

ANNEX A – SPECIFICATION

ITEM 1		UNMANNED AERIAL VEHICLE AND ASSOCIATED ACCESSORIES		
QUANTITY REQUIRED		1		
Ser No.	Specification	Compliance (Please Tick)		Remarks (To Be Completed by Tender)
		YES	NO	
(a)	(b)	(c)	(d)	(e)
1	<p>Main UAV Unit</p> <ul style="list-style-type: none"> • Size: At least 1.60 metres diameter (motor-to-motor) • Type: Multirotor • Maximum payload weight: At least 10kg • Flight time: At least 50 minutes without payload • Flight controller: Pixhawk based flight controllers (Cube AutoPilot preferable) or any open-sourced flight controller that supports Mission Planner or its equivalent software <ul style="list-style-type: none"> ○ Interface software: Open-source software such as Mission Planner or its equivalent, which must have the following functionalities: <ul style="list-style-type: none"> ▪ Programming of autonomous waypoint mission with maps ▪ Receiving telemetry from the UAV ▪ Open-architecture that allows complete modifications of UAV parameters • Power Source: Lithium-Polymer (Li-Po) batteries or higher-efficiency battery technology <ul style="list-style-type: none"> ○ Supplied with 2 sets of spare batteries (in total 3 sets of batteries to be supplied) ○ Supplied with fast charger to charge at least one set of battery per charging cycle (1 set = Number of batteries required for flight) • Battery charger specification: <ul style="list-style-type: none"> ○ Features: Balance charging of the supplied batteries, fast charging, battery discharge function and storage charging function ○ Operating voltage: 220/240VAC 50/60Hz with British standard 3-pin plug • Wind resistance: At least 30km/h (Level 5 on Beaufort Wind Scale) • Operating temperature: 30-45°C • Operating humidity: Relative Humidity above 80% • Operating environment: Misty, Dusty, Hot and Wet 			



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		YES	NO	
(a)	(b)	(c)	(d)	(e)
	<ul style="list-style-type: none"> • Optional: <ul style="list-style-type: none"> ○ Ability to sustain minimal damage sustained by UAV from an unexpected hard landing • Warranty: The UAV unit and all the supplied equipment should have at least 6 months of warranty for any issue related to standard use cases except damages caused by user due to misuse, normal wear and tear and accidents. <p>Sensors and systems included</p> <ul style="list-style-type: none"> • Positioning Sensors: Must include GPS, GLONASS, Galileo, BeiDou • Positioning Accuracy: 0.5m or better • ADS-B range (for UAV situational awareness): At least 20km diameter of the UAV • LIDAR specifications: <ul style="list-style-type: none"> ○ Minimum of 40m ranging distance ○ Distance measurement accuracy of at least 2.5cm • Inclusive of autonomous collision detection and avoidance system • Equipped with Gyroscope, Accelerometer, Compass and Magnetometer with each system having its own redundancy • Live streaming of First-Person View (FPV) from the UAV for at least 5km • Equipped with trip recording camera: <ul style="list-style-type: none"> ○ Is detachable ○ At least Full HD (1920x1080p) resolution ○ Able to record the mission continuously for 3 hours ○ Recorded video files should be able to be downloaded/recovered easily ○ Memory storage device is to be easily replaceable in short amount of time (use of removable Solid-State Memory Storage device is preferable) 			



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		YES	NO	
(a)	(b)	(c)	(d)	(e)
	<ul style="list-style-type: none"> • Optional: Feature to enable easy locating and retrieving of UAV in case of crash <p><u>Logistics included</u></p> <ul style="list-style-type: none"> • Quick and simple assembly and disassembly process <ul style="list-style-type: none"> ○ Supplied with the appropriate tools required for the assembly and disassembly process • Easily transportable by maximum 2 persons • Equipped with payload release mechanism (<i>refer to picture in Table 2</i>) • Supplied with Fire Safe Storage Box for the storage and transportation of Li-Po batteries (each battery is supplied with individual Fire Safe Storage Box) • Supplied with the appropriate box or case for the transportation of the UAV unit and its accessories <p><u>Accessories included</u></p> <ul style="list-style-type: none"> • Supplied with at least two sets of propeller guards (1 set = number of rotors) • Supplied with at least two sets of spare propellers (1 set = number of rotors) • Two extra sets of frame parts (i.e. arms and landing legs) and other required parts required to repair and maintain the UAV in case of crash • At least two sets of ground telemetry radio set (transmitter and receiver unit) operating at 433MHz and can operate at a distance of at least 5km 			



