjacent Channel Rejection	≧60dB
Intermodulation Response rejection	≧64dB
Blocking	≧70dB
Spurious Emission	≤ -57dBm from 9KHz to 1GHz
	≤ -47dBm from 1GHz to 4GHz
Spurious Response Rejection	≧ 70dB
Audio Distortion	≤ 5%
Standby Current Drain	65mA (without power save)
	35mA (with 1/2 Duty Cycle)
	20mA (with 1/3 Duty Cycle)
Audio Output Power	≧ 500mW@10% Distortion
Other	
1 X belt clip 1 X antenna	
1 X battery pack	
1 X charger	
1 X headset adaptor	
1 X user manual	

1.10. Ground Control Point Pads

- Complete Ground Control Point set for aerial UAV mapping
- Durable carry bag for GCP squares and stakes
- 10 no. off 60mm x 60mm format squares
- Vivid black & white squares allowing for high contrast
- Ariel survey targets shall be of a durable mesh material having an anti-reflective coating that reduces glare from the sun and able to withstand all weather conditions
- Centre grommet for GNSS positioning
- Corner grommets for staking to ground
- 4 no. off metal stakes per GCP square

1.11. Aviation First Aid Kit

- The First Aid kit shall be light and compact.
- Comply with SACAA requirements.
- Includes an Emergency Signal Strip Kit and common signals are printed on the back of the bag.
- The kit shall be suited for a 2-seater light aircraft.
- The first aid kits must include a digital thermometer.

1.12. Fire Extinguisher

- 1.5Kg Dry Chemical Powder Fire Extinguisher with bracket
- SABS Approved
- For use on ABC Fires
- Type A Fires - Combustible Materials
- Type B Fires - Flammable Liquids
- Type C Fires – Electrical
- Fire Rating 5A34B

2. LIDAR CAMERA/SENSOR PAYLOAD

Deliverables:

2.1. Lidar Camera/Sensor (The camera/sensor shall include a storge case)
2.2. Lidar Camera/Sensor Processing Software

Specifications:

2.1. Lidar Camera/Sensor (The camera shall include a storge case)

2.1.1. General

Dimensions	192 × 162 × 202 mm (L × W × H)
Weight	1.60 kg
Environmental Protection	IP54 (without single gimbal connector)
Supported Aircraft	Compatible with the drone item 1 as per Annexure 1
Power	64 W (typical) | 100 W (max.)
Operating Temperature	-20° to 50° C
Storage Temperature	-40° to 70° C

2.1.2. System Performance

Point Cloud System Accuracy (120 m flight altitude)	Vertical Accuracy: 3 cm (RMSE); Horizontal Accuracy: 4 cm (RMSE)
Point Cloud System Accuracy (300 m flight altitude)	Vertical Accuracy: 5 cm (RMSE); Horizontal Accuracy: 7.5 cm (RMSE)
Point Cloud Thickness (120 m nadir flight altitude)	1.2 cm @ 1σ
Point Cloud Thickness (300 m nadir flight altitude)	2 cm @ 1σ
Combined Horizontal FOV (Dual RGB Mapping Cameras)	107°
RGB Ground Sampling Distance (GSD)	Average 3 cm (300 m nadir flight altitude)

2.1.3. LiDAR

Laser Wavelength	1535 nm
Laser Beam Divergence	0.25 mrad (1/e²)
Laser Spot Size (120 m)	Φ 41 mm @ 120 m (1/e²)
Laser Spot Size (300 m)	Φ 86 mm @ 300 m (1/e²)
Ranging Accuracy	±10 mm
Absolute Accuracy	< 5 mm (1σ) Repeatability
Detection Range (10% reflectivity, 350 kHz)	700 m
Detection Range (10% reflectivity, 100 kHz)	950 m
Detection Range (80% reflectivity, 100 kHz)	2000 m
Wire Detection Range (21.6 mm STD Steel Core Alu Wire)	300 m @ 100 klx, 350 kHz
Wire Detection Range (18.4 mm Black PVC Insulated Wire)	100 m @ 100 klx, 350 kHz
Min Detection Range	10 m
Cross-Cycle Calculation	300 m @ 100 klx, 350 kHz
Laser Pulse Emission Frequency	100 kHz (recommended flight altitude < 500 m); 350 kHz (recommended flight altitude < 300 m); 1000 kHz (recommended flight altitude < 100 m); 2000 kHz (recommended flight altitude < 50 m)

