Copy No 1

INVITATION FOR EXPRESSION OF INTEREST FOR PROCUREMENT OF AUTONOMOUS SURVEILLANCE AND ARMED DRONE SWARM (A-SADS) FOR HIGH ALTITUDE AREA UNDER MAKE-II CATEGORY OF DAP-2020

References : **Defence Acquisition Procedure - 2020.**

Appendices :

Appendix 'A'	:	Preliminary Service Qualitative Requirements
Appendix 'B'	:	Commercial Evaluation Criteria.
Appendix 'C'	:	Technical Evaluation Criteria.
Appendix 'D'	:	Correctness Certificate.
Appendix 'E'	:	Confidentiality Agreement.
Appendix 'F'	:	EoI Compliance Certificate.
Appendix 'G'	:	Information Performa

1. **Introduction**. Drone technology has proved to be a Force Multiplier in military operations as evident from its application in various recent conflicts across the World especially Armenia - Azerbaijan, Syria, Strike on Oilfields in Saudi Arabia, and the ongoing Russia-Ukraine conflict. Even in our context, the recent incidents along the borders have been a noticeable **increase in drone related incidents** along the Northern Borders in the recent past. There are also confirmed incidents of dropping of undesirable payloads into Indian Territory by hostile drones, and drones carrying out surveillance activities have also seen sighted by own forward troops. Hence, there is an **urgent operational requirement to induct this niche technology into Indian Army at the earliest**. Achieving requisite combat edge over the adversary necessitates induction of Swarm Drones to equip the tactical commanders with a Force Multiplier capable of providing surveillance inputs, undertaking close recce of a particular area to confirm inputs received from other ISR resources, engage varied targets like A vehicles, B vehicles, artillery, Air Defence equipment and enemy command and control centres. A-SADS can be employed in both offensive and defensive ops, providing a decisive edge to the tactical commanders employing them. A group of drones operating in conjunction with the ground manoeuvre forces will provide an aerial manoeuvre capability during both offensive and defensive operations, thereby enhancing the combat potential of the ground forces.

2. **Objective** The objective of this invitation of Expression of Interest (EoI) is to seek willingness of Indian Vendors to participate in the Make II Project for procurement of Autonomous Surveillance and Armed Drone Swarm (A-SADS) for High Altitude Area under Make-II category of DAP-2020. Indian Vendors meeting the Technical, Commercial and Project Requirements laid out in the EoI will be issued a 'Project Sanction Order' to develop a prototype as per provisions of DAP-2020.

3. **Layout** The EoI has been covered under following parts:-

(a) Part I : General Information.

(b) Part II : Scope of the Project.

(c) Part III : Evaluation Criteria.

(d) Part IV : Procedure for submission of response to the EoI.

(e) Part V : Miscellaneous.

4. The nodal officer for this project for all queries/ clarifications/ coordination will be the **Member Secretary, Project Facilitation Team (PFT)**, Autonomous Surveillance and Armed Drone Swarm (A-SADS) for High Altitude Area. Address and contact details of the nodal officer are given at **Paragraph 31 of the EoI**.

PART-I : GENERAL INFORMATION

5. **Nomenclature**. Autonomous Surveillance and Armed Drone Swarm (A-SADS) for High Altitude Area.

6. **Categorisation**. 'In accordance with **Para 5 of Chapter-III of DAP-2020'**. The project shall be further categorised as under:-

(a) **Prototype Development Phase**. **'Make-II (Industry Funded)'**, in accordance with Para 5 (b) (i) of Chapter-III of DAP-2020 with minimum 50% Indigenous Content.

(b) **Procurement Phase**. **Buy Indian (IDDM)** with min 50% IC, in accordance with Para 6 (d) of Chapter-III of DAP-2020'.

7. **Indigenous Content**. The product will be indigenously designed, developed and manufactured and should have minimum of 50 % Indigenous Content (IC) on cost basis of the total contract value at both prototype as well as production stages.