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		YES	NO	
(a)	(b)	(c)	(d)	(e)
2	<p><u>Remote Controller Set (With Required Receiver) Included</u></p> <ul style="list-style-type: none"> • Total Number of channels: Minimum 16 channels • Transmission Power: Minimum 20dB • Maximum transmission distance: More than 10km • Operating Frequency: Must include 2.400 to 2.483GHz • Battery type: Rechargeable Li-Ion battery and have an endurance of 5-20 Hours Per-Charge <ul style="list-style-type: none"> ○ For detachable batteries, must be supplied with wires and/or fast charger ○ For non-detachable batteries, must be supplied with fast charger that operates at 220/240VAC 50/60Hz with a 3-pin British standard plug or the required accessories for fast charging • Connection ports must include, but not limited to: <ul style="list-style-type: none"> ○ USB Type-C ○ HDMI ○ RJ45 ○ TF Card • Remote controller Operating System: Android Operating System • Remote controller supported Language: English • Datalink encryption: Minimum AES-128 encryption • Antenna: Fitted with antenna that suits the remote controller's operating frequencies • Operating manual: Supplied with operating manual in English language • Warranty: The remote controller and all the supplied equipment should have at least 6 months of warranty for any issue related to standard use cases except damages caused by user due to misuse, normal wear and tear and accidents. 			



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		YES	NO	
(a)	(b)	(c)	(d)	(e)
	Features: <ul style="list-style-type: none"> • Upgradable firmware through application and online (OTA updates) • Latest Frequency Hopping Spread Spectrum (FHSS) technology • Installed with Mission Planner Software or equivalent Ground Control System (GCS) software • Built-in touchscreen display with at least 7-inch HD display with high screen brightness for outdoor usage • Dust-free, waterproof and drop-resistant materials and design • 2 units of dual-axis joystick for control of UAV manoeuvres • At least 1 unit of dual-axis independent joystick for gimbal control or any other payload • At least 2 rotary axes • At least 4 quantity of 3-position switches • Supports Open SDK Protocol • Supports HD Video transmission and HD video streaming via RTSP or similar transmission protocol • Option: <ul style="list-style-type: none"> ○ Cellular connectivity that is compatible with Brunei Darussalam's cellular networks systems 			
3	<u>Delivery included</u> <ul style="list-style-type: none"> • For overseas supplier, inclusive of full delivery to Ministry of Defence, Brunei Darussalam inclusive of delivery charges, export clearance, import duties, customs clearance and associated requirements. • The delivered UAV system as a whole will be subjected to, and required to pass the following acceptance test during delivery: 			



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		YES	NO	
(a)	(b)	(c)	(d)	(e)
	<ul style="list-style-type: none"> ○ Basic flying manoeuvres ○ Radio control range ○ Maximum load carriage capability ○ Flight endurance test ○ Autonomous flight with waypoints ○ Payload release 			
4	<p><u>Training included</u></p> <ul style="list-style-type: none"> • Minimum of 2 weeks (8 working days; Monday to Thursday) consisting of theory and hands-on operating on the aircraft for 3 participants. • Training days are subject to weather conditions and no additional charges shall be incurred for sessions to be rescheduled due to unfavourable conditions. • Training is to include the following scope: <ul style="list-style-type: none"> ○ Basic flight manoeuvres ○ Line of Sight (LOS) flying ○ First Person View (FPV) flying ○ Payload release ○ Payload securing and centre of gravity (CG) management ○ Autonomous flight with waypoints and navigation (inclusive of using the software) ○ Operation area geofencing ○ Procedure for safe flights ○ Safe flying conditions (weather and environment) ○ Emergency procedures (e.g. motor failure mid-flight and etc.) ○ Troubleshooting faults ○ Routine checks for preventive maintenance ○ Pre- and post-flight checks ○ Replacement of worn-out parts ○ Calibration of UAV sensors 			



Item	Picture Reference
Main UAV Unit	
Remote Controller	
Payload Release Mechanism	



