BROAD / AoN DETAILS FOR PROCUREMENT OF QUANTITY FIVE SETS OF AUTONOMOUS SURVEILLANCE AND ARMED DRONE SWARM (A-SADS) TO BE EMPLOYED IN DESERT/ PLAINS

1. **AoN Date**. **21 Jul 2022** (Minutes of the Defence Procurement Board (DPB) [09/2022] Meeting received from Ministry of Defence [Acquisiton Wing] vide DGCD (AoN & Cat) letter Number 00727/GS/CD (AoN & Cat)/DPB (Jul 22) dated 29 Aug 2022.

2. **Item Description (weapon/ equipment/ platform)**. **Autonomous Surveillance and Armed Drone Swarm for Desert/ Plains**.

3. **Quantity**. Five Sets (consisting of 50 drones each set) of Autonomous Surveillance and Armed Drone Swarm (A-SADS) alongwith supporting equipment.

4. **Categorisation**. **Buy Indian (IDDM)** with minimum 50% Indigenous Content in accordance with Chapter-III of DAP-2020.

5. **Parameters/ QRs of the Item**. Parameters/ QRs are consists with four parts :-

   (a) Part-I (Operational Parameters).

   (b) Part-II (Technical Parameters).

   (c) Part-III (Maintainability & Ergonomic Parameters).

6. **PART-I (OPERATIONAL PARAMETERS)**.

   (a) **System Components**. A set of 50 Swarm Drones should consist of :-

      (i) 50 drones.

      (ii) Two Ground Control Station (GCS).

      (iii) Ground Data Terminal consisting of High Power Airborne Data links.

      (iv) Two Remote Video Terminals (RVTs) with transponders.

      (v) **Optical Sensors**. Aerial Vehicles will have EO/IR sensors as under:-

         (aa) Twelve aerial vehicles will have one High Performance EO-IR sensor with LRF.

         (ab) 38 aerial vehicles will have one Standard EO-IR sensor.

      (vi) **Explosive Payloads**. Following explosive payloads will be provided :-

         (aa) **Anti Personnel**. Quantity 50 each of 3 kg and 5 kg ammunition.

         (ab) **Shaped Charge Top Attack Ammunition**. Quantity 20 Top attack shaped charge ammunition.

         (ac) The explosive payloads should be user configurable.

      (vii) **Aerial Data Relay (ADR)**. 15 drones should be configured as ADRs for data relay.

(viii) Suitable battery chargers to enable charging the batteries from AC mains and generators.

(b) **All Up Weight (AUW)**. AUW with payloads should not exceed 50 kgs.

(c) **Size**. The size of AV in launch condition should not exceed **3.5 mtr x 2.5 mtr**.

(d) **Launch Altitude**. The Swarm drones must be capable of being launched from altitudes upto 3000 mtr AMSL.

(e) **Operating Altitude**. The drones should be capable of operating at altitudes of not less than 1000 mtr Above Ground Level.

(f) **Operating Temperature**. The swarm drone system should be able to operate under following temperatures:-

(i) Maximum - 40^0C to 45^o C.

(ii) Minimum - 0^0C to 5^o C.

(g) **Operating Range**. The operating range of the drones with Aerial Data Relay (ADR) should be minimum 50 km (one way distance).

(h) **Endurance**. Drones should have an endurance of minimum three hours.

(j) **Launch and Retrieval**. Vertical Take Off and Landing (VTOL) from unprepared area, tube/canister launched and retrieval mechanism should be VTOL/ parachute.

(k) **Operating Capability Under Difficult Climatic/ Weather Conditions**. Swarm drones should be capable of operating in light rains and should be able to take off and land in head wind speeds of not less than 30 km per hour.

(l) **Flight Modes**. The drone should be able to operate in the following flight modes :-

(i) **Fully Autonomous Mode**. Follow a pre-programmed flight path. Dynamic re-programming of the flight path must be possible.

(ii) **Semi-Autonomous Mode**. Control of heading, air speed and altitude of the AV by the operator with other parameters being controlled by the autopilot.

(iii) **Loiter Mode**. Fly around a fixed point.

(iv) **Target Seeking Mode**. Keep camera locked on to a fixed / moving target.

(v) **Camera Guide Mode**. Follow a locked on moving target.

(vi) **Manual Mode**. For the pilot to physically control the AV for manoeuvring (in case of autopilot failure or manual override).

(vii) **Return Home Mode**. In case during the flight there is break in communication (duration should be programmable by the user), the AV should automatically change to 'Return Home' mode.

