

REQUEST FOR COMMENTS OF STAKEHOLDERS/OEM/FIRMS
ON QRS/TDS FOR NANO UAV

1. The proposed QRs/TDs of Nano UAV is attached as **Appendix 'A & B'**. The OEMs/Vendors are requested to forward information of the product which they can offer and also forward correct specifications of their system against each parameter. Complied or not complied remarks will not be accepted.

2. The required information/details may please be forwarded at the following addresses by **12th February 2019**.

Directorate General CRPF

East Block-7, Sec-1, R.K. Puram, New Delhi-110066

Email: comncell@crpf.gov.in

3. An early response is requested.

QRS OF NANO UAV

SN	Parameter	Specifications
1	Nano UAV system should consist of the following sub-systems:-	
1.1	UAV Bird with battery pack	
1.2	Ground Control station with data link equipment	
1.3	Daylight & night Camera Payload	
1.4	Universal Battery Charger with Power Supply System	
2	<u>Nano UAV characteristics:-</u>	
2.1	Role	Personal soldier Surveillance, air platform of very small size of close range surveillance and detection during day and night.
2.2	Launch and Recovery mode	i) Vertical Take Off and Landing (VTOL) from within an area of 01m x 01m clearing or less.
		ii) Payload should not damage during recovery of UAV
2.3	Aural Signature	≤40dbs at 50 feet Above Ground Level
2.4	Payloads carrying capability	Should have capability to carry electro Optic (EO) for day and Thermal Imager (TI) for night one at a time. or Integrated day & Night payload. (As per user requirement)
2.5	Flight Modes	a) Fully Autonomous Vertical Take Off
		b) Fully Autonomous Vertical Landing
		c) Hover at defined waypoint
		d) Autonomous waypoint navigation (pre-defined as well as dynamically adjustable waypoints during flight)
		e) Remote Piloted mode for video based user navigation.
		f) Vision based Autonomous Target Tracking of fixed and moving targets.
		g) Should be controllable in real time from the GCS up to recovery.
		h) Fully autonomous and stabilized.
2.6	Endurance	20 minutes or more with all payloads at Mean Sea Level.
2.7	Operating Altitude	100 feet AGL (Above Ground Level) or more.
2.8	Launch Altitude	2000m AMSL (Above Mean Sea Level) or more
2.9	Range of Operation	Minimum 1 km line of sight
2.10	Cruise Speed	18 km/h or more
2.11	Operating Wind Conditions	a) Take off: 10 knots or more b) Landing: 10 knots or more c) gust: 20 knots or more
2.12	Failsafe features	a) Automatic Return to Home on communication failure
		b) Automatic Return to Home/ Land on low battery

SN	Parameter	Specifications
		c) Multiple GPS on-board for GPS failure redundancy
2.13	Propulsion system	Electrical with rechargeable batteries
3.	<u>Payload characteristics:-</u>	
3.1	Payloads required	a) Electro Optic (EO) for day (colour) b) Thermal Imager (TI) for night or c) Integrated day & night payload. (As per user requirement)
3.2	Payload and Video Stabilization	a) All payloads should be gimbals stabilized on-board. b) Video output should be digitally stabilized at all zoom levels. c) Quality of video should not be affected by UAV vibrations.
3.3	Electro optic (EO) Daylight Payload	a) Colour Camera with 360° pan and 90° tilt control during flight. b) Resolution: 1280 X 720 pixel or better c) Optical Zoom: 10X zoom with minimum-FOV≤5°, maximum-FOV ≥ 45° (wide field). Digital zoom: 4X d) Should be able to detect human size target at 250 meter slant or more
3.4	Thermal Imager (TI) Night Payload	a. Thermal Camera with 360° pan and 90° tilt control during flight. b. Resolution: 640 X 480 pixels or better c)White/Black Hot modes d) Digital Zoom: 4X or more e) Should be able to detect human size target at 100 meter slant or more
3.5	Night Recovery Beacon	Switchable (from GCS) LED light when operating with Night Payload
4.	<u>Ground Control Station characteristics:-</u>	
4.1	Option-1: GCS should have MIL-STD-810G or better and IP51 or better, semi rugged laptop. Option-2: GCS should have MIL-STD-810G or better and IP65 or better, rugged laptop. (As per user requirement)	
4.2	Computing Hardware :-	
	CPU	Intel Core i5 v Pro Processor, 2.3 GHz or better
	Storage	Minimum 500 GB
	Memory	2GB or more
	Display	Minimum 10 inch – 1024 x 768 XGA sunlight readable screen, anti-glare.
	Keyboard &	Touch screen
	input	