Number of Returns (100 kHz, 350 kHz)	4, 8, 16 returns
Number of Returns (1000 kHz)	4, 8 returns
Number of Returns (2000 kHz)	4 returns
Scanning Mode and FOV – Linear	Horizontal 80°, vertical 3°
Scanning Mode and FOV – Star-Shaped	Horizontal 80°, vertical 80°
Scanning Mode and FOV – Non-Repetitive	Horizontal 80°, vertical 80°
Laser Safety Classification	Class 1 (IEC 60825-1:2014)

2.1.4. RGB Mapping Camera

Sensor	4/3 CMOS
Photo Size (100 MP)	12288 × 8192
Photo Size (25 MP)	6144 × 4096
Lens Equivalent Focal Length	28 mm
Field of View (FOV)	73.3° (dia), 62° (hor), 41.2° (vert)
Aperture	f/2.0–f/11
Mechanical Shutter	2–1/1500 s (f/2.0); 2–1/2000 s (f/2.8–f/11)
Shutter Count	500,000
Electronic Shutter	2–1/16000 s
Minimum Photo Interval – JPEG	25 MP: 0.5 s; 100 MP: 1 s
Minimum Photo Interval – RAW or JPEG + RAW	1.2 s
Video Format	MP4 (MPEG-4 HEVC/H.265)
Video Resolution – 4K	3840 × 2160 @ 30 fps
Video Resolution – FHD	1920 × 1080 @ 30 fps

2.1.5. Positioning and Orientation (POS)

GNSS Update Rate	5 Hz
POS Update Rate	200 Hz
Attitude Error – Yaw Angle	0.02° (post-processed, 1σ)
Attitude Error – Pitch/Roll Angle	0.01° (post-processed, 1σ)
Positioning Accuracy – Horizontal (RTK fix)	1.0 cm + 1 ppm
Positioning Accuracy – Vertical (RTK fix)	1.5 cm + 1 ppm
Supported PPK Differential Data Format – DAT	Generated in Base Station Mode by D-RTK 3 Multifunctional Station and D-RTK 2
Supported PPK Differential Data Format – RINEX	v2.1x, v3.0x
Supported PPK Differential Data Format – RTCM	v3.0, v3.1, v3.2, v3.3 (MSM3, MSM4, MSM5, MSM6, MSM7)
Supported PPK Differential Data Format – OEM	OEM4, OEM6

2.1.6. Gimbal

Degrees of Freedom	3-axis (pitch, roll, yaw)
Angular Accuracy	±0.01°
Mechanical Range – Pitch	-135° to +73°
Mechanical Range – Roll	-90° to +60°
Mechanical Range – Yaw	-105° to +105°
Controllable Range – Pitch	-120° to +60°
Controllable Range – Yaw	-80° to +80°
Self-Check Method – Roll Axis	Self-check not required
Self-Check Method – Yaw Axis	Checks using limit stop
Self-Check Method – Pitch Axis	Self-check not required
Mounting Method	Detachable SKYPORT (lidar single gimbal connector)

Data Storage

Raw Data Storage	Photo / IMU / Point cloud / GNSS / Calibration files
Standard Memory Card	CFexpres Type B Memory Card, sequential write speed 1500 MB/s
Standard Card Reader	Read/write speed > 900 MB/s

2.1.7. Software Ecosystem

Data Collection	Compatible with the drone item 1 as per Annexure 1
Data Processing	Compatible with the drone item 1 as per Annexure 1
Data Application	Compatible with the drone item 1 as per Annexure 1
Cloud Application	Compatible with the drone item 1 as per Annexure 1
DJI Terra Export Formats	PNTS / LAS / LAZ / PLY / PCD / S3MB
DJI Modify Import Formats	LAS

2.2. Lidar Camera/Sensor Processing Software

The latest version of the processing software shall be supplied. The software shall be fully compatible with aerial survey data captured using a LiDAR system with integrated RGB camera/sensor. It shall support accurate LiDAR point-cloud generation, optimization, and fusion with RGB data, ensuring seamless integration for mapping, 3D modelling, and analysis.
All processing software licenses shall be capable of installation on the Company's servers or network infrastructure and shall permit access for up to two authorized users, with any one of the two able to utilize the license at a given time for the processing of data.