8. **Quantities**. The quantities sought for the project are :-

(a) **Prototype Development Stage**. Following quantities of Autonomous Surveillance and Armed Drone Swarm (A-SADS) for High Altitude Area will be provided at Prototype Development Stage :-

Serial No	Items	Quantity
(i)	Aerial Vehicles (AVs) to include two Aerial Data Relay payloads, two High Performance EO-IR Sensor with LRF and 18 Standard EO-IR Sensor	20
(ii)	Ground Control Station (GCS)	01
(iii)	HE (Fragmentation) 3 kg bombs	05
(iv)	HE (Fragmentation) 5 kg bombs	05
(v)	Shaped Charge Top Attack ammunition	05
(vi)	Remote Video Terminals (RVTs) with transponders	04

(b) **Procurement Stage**. Five sets consisting of 50 drones each and two sets consisting of 75 drones each of Autonomous Surveillance and Armed Drone Swarm (A-SADS) for High Altitude Area as under :-

Ser No	Item	Quantity
(i)	Aerial Vehicles (AVs)	400
(ii)	Ground Control Station (GCS)	18
(iii)	HE (Fragmentation) 3 kg bomb	400
(iv)	HE (Fragmentation) 5 kg bomb	400
(v)	Shaped Charge Top Attack ammunition	160
(vi)	Remote Video Terminals (RVTs) with transponders	18
(vii)	Aerial Data Relay (ADR)payloads	125
(viii)	High Performance EO-IR Sensor with LRF	100
(ix)	Standard EO/ IR Sensor	300

9. **Make-II Procedure**. Make-II Procedure is available at Chapter III of DAP-2020 and amendments thereto.

10. **Appreciated Timelines**. Tentative timelines for the project are as given at **Serial No 14**.

PART- II : SCOPE OF THE PROJECT

Autonomous Surveillance and Armed Drone Swarm (A-SADS) for High Altitude Area

11. **Scope**. Five sets consisting of 50 drones each and two sets consisting of 75 drones each of Autonomous Surveillance and Armed Drone Swarm (A-SADS) for High Altitude Area is an inescapable requirement to cater for five Pivot Formations and two strike formations deployed in High Altitude Area, which will be developed by the Indian Industry. This project is aimed at meeting this requirement indigenously.

12. **Preliminary Services Qualitative Requirements (PSQR) of the Proposed System**. PSQR (aligned to DAP-2020) for Autonomous Surveillance and Armed Drone Swarm (A-SADS) for High Altitude Area is attached as **Appendix 'A'**.

Time Lines and Milestones

13. Stages of development and procurement are as per Chapter-III of DAP-2020 and amendments thereto.

14. **Time Lines & Milestones.**

Ser No	Activity	Remarks	Timelines (from AoN)
(a)	Issue of EoI	By Project Facilitation Team (PFT)	T_0
(b)	EoI Responses Submission	By EoI respondents (Indian Vendors)	T_0 + 8 weeks
(c)	EoI Responses Evaluation	By Project Facilitation Team (PFT)	6 weeks T_0 + 14 weeks
(d)	Short listing of DAs and Issue of Project Sanction Order for Development of Prototype	To selected DAs, those meeting evaluation criteria	2 weeks T_0 + 16 weeks
(e)	Design and Development of Prototype and Prototype Readiness Review	(i) Design & Development of Prototype. (ii) Prototype Readiness Review by PFT to ensure matching of development of product as per PSQR. (iii) More than one review may be conducted, on required basis. Dates will be promulgated by the PFT, as per progress of the project	T_0 + .16 to T_0 + 64 weeks
(f)	Single Stage Composite Trials, Ratification and Acceptance of Trial Report, Conversion of PSQRs to GSQRs, Issue of commercial RFP & Solicitation of Commercial Offers and conclusion of contract.	As per DAP-2020 and amendment thereto as applicable. Sequence of activity after development of prototype upto signing of contract will be amplified in the PSO.	-

Development of Prototype and Prototype Readiness Review

15. Prototype will be developed by the selected vendors after the issue of Project Sanction Order. Prototype Readiness Review by PFT to ensure matching of development of product as per PSQR will be carried out. All possible and reasonable assistance and any clarification related to functional or operational aspects of development as sought by DAs will be provided by Project Facilitation Team (PFT).

16. **Assistance to be Provided.** Assistance to Development Agencies (DAs) will be provided by provision of ranges for carrying out trials. Ranges will be provided for a duration of 10 days in two blocks of 5 days each on sharing basis. Access to various types of equipment for collection of data for training of Artificial Intelligence software will be facilitated by the PFT. Additional assistance if any will be solely at the discretion of the PFT. In case any damage occurring to equipment/ property/ personnel resulting from the testing of the job of private entity, the private entity is liable to bear the expenses of repair/ replacement of the facility and all necessary insurance coverage for the job shall be the responsibility of the private entity.

Solicitation of Commercial Offers

17. A commercial Request for Proposal (RFP) for 'Buy (Indian-IDDM)' phase would be issued to all DA(s) for soliciting their commercial offers. Sequence of activity after development of prototype upto signing of contract will be amplified in the PSO. **Additional technical information/ documentation, as may be necessary including those related to Indigenous Content and IPRs would also be required to be provided by the vendor prior to the issue of Commercial RFP** (as applicable).