SN	Parameter	Specifications
4.3	Battery Operation	Minimum two hours at peak utilisation.
4.4	Battery Charging time of GCS	Should be less than 3.5 hours
4.5	Data portability	Ports for data transfer to external secondary storage devices
4.6	Interface	VGA/HDMI, USB, 10/100/1000 Ethernet.
4.7	Capability	<ul style="list-style-type: none"> a) Transmit control commands to UAV. b) Receive UAV flight and propulsion parameters. c) Receive, display and record real time day and night video from UAV. d) Capability to control UAV while on the move.
4.8	GCS Application Software	<ul style="list-style-type: none"> a) Geographic Map along with UAV location, UAV trajectory, camera view polygon, waypoints and flight plan. b) Real-time video from the UAV with on-screen display of important parameters like:- <ul style="list-style-type: none"> i. Coordinate of target ii. Ground altitude of target iii. UAV Position iv. Height of UAV above ground label v. Distance of UAV from GCS vi. Bearing (Azimuth) of UAV from GCS vii. Ground speed of UAV viii. UAV Heading/ True North indication ix. Mission time c) Geographic map and real-time video should be displayed at all times during the flight. d) Geographic map and real-time video views should be resizable and/or switchable to allow user to switch between big map/small video and small map/big video views through a single click/button input. e) Artificial Horizon indicating UAV altitude. f) Switchable between 2D/3D views, capability to Tilt/rotate 3D map as per user input.
4.9	Map Formats	<ul style="list-style-type: none"> a) Should have the capability to integrate geo-referenced raster maps provided in at least one of the commonly used digital map formats (GIF, TIFF, DTED and SRTM etc.) b) Should be able to work with Google Maps, application should have the capability to download maps automatically after specifying location GPS co-ordinates.

SN	Parameter	Specifications
4.10	Payload Controls	a) Selection and switch on/off of payload b) Pan/Tilt/Zoom Controls c) Point payload to ground co-ordinate function d) Recording on/off e) Switch on/off Night Recovery Beacon
4.11	Joystick Controls	i. Full Camera Control- a).Pan/Tilt b). Zoom In/Out c).Black/White Hot ii. RPV Mode iii. Altitude Control
4.12	Video	a) Video should be recorded in any commonly portable video formats (AVI/MPEG/ MP4 etc) b) Video of the full flight should be recorded c) Should have capability to take image snapshots at any time during flight d) Software should be provided that will facilitate extraction of imagery from the recorded video post flight
4.13	Pre-flight checks	Self-test of UAV system, Output: go/no go
5.	<u>Communication Link:-</u>	
5.1	Communication link equipment capability	i) Transmit control commands from GCS to UAV ii) Transmit parameter of UAV and payload to GCS iii) Transmit day and night video from UAV to GCS
5.2	Type of link	Secured digital uplink & downlink with AES encryption.
5.3	Frequency Band	System should operate on S & C frequency Band uplink and down link, preferably on license free band i.e 2.4 Ghz or 5.8 Ghz.
6.	<u>General System requirements:-</u>	
6.1	Weight	The weight of complete Nano UAV bird including battery pack & one payload should \leq 250 gms.
6.2	Assembly/ Disassembly time	Less than 2 minutes each.
6.3	Life of Nano UAV	The total technical life of Nano UAV should not be less than 750 landings.
6.4	Environmental Conditions for Operation and Storage	The UAV and associated systems should be certified for operation and storage for following environment conditions. i) Damp Heat: 40 °C at RH not less than 95%
		ii) Operating temperature & Storage temp: -10°C to +55°C
		iii) Ability to withstand dust, drizzle and humid conditions