3. PHOTOGRAMMETRY CAMERA/SENSOR PAYLOAD

Deliverables:

3.1. Photogrammetry Camera/Sensor (The camera/sensor shall include a storge case)
3.2. 512GB MicroSDXC memory card (4k) and adapter (2 No. off)
3.3. Pro Reader (1 No. off)

Specifications:

3.1. Photogrammetry Camera/Sensor (The camera shall include a storge case)

3.1.1. General

- Dimensions - 198×166×129 mm
- Weight - Approx. 800 g
- Power - 20W
- IP Rating - IP4X
- Supported Aircraft - Compatible with the drone item 1 as per Annexure 1
- 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.

3.1.2. 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
  24mm F2.8 LS ASPH (with lens hood and balancing ring/filter), FOV 84°
  35mm F2.8 LS ASPH (with lens hood and balancing ring/filter), FOV 63.5°
  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
  *Aperature value no larger than f/5.6
- Aperture Range - f/2.8-f/16
- ISO Range
  Photo: 100-25600
  Video: 100-25600

3.1.3. Video

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

3.1.4. Gimbal

- Stabilized System - 3-axis (tilt, roll, pan)
- Angular Vibration Range ±0.01°
- Mount - Detachable to a aircraft's gimbal port to connect user payloads
- Mechanical Range

3.1.5. Tilt: -130° to +40°;
Roll: -55° to +55°;
Pan: ±320°

3.2. 512GB MicroSDXC memory card and adapter (2 No. off)

- MicroSDXC memory card with 4K UHD.2 suitable for video recording, Full HD video, and high-resolution photos. Super-fast SanDisk Extreme
- Read speeds up to 200MB/s and writes up to 140MB/s.
- A2-rated for fast application performance
- The card shall optimize performance capabilities for timesaving media offloads with quick read speeds up to 200MB/s8 (64GB - 1TB) and include a Pro-Reader SD and microSD to achieve maximum speeds.
- Capture fast-action photos or shoot 4K UHD video2 with write speeds of up to 140MB/s.
- Capturing uninterrupted 4K UHD2 and Full HD video with its UHS Speed Class 3 (U3) and Video Speed Class 30 (V30) ratings.4
- Durable card design for use in extreme environments which are shockproof, temperature-proof, waterproof, and X-ray-proof,3

3.3. Pro Reader (1 No. off)

- Professional PRO-READER Multi-Card reader with aluminium enclosure which helps keep your CF, SD, and microSD cards cool to achieve maximum performance for accelerated offloading to minimize downtime. With a USB-C (10Gbps) port that enables super-fast media transfers, this reader plays well with compatible USB Type-C iPad devices, G-RAID drives, and computers.
- 1 x SD Card Slot
- 1 x microSD Card Slot
- 1 x CompactFlash Card Slot
- 10 Gb/s USB 3.2 Gen 2 Type-C Interface
- Bus Powered
- Integrated Write-Protect Lock Switch

- Stackable Aluminium Enclosure Design
- Includes USB Type-C Cable
- Windows and Mac Compatible

4. HIGH PRECISION BASE STATION

Deliverables:

4.1. RTK 3 Multifunctional station
4.2. RTK 3 Survey Pole and tripod kit
4.3. Carry bag for base station
4.4. WB37 Intelligent Battery (3 No. off)

Specifications:

A high-precision GNSS receiver that supports all major global satellite navigation systems, providing real-time differential corrections that generate centimetre-level positioning data for improved relative accuracy

4.1. RTK 3 Multifunctional Station

GNSS Receiver	
Supported GNSS Frequencies	GPS (L1C/A, L2C, L5), BeiDou (B1I, B2I, B3I, B1C, B2a, B2b), Galileo (E1, E5a, E5b, E6), GLONASS (L1, L2), QZSS (L1C/A, L2C, L5), L-Band
Base Station Accuracy	Horizontal: 1.5 m RMS; Vertical: 3.0 m RMS
Differential Accuracy	Horizontal: 30 cm RMS; Vertical: 40 cm RMS (20 min convergence)
Network RTK Calibration Accuracy	Horizontal: 1.0 cm + 1 ppm; Vertical: 3.0 cm + 1 ppm
Rover Station RTK Accuracy	Horizontal: 0.8 cm + 1 ppm; Vertical: 1.5 cm + 1 ppm
Tilt RTK Accuracy	Up to 60° tilt; <2 cm within 30° tilt
Initialization Reliability	>99.9%

Data Transmission	
Protocols Supported	RTCM v3.0, v3.1, v3.2, v3.3, MSM4–MSM7
Differential Data Format	RTCM 3.2 raw observation data in DAT format
Transmission System	O4 Enterprise system
Operating Frequency	2.4 GHz, 5.2 GHz, 5.8 GHz (Base/Relay/Rover modes)