ITEM 2		VTOL UNMANNED AERIAL VEHICLE AND ASSOCIATED ACCESSORIES		
QUANTITY REQUIRED		1		
Ser No.	Specification	Compliance (Please Tick)		Remarks (To Be Completed by Tender)
		YES	NO	
(a)	(b)	(c)	(d)	(e)
1	<p>Main UAV Unit</p> <ul style="list-style-type: none"> • UAV Size: Between 1.8m to 2.0m of main rotor diameter • UAV Type: Flybarless, Cyclic/Collective Pitch Mixing (CCPM) Helicopter • Weight (Without Battery): Approx. 7.0 kg • Motor: <ul style="list-style-type: none"> ○ Brushless Motor ○ Input Voltage : 12S (44.4V) ○ Maximum usable weight (excluding battery): 11.0 kg or better • Flight time without payload: Minimum of 40 minutes with 22,000 mAh battery • Flight controller: Pixhawk based flight controller (Cube AutoPilot preferable) <ul style="list-style-type: none"> ▪ Interface software: Open-source software such as Mission Planner or its equivalent, which must have the following functionality: Programming of autonomous waypoint mission with maps ▪ Receiving telemetry from the UAV ▪ Open-architecture that allows complete modifications of UAV parameters • Power Source: Lithium-Polymer (Li-Po) batteries or higher-efficiency battery technology <ul style="list-style-type: none"> ○ Supplied with at least 3 sets of 22,000 mAh batteries (1 set is the number of batteries required for each flight; 1 set is supplied with the UAV and 2 sets of spare batteries) ○ Supplied with fast charger to charge at least one set of battery per charging cycle • Battery charger specification: <ul style="list-style-type: none"> ○ Features: Balance charging of the supplied batteries, fast charging, battery discharge function and storage charging function ○ Operating voltage: 220/240VAC 50/60Hz with British standard 3-pin plug • Wind resistance: At least 30km/h (Level 5 on Beaufort Wind Scale) 			



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		YES	NO	
(a)	(b)	(c)	(d)	(e)
	<ul style="list-style-type: none"> • Operating temperature: 30-45°C • Operating humidity: Relative Humidity above 80% • Operating environment: Misty, Dusty, Hot and Wet • Optional: <ul style="list-style-type: none"> ○ Ability to sustain minimal damage sustained by UAV from an unexpected hard landing • Warranty: The UAV unit and all the supplied equipment should have at least 6 months of warranty for any issue related to standard use cases except damages caused by user due to misuse, normal wear and tear and accidents. • Delivery: UAV is to be delivered fully assembled and ready to fly 			
	<p><u>Sensors and systems included</u></p> <ul style="list-style-type: none"> • Positioning Sensors: Must include GPS, GLONASS, Galileo, BeiDou • Positioning Accuracy: 0.5m or better • ADS-B range (for UAV situational awareness): At least 20km diameter of the UAV • Obstacle avoidance specifications: <ul style="list-style-type: none"> ○ Minimum of 25m ranging distance ○ Minimum of 34 degrees forward looking sensor with detection angle vertically and horizontally ○ Automatic collision avoidance measure • Equipped with Gyroscope, Accelerometer, Compass and Magnetometer with each system having its own redundancy • Live streaming First-Person View (FPV) from the UAV for at least 5km • FPV camera specification: <ul style="list-style-type: none"> ○ Resolution: Minimum 1080p at 30 frames per second ○ Camera view: Minimum 130 degrees ○ Camera aperture: At least F2.0 or better ○ Equipped with at least 2-axis gimbal ○ Rotatable camera in horizontal direction at least 180 degrees ○ Rotatable camera in vertical direction at least 90 degrees ○ Features include Auto Exposure, Auto Focus, Auto White Balance and Low Light Compensation 			