SN	Parameter	Specifications
6.5	Portability and Operation	The Nano UAV should be battery operated portable, light in weight, compact, for day and night surveillance, capable of being carried and operated by one man.
6.6	Battery of AV	The intelligent standard lithium based battery pack should have the backup of minimum 20 minutes.
6.7	Battery Charger of AV battery	Suitable universal battery charger to charge the batteries within one hour.
6.8	Accessories	a) Water proof Back Packs IP66: 1 set
		b) Field Repair kit: 1 No's
		c) Lithium based Battery packs; 3No's
		d) Spare propeller Sets: 2 No's
		e) Associated Cables & Mountings: 1set
		f) Hard transportation boxes: 1set
		g) User, Technical & Maintenance Manual: 1set
		h) Log book : 1 set
7	Miscellaneous	
7.1	Training : 5 working days training will be provided to 04 students .	
7.2	Nano UAV must complied all relevant parameters as per DGCA F.No.05-13/2014-AED Vol.IV dated 27.08.2018	

TRIAL DIRECTIVES OF NANO UAV

Trial/Technical evaluation of UAV will be conducted by a Board of Officers (B.O.O.) to assess actual performance of the equipment.

2. All parameters/Specifications mentioned in QRs will be checked by the Board of Officers in the presence of representative of firm.

i) **Physically check:-** In this category, specifications of the equipment will be checked physically as per QRs.

ii) **Practically check:-** The representative of firm will show all the features/ configuration of the equipment to the board of officers during trial.

iii) **Submission of certificates:-** Firm will provide certificate from Govt. Lab. or DRDO or NABL accredited or ILAC accredited laboratory which are mentioned in respective parameters.

SN	Parameter	Specifications	Trial directives
1	Nano UAV system should consist of the following sub-systems:-		
1.1	UAV Bird with battery pack		Board will check it physically and will ensure that items are available as per tender publication.
1.2	Ground Control station with data link equipment		
1.3	Daylight & night Camera Payload		
1.4	Universal Battery Charger with Power Supply System		
2	Nano UAV characteristics:-		
2.1	Role	Personal soldier Surveillance, air platform of very small size of close range surveillance and detection during day and night.	Board will check it practically during day and night and will ensure that UAV equipped with these features.
2.2	Launch and Recovery mode	i) Vertical Take Off and Landing (VTOL) from within an area of 01m x 01m clearing or less. ii) Payload should not damage during recovery of UAV	Board will check practically by vertically take off and landing the UAV within the shown area and will ensure that payload should not damage during recovery of UAV.
2.3	Aural Signature	≤40dbs at 50 feet Above Ground Level	The firm will submit certificate of Govt. Lab. or DRDO or NABL accredited or ILAC accredited laboratory.
2.4	Payloads carrying capability	Should have capability to carry electro Optic (EO) for day and Thermal Imager (TI) for night one at a time. or Integrated day & Night payload. (As per user requirement)	Board will check practically.

SN	Parameter	Specifications	Trial directives
2.5	Flight Modes	a) Fully Autonomous Vertical Take Off	Board will check it practically.
		b) Fully Autonomous Vertical Landing	
		c) Hover at defined waypoint	
		d) Autonomous waypoint navigation (pre-defined as well as dynamically adjustable waypoints during flight)	
		e) Remote Piloted mode for video based user navigation.	
		f) Vision based Autonomous Target Tracking of fixed and moving targets.	
		g) Should be controllable in real time from the GCS up to recovery.	
		h) Fully autonomous and stabilized.	
2.6	Endurance	20 minutes or more with all payloads at Mean Sea Level.	Board will check practically with maximum payload up to launch altitude of 1000 meter Above Mean Sea Level (AMSL).
2.7	Operating Altitude	100 feet AGL (Above Ground Level) or more.	Board will check practically by flying the UAV.
2.8	Launch Altitude	2000m AMSL (Above Mean Sea Level) or more	Firm will submit OEM certificate.
2.9	Range of Operation	Minimum 1 km line of sight	Board will check practically.
2.10	Cruise Speed	18 km/h or more	Board will check practically and firm will submit OEM certificate..
2.11	Operating Wind Conditions	a) Take off: 10 knots or more	Board will check it practically or firm certificate will be accepted in this regard.
		b) Landing: 10 knots or more	
		c) gust: 20 knots or more	
2.12	Failsafe features	a) Automatic Return to Home on communication failure	Board will check it practically.
		b) Automatic Return to Home/ Land on low battery	