Bluetooth	Bluetooth 5.1, 2.400–2.4835 GHz, <10 dBm EIRP
Max Transmission Distance (Base Mode)	FCC: 15 km, SRRC: 12 km, CE/JP: 8 km
Max Transmission Distance (Relay Mode)	Up to 25 km (aircraft–relay), up to 1 km (relay–controller)
Max Transmission Distance with Interference	Strong: 1.5–5 km; Medium: 5–15 km; Low: 15–25 km; Obstructed: 0.5–3 km
Relay Range Extension	3x–5x in severe obstruction; 1x–3x in mild obstruction

Electrical Properties	
Power Consumption	Relay: 14.5 W, Base: 7 W, Rover: 6.2 W
Power Output Ports	USB Type-C, Ethernet (Relay Version)
Supported Power Supplies	USB PD 3.0 (9–15 V); PoE IEEE 802.3 standards (30–99.9 W, 50–57 V)
Battery Type	LiPo, 6500 mAh, 46.8 Wh
Battery Operating Time	Relay: 4 hrs, Base: 7 hrs, Rover: 10 hrs

Physical Characteristics	
Operating Temperature	Station: -20° to 55°C; Relay: -30° to 55°C
Altitude Limit	6000 m
Ingress Protection	IP67
Drop Resistance	2 m with pole (station)
Dimensions	Station: 163 × 89 mm; Relay: 163 × 344 mm
Weight	Station: ~1.26 kg; Relay: ~2.24 kg

4.2. **RTK 3 Survey Pole and Tripod Kit**

This specification outlines the requirements for a durable survey pole and tripod kit designed to provide a stable platform for GNSS reference stations used in RTK workflows. The equipment shall ensure secure mounting, precise levelling, and field-ready reliability for use across surveying, construction, agriculture, utilities, and environmental applications

Key Features	
Field-Ready Durability	Constructed from corrosion-resistant aluminum and reinforced plastic for rugged outdoor use.

Stable Locking Mechanism	Ensures the GNSS station remains securely in place without drift or wobble.
Lightweight Design	Portable and easy to transport, deploy, and reposition while maintaining stability.
Quick Setup	Tool-free installation allows setup in under one minute.
Precise Leveling	Integrated bubble level for accurate positioning on uneven terrain.

Technical Specifications	
Survey Pole Height	125 cm to 200 cm (without 5/8" thread)
Survey Pole Weight	900 g
Tripod Height	92 cm
Tripod Weight	2800 g
Self-locking Survey Pole	
Dual-lock Tripod	

4.3. **Carry Bag for Base Station**

- TK stage plus bag for RTK 3 survey pole with tripod and RTK Head unit.

4.4. **WB37 Intelligent Battery (3 No. off)**

The battery provides reliable power for extended field operations for use with high-precision GNSS mobile stations, survey controllers, and compatible electronic equipment.

Technical Specifications	
Parameter	Specification
Battery Type	Rechargeable Lithium-Ion (Li-Ion)
Nominal Voltage	7.6 V
Capacity	4920 mAh
Energy	37.39 Wh
Weight	Approx. 265 g
Operating Temperature	-20 °C to +50 °C
Storage Temperature	-30 °C to +60 °C
Charging Time	Approx. 70 minutes with compatible hub
Cycle Life	≥ 400 charge/discharge cycles
Operating Modes	Supports GNSS Base, Rover, and Relay station functions

Runtime	Approx. 7 hrs (Base Station), 10 hrs (Rover), 4 hrs (Relay)

5. ROVING GNSS RECEIVER MOBILE STATION

Deliverables:

5.1. Roving GNSS Receiver
5.2. Roving GNSS Receiver Configuration Level (Base and Rover Mode)
5.3. Dual Battery Charger with Power Supply and Power Cord (Europe)

Specifications:

5.1. Roving GNSS Receiver

5.1.1. GNSS measurements

- Constellation agnostic, flexible signal tracking, improved positioning in challenging environments1 and inertial measurement integration with GNSS technology.
- Increased measurement and stakeout productivity and traceability with TIP technology IMU-based tilt compensation.
- Advanced Custom Survey GNSS chips with 672 channels
- CenterPoint RTX correction service is activated and ready to use for the initial 12 months.
- Reduced downtime due to loss of radio signal or cellular connectivity
- Technology for mitigation of ionospheric GNSS signal disruptions
- Signals tracked simultaneously GPS: L1C, L1C/A, L2C, L2E, L5
  GLONASS: L1C/A, L1P, L2C/A, L2P, L3 SBAS (WAAS, EGNOS, GAGAN, MSAS): L1C/A, L5 Galileo: E1, E5A, E5B, E5 AltBOC, E62 BeiDou: B1, B1C, B2, B2A, B2B, B3 QZSS: L1C/A, L1S, L1C, L2C, L5, L6
  NavIC (IRNSS): L5
  L-band: RTX Corrections
- Iridium filtering above 1616 MHz allows antenna to be used up to 20 m away from iridium transmitter
- Japanese LTE filtering below 1510 MHz allows antenna to be used up to 100 m away from Japanese LTE cell tower
- Digital Signal Processor (DSP) techniques to detect and recover from spoofed GNSS signals
- Advanced Receiver Autonomous Integrity Monitoring (RAIM) algorithm to detect and reject problem satellite measurements to
- improve position quality
- Improved protection from erroneous ephemeris data
- Positioning Rates: 1 Hz, 2 Hz, 5 Hz, 10 Hz, and 20 Hz

5.1.2. Positioning performance

Static GNSS surveying

High-Precision Static
- Horizontal 3 mm + 0.1 ppm RMS
- Vertical 3.5 mm + 0.4 ppm RMS

Static and Fast Static
- Horizontal 3 mm + 0.5 ppm RMS
- Vertical 5 mm + 0.5 ppm RMS

Real time kinematic surveying

Single Baseline <30 km
- Horizontal 8 mm + 1 ppm RMS
- Vertical 15 mm + 1 ppm RMS

Network RTK4
- Horizontal 8 mm + 0.5 ppm RMS
- Vertical 15 mm + 0.5 ppm RMS

RTK start-up time for specified precisions
- 2 to 8 seconds

Inertial platform (tip) technology

TIP Compensated Surveying6
- Horizontal RTK + 5 mm + 0.4 mm/° tilt (up to 30°) RMS
- Horizontal RTX + 5 mm + 0.4 mm/° tilt (up to 30°) RMS

IMU
- Integrity Monitor Bias monitoring Temperature, age and shock

RTX correction services

CenterPoint RTX
- Horizontal 2 cm RMS
- Vertical 3 cm RMS
- RTX convergence time for specified precisions in RTX Fast regions < 1 min
- RTX convergence time for specified precisions in non RTX Fast regions < 15 min
- RTX QuickStart convergence time for specified precisions < 1 min

xFILL8
- Horizontal RTK9 + 10 mm/minute RMS
- Vertical RTK9 + 20 mm/minute RMS

xFILL premium
- Horizontal 3 cm RMS
- Vertical 7 cm RMS

Code differential gnss positioning
- Horizontal 0.25 m + 1 ppm RMS
- Vertical 0.50 m + 1 ppm RMS
- SBAS typically <5 m 3DRMS

5.1.3. Hardware

Physical Dimensions (W×H)
- 11.9 cm x 13.6 cm (4.6 in x 5.4 in)

Weight
- 1.12 kg (2.49 lb) with internal battery, internal radio with UHF antenna,
- 3.95 kg (8.71 lb) items above plus range pole, controller & bracket

Temperature
- Operating -40 °C to +65 °C (-40 °F to +149 °F)
- Storage -40 °C to +75 °C (-40 °F to +167 °F)

Humidity

- 100%, condensing

Ingress protection

- IP67 dustproof, protected from temporary immersion to depth of 1 m (3.28 ft)

Shock and vibration (Tested and meets the following environmental standards)

Shock

- Non-operating: Designed to survive a 2 m (6.6 ft) pole drop onto concrete.
- Operating: to 40 G, 10 msec, sawtooth

Vibration

- MIL-STD-810F, FIG.514.5C-1

Electrical

- Power 11 to 24 V DC external power input with over-voltage protection on Port 1 and Port 2 (7-pin Lemo)
- Rechargeable, removable 7.4 V, 3.7 Ah Lithium-ion smart battery with LED status indicators
- Power consumption is 4.2 W in RTK rover mode with internal radio1

Operating times on internal battery

- 450 MHz receive only option 6.5 hours
- 450 MHz receive/transmit option (0.5 W) 6.0 hours
- 450 MHz receive/transmit option (2.0 W) 5.5 hours
- Cellular receive option 6.5 hours