Deliverables

18. The project is envisaged to have the following deliverables :-

(a) **Prototype Development Stage**. Prototype quantities as under will be provided :-

Serial No	Items	Quantity
(i)	Aerial Vehicles (AVs) to include two Aerial Data Relay payloads, two High Performance EO-IR Sensor with LRF and 18 Standard EO-IR Sensor	20
(ii)	Ground Control Station (GCS)	01
(iii)	HE (Fragmentation) 3 kg bomb	05
(iv)	HE (Fragmentation) 5 kg bomb	05
(v)	Shaped Charge Top Attack ammunition	05
(vi)	Remote Video Terminals (RVTs) with transponders	04

(b) **Procurement Stage**. Five sets consisting of 50 drones each and two sets consisting of 75 drones each of Autonomous Surveillance and Armed Drone Swarm (A-SADS) for High Altitude Area as under :-

Ser No	Item	Quantity	Delivery Schedule
(i)	Aerial Vehicles (AVs)	400	Four sets per year.
(ii)	Ground Control Station (GCS)	18	
(iii)	HE (Fragmentation) 3 kg bomb	400	
(iv)	HE (Fragmentation) 5 kg bomb	400	
(v)	Shaped Charge Top Attack ammunition	160	
(vi)	Remote Video Terminals (RVTs) with transponders	18	
(vii)	Aerial Data Relay (ADR)payloads	125	
(viii)	High Performance EO-IR Sensor with LRF	100	
(ix)	Standard EO/ IR Sensor	300	

(c) Training and Technical literature to include User Hand Book, Preservation Instructions, Complete Equipment Schedule and Technical Manuals. These will be provided with the equipment during the procurement phase. Details will be further amplified in the Request for Proposal (RFP).

(d) **Warranty**. The goods supplied shall carry a standard warranty for 24 months from the date of acceptance by JRI. Details will be further amplified in the Commercial Request for Proposal (RFP).

(e) **Comprehensive Maintenance Contract (CMC)**. An appropriate **Comprehensive Maintenance Contract (CMC) for three years** after two years warranty will be required for repair & maintenance of the equipment. Details will be further amplified in the Request for Proposal (RFP).

PART III : EVALUATION CRITERIA

Commercial Evaluation Criteria

19. EoI respondents will furnish their response to the Commercial Evaluation Criteria as per **Appendix 'B'**.

Technical Evaluation Compliance Matrix

20. The respondents to this EoI are required to furnish information and compliance/ information as per **Appendix 'C'** against PSQR of the equipment.

21. **Indigenous Content**.

(a) **Prototype Development Stage**. **Minimum 50% Indigenous Content** with indigenous design and development.

(b) **Procurement Phase**. Post successful development of prototype(s), further procurement will be as per the **'Buy (Indian-IDDM)'** procedure with a **minimum of 50% Indigenous Content** in accordance with Para 21 of Chapter-I of DAP 2020.

22. **Additional Information**. Additional information required to be furnished as part of the EoI response is given at **Appendix 'G'**.

23. **Foreign Collaboration**. If the DA is collaborating/ plans to collaborate with a foreign technology provider, the nature of such collaboration and the technology areas being transferred must be stated in the response (please refer Para 12 of **Appendix 'G'**).

PART-IV : PROCEDURE FOR SUBMISSION OF RESPONSE TO THE EoI

24. The response to the EoI shall be submitted as per formats given at **Appendix 'B'** to **Appendix 'G'**.

25. **Guidelines for Submitting EoI Responses**

(a) The responses should be submitted strictly as per the formats given in respective Appendices. Should a vendor need to mention any other information, a separate column / row may be added. Vendors should provide compliance or non-compliance to parameters and no conditional response/ compliance shall be submitted by the firm/ vendors.

(b) All responses and Appendices should be submitted in a single file / folder. Supporting documents / additional references should be submitted in a separate folder with proper reference mentioned against each parameter / sub parameter in respective appendices.

(c) Any supporting document / evidence without any reference to specific parameter of criteria will not form part of the assessment.

26. **Rejection Criteria for Selection as DAs**. The following may lead to rejection of EoI response :-

(a) Failure to meet Commercial Evaluation Criteria given at **Appendix 'B'**.

(b) Failure to meet/ comply with the Technical Evaluation Criteria Specifications given at **Appendix 'C'**.

(c) Failure to offer compliance to any of the terms and conditions given in the EoI.