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	<ul style="list-style-type: none"> • Equipped with trip recording camera: <ul style="list-style-type: none"> ○ Is detachable ○ At least Full HD (1920x1080p) resolution ○ Able to record the mission continuously for 3 hours ○ Recorded video files should be able to be downloaded/recovered easily ○ Memory storage device is to be easily replaceable in short amount of time (use of removable Solid-State Memory Storage device is preferable) • Optional: Feature to enable easy locating and retrieving of UAV in case of crash 			
	<p><u>Logistics included</u></p> <ul style="list-style-type: none"> • Quick and simple assembly and disassembly process <ul style="list-style-type: none"> ○ Supplied with the appropriate tools required for the assembly and disassembly process • Easily transportable by maximum 2 persons • Equipped with payload release mechanism (<i>refer to picture in Table 2</i>) • Supplied with Fire Safe Storage Box for the storage and transportation of Li-Po batteries (each battery is supplied with individual Fire Safe Storage Box) • Supplied with the appropriate box or case for the transportation of the UAV unit and its accessories 			
	<p><u>Accessories included</u></p> <ul style="list-style-type: none"> • Two extra sets of frame parts (i.e. landing skid, fuselage, swash plate) and other required parts required to repair and maintain the UAV in case of crash • Supplied with at least one set of spare blades of each blade size for the main blade (1 set = number of blades on the rotor): <i>*Measurement is for one piece of blade</i> <ul style="list-style-type: none"> ○ 900mm ○ 800mm • Supplied with at least two sets of each blade size for the tail blade (1 set = number of blades on the rotor): <i>*Measurement is for one piece of blade</i> <ul style="list-style-type: none"> ○ 120mm • Supplied with Digital Pitch Gauge 			



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(a)	(b)	(c)	(d)	(e)
	<ul style="list-style-type: none"> Supplied with at least one extra set of Brushless Servo Motor for CCPM Supplied with at least one extra Rudder Brushless Servo At least two sets of ground telemetry radio set (transmitter and receiver unit) operating at 433MHz and can operate at a distance of at least 5km. (1 Set = 1 Pair of Transmitter and Receiver) 			
2	<p><u>Remote controller set (with required receiver) included</u></p> <ul style="list-style-type: none"> Total Number of channels: Minimum 16 channels Transmission Power: Minimum 20dB Maximum transmission distance: More than 10km Operating Frequency: Must include 2.400 to 2.483GHz Battery type: Rechargeable Li-Ion battery and have an endurance of 5-20 Hours Per-Charge <ul style="list-style-type: none"> For detachable batteries, must be supplied with wires and/or fast charger For non-detachable batteries, must be supplied with fast charger that operates at 220/240VAC 50/60Hz with a 3-pin British standard plug or the required accessories for fast charging Connection ports must include, but not limited to: <ul style="list-style-type: none"> USB Type-C HDMI RJ45 TF Card Remote controller Operating System: Android Operating System Remote controller supported Language: English Datalink encryption: Minimum AES-128 encryption Antenna: Fitted with antenna that suits the remote controller's operating frequencies Operating manual: Supplied with operating manual in English language 			



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3	<p><u>Delivery Included</u></p> <ul style="list-style-type: none"> • For overseas supplier, inclusive of full delivery to Ministry of Defence, Brunei Darussalam inclusive of delivery charges, export clearance, import duties, customs clearance and associated requirements. 			



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		YES	NO	
(a)	(b)	(c)	(d)	(e)
	<ul style="list-style-type: none"> The delivered UAV system as a whole will be subjected to, and required to pass the following acceptance test during delivery: <ul style="list-style-type: none"> Basic flying manoeuvres Radio control range Maximum load carriage capability Flight Endurance test Autonomous flight with waypoints Payload release 			
4	<p><u>Training Included</u></p> <ul style="list-style-type: none"> Minimum of 3 weeks (12 working days; Monday to Thursday) consisting of theory and hands-on operating on the aircraft for 3 participants. Training days are subject to weather conditions and no additional charges shall be incurred for sessions to be rescheduled due to unfavourable conditions. Training is to include the following scope: <ul style="list-style-type: none"> Basic flight manoeuvres Line of Sight (LOS) flying First Person View (FPV) flying Payload release Payload securing and centre of gravity (CG) management Autonomous flight with waypoints and navigation (inclusive of using the software) Operation area geofencing Procedure for safe flights Safe flying conditions (weather and environment) Emergency procedures (e.g. autorotation and etc.) Troubleshooting faults Routine checks for preventive maintenance Pre- and post-flight checks Replacement of worn-out parts Calibration of UAV sensors 			

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Remote Controller	
Payload Release Mechanism	