5.1.4. Communications and data storage

- Serial 3-wire serial (7-pin Lemo)
- USB v2.0 Supports data download and high speed communications
- Radio modem
- Fully Integrated, sealed 450 MHz wide band receiver/transmitter with frequency range of 403 MHz to 473 MHz, support of associated radio protocols:
- Transmit power 2 W
- Range 3–5 km typical / 10 km optimal14
- Cellular15
- (not available in all models)
- Integrated, 3.5 G modem, HSDPA 7.2 Mbps (download), GPRS multi-slot class 12, EDGE multi-slot class 12, Penta-band UMTS/
- HSDPA (WCDMA/FDD) 800/850/900/1900/2100 MHz, Quad-band EGSM 850/900/1800/1900 MHz, GSM CSD, 3GPP LTE
- Bluetooth Version 4.116
- Wi-Fi 802.11 b,g, access point and client mode, WPA/WPA2/WEP64/WEP128 encryption
- I/O ports Serial, USB, TCP/IP, IBSS/NTRIP, Bluetooth
- Data storage 6 GB internal memory
- Data format CMR+, CMRx, RTCM 2.1, RTCM 2.3, RTCM 3.0, RTCM 3.1, RTCM 3.2 input and output
- 24 NMEA outputs, GSOF, RT17 and RT27 outputs, 1 PPS output

5.1.5. WEBUI

- Offers simple configuration, operation, status, and data transfer
- Accessible via Wi-Fi, Serial, USB, and Bluetooth

5.1.6. Supported controllers & field software
- Android, iOS and associated devices running supported apps
- Associated software
- Internet Base Station Service (IBSS) for streaming RTK corrections

5.1.7. Certifications
- FCC Part 15 (Class B device), 24, 32; CE Mark; RCM; PTCRB; BT SIG

5.1.8. Accessories
- Storage carry case

5.2. Roving GNSS Receiver Configuration Level (Base and Rover Mode)

The configuration level/license provides full functionality for GNSS receivers to operate interchangeably as a Base Station or Rover. It is required for survey, construction, mapping, and geospatial data applications that demand centimetre-level accuracy, real-time correction services, and advanced data handling.

5.2.1. Key Functional Features

Feature	Description
Dual Mode Operation	License enables operation as either a GNSS Base Station or a Rover, switchable as required.
High-Precision RTK	Supports centimetre-level positioning accuracy in real-time kinematic (RTK) workflows.
Correction Data Management	Generates and transmits GNSS correction data streams when in Base Station mode; receives and applies corrections in Rover mode.
Network RTK Compatibility	Supports NTRIP (Networked Transport of RTCM via Internet Protocol) and other industry-standard correction formats.
Advanced Error Modelling	Applies multi-constellation, multi-frequency error reduction techniques for improved stability and accuracy.
Scalability	Enables integration into small- and large-scale survey operations without hardware replacement.
Flexible Licensing	Delivered as a software activation code linked to the GNSS receiver's unique identifier.

5.2.2. Applications

- Land Surveying: Establishes reference stations and enables mobile survey rovers for topographic, cadastral, and boundary surveys.
- Construction: Supports base-to-rover setups for machine control, grade checking, and site calibration.
- GIS and Mapping: Provides accurate geolocation for asset mapping, environmental studies, and infrastructure planning.
- Monitoring: Enables use in deformation monitoring, structural movement tracking, and geotechnical observation systems.

5.2.3. Compliance and Standards

The configuration level/license shall comply with internationally recognized GNSS correction data standards, including RTCM 3.x, RINEX, and NMEA protocols. Compatibility with multiple satellite constellations (GPS, GLONASS, Galileo, BeiDou, QZSS) shall be ensured where supported by the host hardware.

5.3. Dual Battery Charger with Power Supply and Power Cord (Europe)

The Dual Battery Charger with Power Supply and Power Cord is designed for use with compatible GNSS receiver batteries. It provides a reliable, safe, and efficient solution for charging two batteries concurrently

5.3.1. Technical Specifications

Feature	Specification
Charger Type	Dual-slot intelligent battery charger
Supported Batteries	Compatible GNSS receiver lithium-ion batteries
Charging Capacity	Up to two batteries simultaneously
Input Voltage	100–240 V AC, 50–60 Hz
Output	DC output suitable for supported GNSS receiver batteries
Power Supply	Integrated AC adapter with European power cord
Charging Indicators	LED status indicators for power and charging progress
Safety Features	Overcharge protection, short-circuit protection, temperature monitoring
Operating Temperature	0°C to +40°C
Storage Temperature	-20°C to +60°C
Dimensions	Approx. 200 × 150 × 80 mm

Weight	Approx. 1.5 kg (including power supply and cord)

5.4. GNSS Receiver Protection Plan

- The Protection Plan shall provide extended hardware support for the high-precision GNSS receiver.
- The protection plan shall cover repairs, replacement, and priority service for hardware faults beyond the standard manufacturer's warranty.
- The plan shall be valid for 12 months from activation after the first 12 months have lapsed.