(d) Failure to submit certificates as mentioned at **Appendix 'D'** to **Appendix 'G'** of the EoI.

(e) Any other parameter of the response considered inadequate by the MoD, Government of India.

27. **Foreclosure Criteria**. As per provisions of Para 20, Chapter-III of DAP-2020, no government funding is envisaged for prototype development, but there is an assurance of orders on successful development and trials of prototype. No foreclosure of the project will be done after issue of Project Sanction Order other than for reasons of default / non-adherence to Project Sanction Order by vendors or delay by DA to produce the prototype for trials.

28. The EoI respondent shall submit three (03) copies of response to the EoI, clearly marking one copy as '**Original Copy**' and second & third as '**Duplicate Copy and Triplicate Copy**'. In the event of any discrepancy between them, the original copy shall govern/ prevail. Each page of the response will bear the signatures of the authorised signatory of the company. The DA shall also submit a soft copy of the response to this EoI in a CD/ DVD.

29. **The Envelopes shall be Addressed as under** :-

Secretary, Project Facilitation Team
General Staff Branch/ Armoured Corps-3,
Directorate General of Armoured Corps, Integrated HQ of MoD (Army)
Room No 501, 'A' Wing, Sena Bhawan
DHQ PO, New Delhi - 110011
email id - xecoord-2020@gov.in
Tele No - 33564

30. The responses to this EoI must be submitted by **17 Nov 2022** at the above mentioned address.

31. The Company will be required to sign and honour the 'Confidentiality Agreement' with MoD Govt of India. The 'Confidentiality Agreement' will be furnished by each EoI respondent at the time of submission of EoI responses as per format given at **Appendix 'E'**.

PART-V : MISCELLANEOUS

32. **Pre EoI Responses Meeting** A pre-response meeting will be held on **20 Oct 2022** at Directorate General of Armoured Corps (Armoured Corps-3), New Delhi-110011. Vendors are required to submit their queries / clarifications / amplifications in writing to this office by **13 Oct 2022**.

33. Guidelines for penalties in business dealings with entities as promulgated by Government from time to time, will be applicable on procurement process & bidders.

34. The Pre-Contract Integrity Pact (PCIP), listed as detailed in Paragraph 92 of Chapter II of DAP-2020, shall apply mutatis mutandis to the 'Buy (Indian-IDDM)' phase of 'Make' project.

35. Respondents would be subject to disqualification if they make false, incorrect or misleading claims in their response to this EoI. A 'Correctness Certificate' as per the format at **Appendix 'D'** will be furnished as part of the response.

36. Please acknowledge the receipt of this invitation for EoI.

File No : A/36026/Swarm Drone Make-II/GS/AC-3 (i)

(Sumeet Bhat)
Colonel
Member Secretary
Project Facilitation Team
Directorate General of Armoured Corps
Armd Corps-3

Dated : 22 Sep 2022

Enclosures : Appendices 'A' to Appendix 'G'

Appendix 'A'
(Refer Para 12 of EoI)

PRELIMINARY STAFF QUALITATIVE REQUIREMENT FOR AUTONOMOUS SURVEILLANCE AND ARMED DRONE SWARM FOR HIGH ALTITUDE AREA

1.	Reference of GS Policy Statement	-	**350**
2.	PSQR No	-	**106**
3.	Other Previous PSQR No	-	-
4.	Reference GSEPC Meeting	-	**1st (2022) Collegiate mtg held on 09 Feb 22.**
5.	Sponsor Dte	-	**Dte Gen Armd Corps (AC-3)**
6.	Sponsor Dte File No	-	**A/36026/Swarm Drone Make-II/GS/AC-3 (i)**
7.	Nomenclature (of equipment)	-	**AUTONOMOUS SURVEILLANCE AND ARMED DRONE SWARM FOR HIGH ALTITUDE AREA**
8.	Security Classification	-	**RESTRICTED**
9.	Priority of Development	-	**PRIORITY-I / On Immediate Basis**
10.	PSQR to be Reviewed / modified	-	**As on Required Basis**
11.	Next Review	-	**As on Required Basis**

GENERAL INFORMATION

Introduction

12. Drone technology has proved to be a Force Multiplier in military operations as evident from its application in various recent conflicts across the world especially Armenia-Azerbaijan, Syria and Strike on Oilfields in Saudi Arabia. Even in our context, the recent incidents along the borders has been a noticeable **increase in drone related incidents** along the Northern & Western Borders in the recent past. There are also confirmed incidents of dropping of undesirable payloads into Indian Territory by hostile drones, and drones carrying out surveillance activities have also been sighted by own forward troops. Hence, there is an **urgent operational requirement to induct this niche technology into Indian Army at the earliest**.