(m) **Swarming and Collaborative Autonomy**. The drones should exhibit autonomous swarm capabilities like **collision avoidance**, **flocking**, **schooling**, **foraging**, **automatic path planning and self healing**.

(n) **Modes of Operation**. The swarm drones should be able to operate in three modes as under :-

(i) **Single Region of Interest Mode**. In this mode, the operator should be able to provide a mission to the swarm that will automatically be distributed amongst the drones.

(ii) **Multi Region of Interest Mode**. In this mode, the swarm will be given multiple missions. Swarm will split into multiple smaller swarms to achieve each mission.

(iii) **Dynamic Mission Mode**. In this mode, the operator should be able to dynamically provide a new mission to the swarm. After receiving the new mission, the drones should redistribute the mission tasks amongst themselves for ISR or targeting.

(o) **Manned Unmanned Teaming (MUM-T) Capability**. The system should be capable of detaching smaller swarms of upto 20 drones to be controlled with Remote Video Terminal (RVT) upto a distance of five km on being authorised by the GCS. RVT should be able to undertake the following functions :-

(i) Select an area on the RVT for surveillance by drones.

(ii) Specify the number of drones required for mission.

(iii) Release of explosive payloads.

(p) **Correction of Fall of Shot**. The drones carrying High Performance EO/IR sensors should be capable of calculating the distance of fall of shot from the target and transmit the correction to GCS and RVTs.

7. **PART-II (TECHNICAL PARAMETERS)**.

(a) **Payloads**. The requisite details are as under :-

(i) **High Performance Colour Day Video Camera**. High Performance Colour Day Video Camera will have a **Colour Day Video Camera** of following specifications :-

(aa) **Resolution**. Provide real time video of minimum 2688 x 1520 pixels resolution at not less than 25 frames per second.

(ab) **Zoom**. Not less than 30 X optical zoom.

(ac) 2 axis gimbal based stabilisation.

(ad) **WFOV**. Not less than 60^0.

(ae) **Pan**. 360^0 (continuous).

(af) **Tilt**. $\pm$ 60^0 from the vertical.

(ag) **Ranges**. Slant ranges in clear weather should be as under :-

	A Vehicle	B Vehicle	Human Targets
Detection	5000 mtr	4000 mtr	2000 mtr
Recognition	2500 mtr	2000 mtr	1000 mtr

(ah) Capable of taking still images.

(aj) Store minimum 180 minutes output on board the AV at minimum 2688 x 1520 pixels resolution at 25 frames per second along with telemetry data.

(ak) The LRF should be capable of measuring ranges upto 5000 mtrs.

(al) **Automatic Target Recognition**. The Artificial Intelligence enabled automatic target recognition ranges should not be less than 400 mtr for an Armoured Fighting Vehicle.

(ii) **Standard Colour Day Video Camera**. Standard Colour Day Video Camera will have a Standard **Colour Day Video Camera** of following specifications :-

(aa) **Resolution**. Provide real time video of minimum 1280 x 720 pixels resolution at not less than 20 frames per second.

(ab) **Zoom**. Not less than 10 X optical zoom.

(ac) 2 axis gimbal based stabilisation.

(ad) **WFOV**. Not less than 60^0.

(ae) **Pan**. 360^0 (continuous)

(af) **Tilt**. $\pm$ 60^0 from the vertical.

(ag) **Ranges**. Slant ranges in clear weather :-

	A Vehicle	B Vehicle	Human Targets
Detection	2500 mtr	2000 mtr	1250 mtr
Recognition	1500 mtr	1000 mtr	750 mtr

(ah) Store minimum 180 minutes output on board the AV at minimum 1280 x 720 pixels resolution at 20 frames per second alongwith telemetry data.

(aj) **Automatic Target Recognition**. The Artificial Intelligence enabled automatic target recognition ranges should not be less than 400 mtr for an Armoured Fighting Vehicle.

(iii) **Monochromatic Night Thermal Camera**. Monochromatic Night Thermal Camera with following specifications will be provided :-

(aa) **Resolution**. Provide real time video of minimum 640 x 480 pixels resolution at not less than 20 frames per second.

(ab) **Field of View**. Not less than 15^0.

(ac) **Pan**. 360^0.

(ad) **Tilt**. $\pm$ 60^0 from the vertical.

(ae) **Ranges**. Slant ranges in clear weather:-

	A Vehicle	B Vehicle	Human Targets
Detection	1500 mtr	1200 mtr	700 mtr
Recognition	800 mtr	600 mtr	500 mtr

(af) **Automatic Target Recognition**. The Artificial Intelligence enabled automatic target recognition ranges should not be less than 200 mtr for an Armoured Fighting Vehicle.