6. ROVING GNSS CONTROLLER

Deliverables:

6.1. GNSS Controller (with storage case) (latest released model)
6.2. GNSS Survey Software License (Perpetual)
6.3. GNSS Pole without Bipod
6.4. Pole Mount Bracket
6.5. Quick Release Pole Mount Clamp with Adjustable Arm
6.6. Bag For GNSS pole (carbon Pole)
6.7. Flash Drive
6.8. GNSS Controller/collector Protection Plan
6.9. GNSS Survey Software Maintenance Plan
6.10. Geospatial Continental GNSS Correction Service (1 Year Subscription)

Specifications:

6.1. GNSS Controller (with storage case) (latest released model)

6.1.1. Physical Specifications

- Size - 30 x 20.9 x 7.1 cm (11.8 x 8.2 x 2.8 ")
- Weight - 1.42 kg (3.12 lb)
- Housing - Glass-fibre reinforced resin with integrated drop bumpers

6.1.2. Environmental specifications

- Operating temperature - –20 °C to 60 °C (–4 °F to 140 °F) MIL-STD-810G 501.5 Procedures II (operation)
- Storage temperature - –40 °C to 70 °C (–40 °F to 158 °F) MIL-STD-810G 501.5 Procedures I (storage)
- Humidity - 90 % RH temp cycle –20 °C/60 °C (–4 °F/140 °F) MIL-STD-810G, Method 507.5, Procedure II
- Sand & dust - IP6x: 8 hours of operation with blowing talcum powder (IEC-529)
- Water - IPx8: Immersion, up to 1 m (3.2 ft) depth for 2 hours
- Drop - 26 drops at room temperature from 1.22 m (4 ft) onto plywood over concrete MIL- STD-810G, Method 516.6, Procedure IV

6.1.3. Security

- TPM (Trusted Platform Module)

6.1.4. Configurations

EMPOWER module support

- 2 x module bays

Languages supported at first boot:

- Chinese (Simplified), English (US), French, German,
- Italian, Japanese, Korean, Portuguese (Brazilian),
- Spanish (Castilian region and Mexico)

6.1.5. Certifications

Among others

- FCC, NRTL, ICES, IC, NRTL, CE, CB, RCM, CCC

Countries

- Certified in countries: USA, Canada, EU, Australia/New Zealand, South Africa, India, Malaysia, Tunisia, UAE, Thailand, Taiwan, Russia

Environmental

- EU RoHS, China RoHS, REACH, WEEE

6.1.6. Accessories

- Storage carry case

6.2. GNSS Survey Software License (Perpetual)

This specification outlines the requirements for a professional GNSS survey software license, provided on a perpetual basis. The software is designed to support general survey applications, enabling efficient, accurate, and versatile GNSS-based fieldwork. The license provides continuous access without renewal fees, ensuring long-term operational capability.

6.2.1. License Type

- Perpetual License – One-time purchase providing indefinite usage rights.
- Authorized for GNSS survey operations across multiple field applications.
- Supports software updates and compatibility with supported GNSS hardware.

6.2.2. Functional Capabilities

The licensed software must support the following capabilities:

- GNSS Surveying: Configurations for static, kinematic, and RTK workflows.
- General Survey Tools: Coordinate geometry (COGO), staking, topo surveys, and data collection.
- Field Data Management: Import/export functionality for survey data, customizable job templates, and support for multiple coordinate systems.
- User Interface: Intuitive graphical interface optimized for field tablets and data collectors.
- Flexibility: Compatibility with GNSS rover and base station configurations.

6.2.3. Interoperability

- Fully compatible with a wide range of GNSS survey receivers and controllers.
- Seamless integration with office survey software for data processing and reporting.
- Support for industry-standard data exchange formats (e.g., RINEX, CSV, DXF).

6.2.4. Deployment and Licensing

- License Key: Delivered electronically or via activation code.
- Installation: Supports Windows-based field controllers and rugged survey tablets.