Operational Philosophy/ Proposed Employment

13. A group of drones operating in conjunction with the ground manoeuvre forces will provide an aerial manoeuvre capability during both offensive and defensive operations, thereby enhancing the combat potential of the ground forces. The shaping of battlefield can be greatly influenced by Drone Swarms, thereby allowing preservation of decisive columns of Mechanised Forces initially and application at place and time of own choosing. If applied in correct time and space matrix, it can yield dividends out of proportion.

14. The inherent advantages of affordability, flexible employability, redundancy, precision, software domination, reduction in mission costs, Beyond Line of Sight (BLOS) attack capability and reduced risk of human casualties make the Swarm Drones a potent option for employment in conventional as well as non-conventional operations.

(a) The advantages accrued by employing Swarm Drones are as under :-

(i) Swarm Drones will provide an aerial manoeuvre capability and preserve decisive ground forces for application at the time of own choosing.

(ii) The swarm drones can carry multiple payloads for ISR, targeting, Aerial Data Relay (ADR), Electronic Warfare and other payloads giving it the capability to undertake multiple tasks in a single mission.

(iii) Swarm drones undertake collaborative attack, ensuring high lethality and increased chances of mission accomplishment.

(iv) It gives the capability to the tactical commander to engage targets which are beyond Line of sight & also on reverse slopes of mountains.

(v) In High Altitude Area, the swarm drones overcome the inherent drawbacks of Line of sight limitations of surveillance devices and time taken to move by road.

(vi) Swarm drones have Artificial Intelligence capability, thus providing autonomous, semi-autonomous and manual modes and capabilities like flocking, schooling, foraging and distributive intelligence for executing multiple missions.

(vii) Swarm drones can carry suitable payloads to execute Electronic Warfare.

(viii) Swarm drones can be employed for trans Line of Control and trans LAC strikes on selected targets.

15. Swarm Drones provide Tactical commander with a Force Multiplier capable of providing Surveillance inputs, carrying out close recce of a particular area to confirm inputs received from other ISR resources, engage varied targets like A vehicles, B vehicles, artillery and Air Defence equipment, enemy command and control centres and other targets. It can be utilised in both offensive and defensive operations, giving a decisive edge to the commanders employing them.

Aim

16. To lay down Qualitative Requirements for Autonomous Surveillance and Armed Drone Swarm for High Altitude Area.

ESSENTIAL PARAMETERS

PART I : OPERATIONAL PARAMETERS

17. The Operational Parameters of Autonomous Surveillance and Armed Drone Swarm for High Altitude Area are as follows : -

(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) A set of 75 Swarm Drones should consist of :-

(i) 75 drones.

(ii) Four Ground Control Station (GCS).

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

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

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

(aa) 20 aerial vehicles will have one High Performance EO-IR sensor with LRF.

(ab) 55 aerial vehicles will have one Standard EO-IR sensor.

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

(aa) **Anti Personnel**. Quantity 75 each of 3 kg and 5 kg HE Fragmentation ammunition.

(ab) **Shaped Charge Top Attack Ammunition**. Quantity 30 shaped charge top attack ammunition.

(ac) The explosive payloads should be user configurable.

(vii) **Aerial Data Relay (ADR)**. 25 drones should be configured as ADRs for data relay.

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

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

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

(e) **Launch Altitude**. The Swarm drones must be capable of being launched from altitudes upto 4500 mtr AMSL.

(f) **Operating Altitude**. The drones should be capable of operating at altitudes of not less than1000 mtr Above Ground Level.

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

(i) Maximum - As actually obtained in locations where proposed to be employed.

(ii) Minimum - Between minus 20°C and minus 10°C.

(h) **Operating Range**. The operating range of the drones with Aerial Data Relay (ADR) should be minimum 30 km (one way distance).

(j) **Endurance**. Drones should have an endurance of minimum two hours.

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

(l) **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 35 km per hour.

(m) **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.

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

(o) **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.

(p) **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.

(q) **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.

PART II : TECHNICAL PARAMETERS

18. The Technical Parameters for Autonomous Surveillance and Armed Drone Swarm for High Altitude Area are as follows :-

(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 **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 state.

(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).

PART III : MAINTAINABILITY & ERGONOMIC PARAMETERS

19. The Autonomous Surveillance and Armed Drone Swarm for High Altitude Area should have the following operational and maintain ability characteristics :-

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

(b) It should conform to opto 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.

DESIRABLE PARAMETERS

20. **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 50 km per hour.

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