

Unmanned Airborne Vehicle (UAV) based Gamma Ray Spectrometer TC Project: GEO9016	 IAEA International Atomic Energy Agency	IAEA Specification Dated: 2021-08-20
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Specification Compliance Matrix Unmanned Airborne Vehicle (UAV) based Gamma Ray Spectrometer

No.	Requirements (e.g. Specification/SoW requirements)	Comply with (Y/N)	Note
3.2.1	The System shall be designed based on combination of UAV with Gamma Ray Spectrometer and HD camera as a payload;		
3.2.2	UAV platform shall provide autonomous deployment and mission capability and capacity for operation with the gamma ray spectrometer and HD camera.		
3.2.3	System shall have HD camera that is additional to built-in aerial camera;		
3.2.4	System shall perform radiological mapping in environmental and radiation protection applications.		
3.2.5	UAV platform shall be designed on multirotor platform equipped by anti-collision beacon.		
3.2.6	System shall provide proper operation of the gamma ray spectrometer, HD camera as well as compatibility to control the peripherals. The compatibility of all components shall be assured.		
3.2.7	System shall operate in the following environmental conditions: Temperature from -10°C to +40°C; humidity from 40% to 95%.		
3.2.8	The System shall communicate with ground station: UAV Flight Control Systems and computer (laptop) or tablet for receiving and displaying transmitted radiation data.		
3.2.9	The frequency range for the System communication and data transmission shall meet requirements of Georgian legislation (Order No.58 of Director of Civil Aviation Agency, from 1 May 2017, for the operation of UAV can be used all frequencies, different from aviation frequency range);		
3.2.10	3.2.10. The System shall include auxiliary (supporting) sensors for: fix the position by multi GNSS, measurement of altitude above ground (laser or radar altimeter), real time clock synchronized with GNSS time, and optionally measurement of temperature, humidity and pressure;		

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3.2.11	The System shall record and transmit at least following data to the ground station in real-time of flight: spectra, counts per second (CPS), Dose Rate, GNSS data (Lat, Lon, altitude, date/time, and number of received satellites) as well as altitude above the ground with a period 1 sec;		
3.2.12	The System shall include the software for data acquisition and data post-processing with capability for data and spectra visualization, data presentation on the map, data export to ASCII or MS Excel format (CSV) and KMZ or KML format.		
3.2.13	MTOW: up to 20 kg;		
3.2.14	Effective flight duration: min. 40 min on one battery set (without payload);		
3.2.15	Wind resistance: up to 10 m/s;		
3.2.16	Remote operation control range: min. 3 km;		
3.2.17	Operation frequencies: according to Georgian legislation (see 3.2.9);		
3.2.18	Aerial preview camera: built-in;		
3.2.19	UAV Flight Control Systems: Type RF, remote controller with antenna, powered by battery (for fervency see 3.2.9);		
3.2.20	Power supply: Rechargeable batteries and battery charger based on 220-240 VAC, 50-60 Hz and 12 VDC with car connector.		
3.2.21	6 spare batteries (the same parameters as standard one from UAV platform);		
3.2.22	Two sets of spare propellers;		
3.2.23	Transport case for all components of UAV platform;		
3.2.24	Software package for diagnostic and UAV setup, survey preparation, UAV flight control with telemetry and video transmitting, flight data recording. A permanent licence is required;		
3.2.25	High resolution HD camera suitable for Photogrammetry: type optical, photos resolution ≥ 20 MP, zoom option, video resolution $\geq 5K$, field of view ≥ 70 degree, supported formats JPEG, MOV, MP4, DNG and with 3-axis mechanical gimbal stabilization;		
3.2.26	3.2.26. Photogrammetry SW (permanent licence) for processing of photos from high resolution camera (specified above), orthophoto map creation, 3D model preparation and picture format converting;		

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3.2.27	Detection type: scintillation NaI(Tl) or equivalent, (temperature stabilized);		
3.2.28	Detector size: $\geq 1.5 \times 1.5$ inch;		
3.2.29	Energy Range: 50 keV – 3 MeV;		
3.2.30	3.2.30. Energy resolution: ≤ 7.5 % at 662 keV of Cs-137;		
3.2.31	Number of Channels: min 1024 (256/512/1024 adjustable);		
3.2.32	Sampling rate: 1 sec (data recording);		
3.2.33	DSP Pulse throughput: min. 50 kcps;		
3.2.34	Altitude above the ground measurement: 0-50m (laser or radar altimeter);		
3.2.35	Ground station laptop or tablet for transmitted radiation data receiving and visualization;		
3.2.36	SW package for Radiological Mapping, real time radiation data receiving and display, data post processing, export, and QC. A permanent licence is required;		
3.2.37	Tripod supporting ground station.		
6.1.	The Contractor shall provide on-site system assembling and support to initial operation, at the End-User's location.		
6.2	The Contractor shall provide on-site five (5) days end-user staff training for: - UAV piloting, - Operation of radiation detector, resp. Gamma Ray Spectrometer and related SW for Radiological Mapping; - Utilization of Photogrammetry SW; - System maintenance.		
6.3	The Contractor shall provide ongoing remote support and service, for one year from conclusion of the training.		
6.4	The Contractor shall provide two (2) complete sets of Operation and Servicing Manuals and Technical Drawings in hard copies and one (1) in electronic version in the English language.		