- Updates: Includes access to official patches, service packs, and feature upgrades released within the supported lifecycle.
- User Rights: Perpetual usage for one licensed user or controller.

6.2.5.Applications

- The perpetual GNSS survey software license is intended for use in:
- Topographic and cadastral surveys
- Construction site layout and staking
- Infrastructure and utility surveys
- Agricultural land measurement and boundary establishment
- Environmental monitoring and forestry mapping

6.2.6.Deliverables

- One (1) perpetual software license for GNSS survey software (general survey module).
- Electronic license activation code and installation files.
- User documentation and access to technical support resources.

6.3. GNSS Pole without Bipod

- Lightweight Construction – Carbon fiber body minimizes operator fatigue.
- High Rigidity – Maintains straightness to ensure accurate height measurements.
- Corrosion-Resistant Materials – Built for long-term outdoor use.
- Standard Thread Interface – Compatible with GNSS receivers, prism holders, and other accessories.
- Ergonomic Grip – Provides comfort and stability during prolonged use.
- Compact Transport – Two-piece telescopic design for easy carrying.

Technical Specifications

Parameter	Specification
Pole Type	Range pole without bipod
Length	2.0 m (extended)
Collapsed Length	Approx. 1.2 m (two-piece design)
Material	High-strength carbon fiber with aluminum fittings
Diameter	Standard Ø 32 mm
Thread Size	5/8" x 11 UNC (industry standard)
Weight	Approx. 0.9–1.0 kg

Sections	2 (telescoping)
Locking Mechanism	Twist-lock with reinforced clamps
Operating Temperature	-20 °C to +60 °C
Color	Carbon fiber finish with measurement graduations

6.4. Pole Mount Bracket

- The bracket shall be suitable and compatible with the GNSS pole as per 6.3 and the GNSS controller as per 6.1.

6.5. Quick Release Pole Mount Clamp with Adjustable Arm

- The quick release pole mount clamp with adjustable arm shall be suitable and compatible with the GNSS pole as per 6.3 and the GNSS controller as per 6.1.

6.6. Bag For GNSS pole (carbon Pole)

- A Stage Plus bag shall be suitable and compatible to store the GNSS carbon pole and pole mount bracket, clamp and adjustable arm.

6.7. Flash Drive

- 32GB Active USB Type C

6.8. GNSS Controller/collector Protection Plan

- The protection plan shall provide comprehensive hardware coverage for the rugged field data controller/collector device.
- The plan shall ensure that the mission-critical handheld controller remains protected against accidental damage, hardware failure, and normal wear and tear over a 12-month period.
- The plan shall be valid for 12 months from activation after the first 12 months have lapsed.

6.9. GNSS Survey Software Maintenance Plan

- The maintenance plan shall ensure continuous access to the latest updates, patches, and feature enhancements, along with dedicated technical support to maintain software reliability and performance.
- The plan shall provide software maintenance and support coverage for survey-grade field data collection software.
- The plan shall be valid for 12 months from activation after the first 12 months have lapsed.

6.10. Geospatial Continental GNSS Correction Service (1 Year Subscription)

6.10.1. Service Features

Feature	Specification
Coverage	Continental coverage across designated service regions (including North America, Europe, Africa, and parts of Asia-Pacific).
Service Duration	12-month subscription, renewable.
Positioning Accuracy	Horizontal: typically 2 cm Vertical: typically 3 cm, dependent on environmental conditions and receiver capability.
Convergence Time	Typical <1min convergence In select areas (NAM, EUR)
Supported Constellations	GPS, GLONASS, Galileo, BeiDou (depending on GNSS receiver compatibility).
Delivery Method	Satellite L-band corrections (primary) and IP/terrestrial delivery (secondary, where available).
Reliability	Redundant global infrastructure providing >99.9% service uptime.
Applications	Land survey, mapping, precision agriculture, construction layout, and geospatial monitoring requiring consistent accuracy across wide areas.

6.10.2. Compatibility

- Works with GNSS receivers supporting RTX/PPP correction services.
- Requires activation via subscription license key linked to receiver serial number.
- Compatible with both rover and base/rover workflow alternatives where satellite corrections are acceptable.

6.10.3. Deliverables

- 1-year subscription activation key for one GNSS receiver.
- Access to satellite-delivered correction streams throughout the subscription period.
- Technical documentation and support resources.

6.10.4. Compliance

- International GNSS standards compliant (RTCM, PPP-based correction protocols).
- Supports integration with geospatial data collection software platforms.