(iv) **Explosive Payloads**. Explosive payloads will be user configurable and following payloads will be provided :-

(aa) **Anti Personnel**. CEP of 3 kg and 5 kg (HE Fragmentation) ammunition should be five mtr or less with drop height of 500-600 mtr. The kill radius for the anti personnel explosive payloads should be as under :-

(aaa) 3 kg HE Fragmentation ammunition - Not less than 15 mtr.

(aab) 5 kg HE Fragmentation ammunition - Not less than 25 mtr.

(ab) **Shaped Charge Top Attack Ammunition**. Shaped charge top attack ammunition should be capable of penetrating RHA plate of not less than 100 mm thickness with CEP of 1.5 mtr or better.

(ac) All munitions should have inbuilt safe arming mechanism.

(b) **GCS**. GCS should be a modular and portable with ruggedized laptops/ screens and compatible with DSM maps. Details are as under :-

(i) **Pre- Flight Checks**. Software should have the capability to perform pre-flight checks of the complete system before every flight for confirming the flight worthiness. As per the checks, GO or NO GO in the drone operation should be indicated.

(ii) **User Controls**. The GCS should provide following controls to the user :-

(aa) Take off/ Land without any manual assistance.

(ab) Set altitude of the drones.

(ac) Way point navigation.

(ad) RPV Mode which allows drones to be flown in semi-autonomous/ manual mode.

(ae) Release of explosive payloads.

(iii) **Display**. The GCS should display the following :-

(aa) Geographic map along with Aerial Vehicle (AV) location, AV trajectory, waypoints and flight plan.

(ab) Real-time AV parameters should be displayed at all times during the flight, such as velocity, position and flight mode.

(ac) Display live video and a synchronised moving map in real time.

(iv) RAM, processor and display of suitable specifications should be provided.

(v) Record and replay optical sensor output, a Solid State Disk (SSD) of minimum 4 TB must be provided.

(vi) Cater for minimum 180 minutes of continuous operation.

(vii) GCS should be ruggedized to conform to MIL STD 810 G.

(c) **Ground Data Terminal (GDT)**. High power airborne data links to transmit commands from GCS to AVs and from AVs to GCS be provided with following specifications :-

(i) **Op Frequency**. Military band frequency when allotted will be utilised for the system. It should have a suitable uplink and downlink with the GCS in S/C Band (2 GHz to 6 GHz) secured with **256** bit AES encryption **or higher standards**. The transmission must be digital. It should be scalable to alternate frequency as per Indian Army requirement at a subsequent stage.

(ii) **Inter Drone Communication Link**. Each drone should be equipped with inter drone telemetry to share relevant drone parameters with 256 AES encryption.

(iii) The system should be able to function in a GPS degraded/denied environment.

(iv) Anti jamming and anti spoofing measures be incorporated in both system hardware and software.

(v) The system should be compatible with GPS, GLONOSS and IRNSS.

(d) **Map**. A moving map to be provided in a resizable window with following facilities :-

(i) Map to be synchronised both in position and scale to the video as per specified zoom.

(ii) There should be facilities to :-

(aa) Annotate the map.

(ab) Allow free movement (dragging) of the map, centre the map on the camera's ground track, centre the map on a specific area, see the map from the camera's point of view, fix the map so that it does not change with the movement of the drones and re-synchronise the map to the drones, as desired.

(ac) Allow selection of way points and flight path.

(ad) Measure distance between ground points.

(ae) Enlarge and reduce the map (zoom in / out).

8. **PART III : MAINTAINABILITY & ERGONOMIC PARAMETERS**

(a) It should conform to JSS-55555 2012 Revision 3 standards (as applicable to the equipment).

(b) It should conform to Op to electronic equipment (Day and Night Camera) compliant to JSS-5855-11-2019.

(c) It should conform to software been verified and validated as per IEEE-12207.

(d) It should conform to applicable EMI/ EMC tests as specified in MIL Standards 461F.

(e) Storage of explosive payload should confirm to ammunition storage regulations stipulated as per STEC guidelines.

(f) **Service Life**. The service life should not be less than 500 landings for Drones, not less than 07 years for IT equipment and minimum 700 battery charging/ discharging cycles.

(g) The equipment should be **packaged with modern packing material** to assist user in **effective handing and also save equipment from damage** in all weather conditions and during transportation.

9. **Special Instructions on Trials if any**. No Cost (NC) Single Stage Composite Trials in accordance with Chapter-III of DAP-2020..

10. **Offsets, if Applicable**. Not Applicable.

11. **ToT, if Applicable**. Not Applicable.

Station : New Delhi

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