SN	Parameter	Specifications	Trial directives
		c) Multiple GPS on-board for GPS failure redundancy	Firm will submit OEM certificate.
2.13	Propulsion system	Electrical with rechargeable batteries	Board will check it practically.
3.	Payload characteristics:-		
3.1	Payloads required	a) Electro Optic (EO) for day (colour) b) Thermal Imager (TI) for night or c) Integrated day & night payload. (As per user requirement)	Board will check practically after fitting the required payloads and ensure that UAV working satisfactorily.
3.2	Payload and Video Stabilization	a) All payloads should be gimbals stabilized on-board. b) Video output should be digitally stabilized at all zoom levels. c) Quality of video should not be affected by UAV vibrations.	Board will check practically all parameters
3.3	Electro optic (EO) Daylight Payload	a) Colour Camera with 360° pan and 90° tilt control during flight. b) Resolution: 1280 X 720 pixel or better c) Optical Zoom: 10X zoom with minimum-FOV≤5°, maximum-FOV ≥ 45° (wide field). Digital zoom: 4X d) Should be able to detect human size target at 250 meter slant or more	Board will check it practically and ensure daylight payload working as per their parameters and firm will produce OEM certificate for resolution and FOV.
3.4	Thermal Imager (TI) Night Payload	a. Thermal Camera with 360° pan and 90° tilt control during flight. b. Resolution: 640 X 480 pixels or better c)White/Black Hot modes d) Digital Zoom: 4X or more e) Should be able to detect human size target at 100 meter slant or more	Board will check it practically and ensure daylight payload working as per their parameters and firm will produce OEM certificate for resolution.
3.5	Night Recovery Beacon	Switchable (from GCS) LED light when operating with Night Payload	Board will check it practically.
4.	Ground Control Station characteristics:-		
4.1	Option-1: GCS should have MIL-STD-810G or better and IP51 or better, semi rugged laptop. Option-2: GCS should have MIL-STD-810G or better and IP65 or better, rugged laptop. (As per user requirement)		Firm will submit certificate of Govt. Lab. or NABL accredited or ILAC accredited laboratory.

SN	Parameter	Specifications	Trial directives
4.2	Computing Hardware :-		
	CPU	Intel Core i5 v Pro Processor, 2.3 GHz or better	BOO will check it practically one by one all parameter, supplier also provide certificate in this regards. Ensure all parameters are available in the equipment.
	Storage	Minimum 500 GB	
	Memory	2GB or more	
	Display	Minimum 10 inch – 1024 x 768 XGA sunlight readable screen, anti-glare.	
	Keyboard & input	Touch screen	
4.3	Battery Operation	Minimum two hours at peak utilisation.	Board will check practically
4.4	Battery Charging time of GCS	Should be less than 3.5 hours	Board will check practically
4.5	Data portability	Ports for data transfer to external secondary storage devices	Board will check practically
4.6	Interface	VGA/HDMI, USB, 10/100/1000 Ethernet.	Board will check practically
4.7	Capability	a) Transmit control commands to UAV. b) Receive UAV flight and propulsion parameters. c) Receive, display and record real time day and night video from UAV. d) Capability to control UAV while on the move.	Board will check capability of the system practically according the mentioned parameters.
4.8	GCS Application Software	a) Geographic Map along with UAV location, UAV trajectory, camera view polygon, waypoints and flight plan. b) Real-time video from the UAV with on-screen display of important parameters like:- i. Coordinate of target ii. Ground altitude of target iii. UAV Position iv. Height of UAV above ground label v. Distance of UAV from GCS vi. Bearing (Azimuth) of UAV from GCS vii. Ground speed of UAV viii. UAV Heading/ True North indication ix. Mission time	Board will check it practically and ensure that all application are working properly.

SN	Parameter	Specifications	Trial directives
		<p>c) Geographic map and real-time video should be displayed at all times during the flight.</p> <p>d) Geographic map and real-time video views should be resizable and/or switchable to allow user to switch between big map/small video and small map/big video views through a single click/button input.</p> <p>e) Artificial Horizon indicating UAV altitude.</p> <p>f) Switchable between 2D/3D views, capability to Tilt/rotate 3D map as per user input.</p>	
4.9	Map Formats	<p>a) Should have the capability to integrate geo-referenced raster maps provided in at least one of the commonly used digital map formats (GIF, TIFF, DTED and SRTM etc.)</p> <p>b) Should be able to work with Google Maps, application should have the capability to download maps automatically after specifying location GPS co-ordinates.</p>	Board will check capability of the system practically according the mentioned parameters.
4.10	Payload Controls	<p>a) Selection and switch on/off of payload</p> <p>b) Pan/Tilt/Zoom Controls</p> <p>c) Point payload to ground co-ordinate function</p> <p>d) Recording on/off</p> <p>e) Switch on/off Night Recovery Beacon</p>	Board will check capability of the system practically according the mentioned parameters.
4.11	Joystick Controls	<p>i. Full Camera Control-</p> <p>a).Pan/Tilt</p> <p>b). Zoom In/Out</p> <p>c).Black/White Hot</p> <p>ii. RPV Mode</p> <p>iii. Altitude Control</p>	Board will check practically.
4.12	Video	<p>a) Video should be recorded in any commonly portable video formats (AVI/MPEG/ MP4 etc)</p> <p>b) Video of the full flight should be recorded</p> <p>c) Should have capability to take image snapshots at any time during flight</p> <p>d) Software should be provided that will facilitate extraction of imagery from the recorded video post flight</p>	Board will check capability of the system practically according the mentioned parameters.

SN	Parameter	Specifications	Trial directives
4.13	Pre-flight checks	Self-test of UAV system, Output: go/no go	Board will check capability of the system practically according the mentioned parameters.
5. <u>Communication Link:-</u>			
5.1	Communication link equipment capability	i) Transmit control commands from GCS to UAV ii) Transmit parameter of UAV and payload to GCS iii) Transmit day and night video from UAV to GCS	Board will check capability of the system practically according the mentioned parameters.
5.2	Type of link	Secured digital uplink & downlink with AES encryption.	Firm will produce OEM certificate.
5.3	Frequency Band	System should operate on S & C frequency Band uplink and down link, preferably on license free band i.e 2.4 Ghz or 5.8 Ghz.	Firm will produce OEM certificate.
6. <u>General System requirements:-</u>			
6.1	Weight	The weight of complete Nano UAV bird including battery pack & one payload should \leq 250 gms.	Board will measure weight of UAV birds with the help of weighing machine.
6.2	Assembly/ Disassembly time	Less than 2 minutes each.	Board will check practically that time to assemble & launch and time to disassemble & pack is not more than 10 min each.
6.3	Life of Nano UAV	The total technical life of Nano UAV should not be less than 750 landings.	Firm will produce OEM certificate.
6.4	Environmental Conditions for Operation and Storage	The UAV and associated systems should be certified for operation and storage for following environment conditions. i) Damp Heat: 40 °C at RH not less than 95%	Firm will submit certificate of Govt. Lab. or NABL accredited or ILAC accredited laboratory.

SN	Parameter	Specifications	Trial directives
		ii) Operating temperature & Storage temp: -10°C to +55°C iii) Ability to withstand dust, drizzle and humid conditions	
6.5	Portability and Operation	The Nano UAV should be battery operated portable, light in weight, compact, for day and night surveillance, capable of being carried and operated by one man.	Board will check practically. That system is operated by battery and being carried out and operated by two men.
6.6	Battery of AV	The intelligent standard lithium based battery pack should have the backup of minimum 20 minutes.	Board will check practically and firm will produce OEM certificate for chemistry of battery.
6.7	Battery Charger of AV battery	Suitable universal battery charger to charge the batteries within one hour.	Board will check practically by charging battery and will ensure that it is capable to charge battery within two to three hours.
6.8	Accessories	a) Water proof Back Packs IP66: 1 set b) Field Repair kit: 1 No's c) Lithium based Battery packs; 3No's	Board will check physically and firm will submit certificate of Govt. Lab. or NABL accredited or ILAC accredited laboratory for IP66.

SN	Parameter	Specifications	Trial directives
		d) Spare propeller Sets: 2 No's	
		e) Associated Cables & Mountings: 1set	
		f) Hard transportation boxes: 1set	
		g) User, Technical & Maintenance Manual: 1set	
		h) Log book : 1 set	
7	Miscellaneous		
7.1	Training : 5 working days training will be provided to 04 students .		Firm will submit undertaking certificate in this regard.
7.2	Nano UAV must complied all relevant parameters as per DGCA F.No.05-13/2014-AED Vol.IV dated 27.08.2018		