

**PRC.PROC 11**

**Annexure E**

**Process for Flight Testing**

## **Annexure E**

### **Process for Flight Testing**

The UAS flight test procedure is to test the compliance of the UAS against the technical criteria of the QCI-DGCA UAS Certification Scheme:

<b>Section</b>	<b>Detail</b>
2.1	Speeds
2.3	Endurance
2.3 (a)	Fuel consumption rate
2.3 (b)	Battery discharge rate
2.4	Operational Altitude
2.8 (a)	Determine that UAS is able to maintain a stable flight without pilot input
2.8 (b)	Determine that pilot is able to control UAS with ease.
4.1 (d)	Determine that UAS is free from excessive vibrations under any operational speed and power condition
6.1 (a)	Determine full functioning of data link communication
6.1 (b)	Demonstration of system to alert the remote pilot with aural and visual signal, for any loss of command and control data link
6.1 (c)	Determine that communication range is sufficient to have a permanent connection with the UAS
6.1 (d)	Determine that when data link is lost or in other contingencies, the UAS follows a predefined path to ensure safe end of flight within the required area restrictions
6.1 (e)	Determine the capability of system to inform remote pilot by means of a warning signal in the event of data link loss
7.3	NPNT compliance
8.1 (b)	Determine whether Geo-fencing capability has been implemented
8.1 (c)	Determine whether Autonomous Flight Termination System or Return Home (RH) option has been implemented
8.1 (g)	Determine whether Detect and Avoid capability option has been implemented (Only for UAS intending to operate in Controlled Airspace)

## **Flight Test Schedule and Checklist**

The Flight test for UAS is to be conducted as per the flight test schedule and their respective activities given below. The given test stages may or may not be conducted in single go.

After the completion of the flight test, the manufacturer shall submit logs and evidence to the CB. The CB needs to maintain a record of the same.

Flight test schedule:

<b>TEST STAGE</b>	<b>MINIMUM DURATION AND HEIGHT</b>
Stage 1: Pre-flight assessment	As per Checklist
Stage 2: Take-off	Rotary Wing: 5 mins hover at 10m AGL on takeoff Fixed Wing: Direct to Stage 3
Stage 3: Loiter / Hover	5 mins at 60 m
Stage 4: Cruise	60% time of endurance
Stage 5: Return to home location	Loiter or Hover at home location for pre-programmed duration
Stage 6: Land	Land immediately after pre-programmed hover or loiter at home location
Stage 7: Endurance test	Full endurance test

**STAGE 1**

**A. Pre-Flight Assessment**

No	Check (whichever applicable)	Manufacturer Report value (to be filled by manufacturer)	Test Lab observations (to be filled by test lab)	
			Observed value / details	Passed Y / N
1	Max. All up Weight of UAS			
2	Weight of UAS without battery			
3	VTOL motor model			
4	Forward Thrust motor model			
5	VTOL Propeller model			
6	Forward thrust propeller model			
7	Battery type			
8	Battery dimension	Width: Length: Height:		
9	Battery Weight			
10	Battery mAh			
11	Payload model			
12	Dimension of UAS	Width/Span: Length: Height:		
13	Engine/motor on with throttle a) 20% less than take off throttle for multi-copter & Hybrid	No excessive vibration		
	b) 80% throttle for FW in static condition (2 mins on ground just before flight)	All components intact		
14	GCS display	Communication link active and working		
		HUD orientation and value correct		
		GPS location of drone correct		
15	Actuator functioning	As per operator input		

Tolerance of 5% will be allowed for Serial numbers 1, 2 & 9

**B.**

**Pre-Flight NPNT Tests**

No.	Check	Required UAS response	UAS Response observed	Passed Y/N
1.	PA with incorrect time and correct location	Reject PA & not arm		
2.	PA with incorrect location and correct time	Reject PA & not arm		
3.	PA with incorrect UUID and everything else correct	Reject PA & not arm		
4.	PA with incorrect pilot pin* with everything else correct	Reject PA & not arm		
5.	PA with correct location, time, UUID and pilot pin*	Accept PA and arm		

\*Pilot Pin cases to be considered when enabled in permission artefact.

**STAGE 2 : Take-off**

Rotary Wing: 5 mins hover at 10m AGL on takeoff

Fixed Wing: Direct to Stage 3

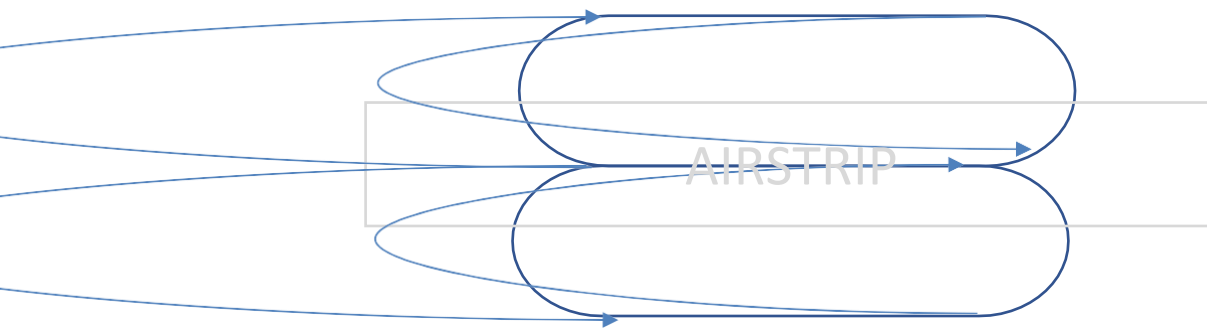
**STAGE 3 : Loiter / Hover**

**A. If UAS is of Rotary wing configuration**

No.	Activity (whichever applicable)	Compliance	Section	UAS Response observed	Passed Y/N
1.	Hover at max 10 m AGL	UAS is free from excessive vibration	4.1 (d)		
		UAS is able to maintain a stable flight without pilot input	2.8 (a)		
2.	Take pilot control of UAS from auto-hover and move in following directions: Left, Right, Forward, Backward, Up and down	Pilot is able to control UAS with ease.	2.8 (b)		

**B. If UAS is of Fixed Wing configuration**

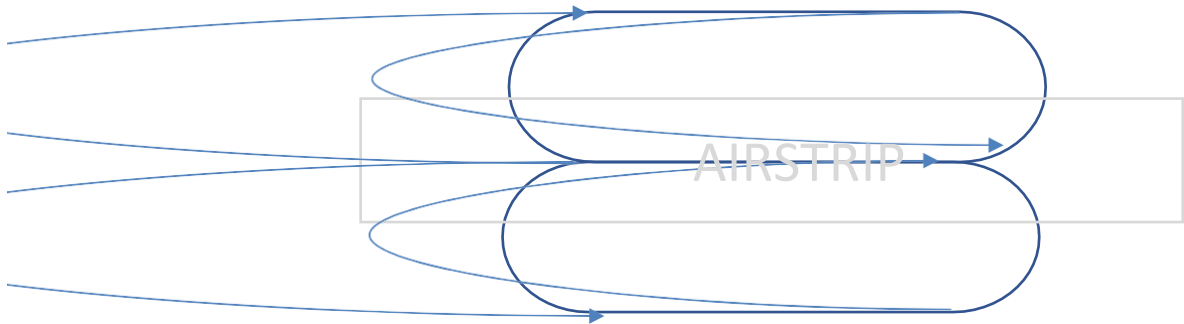
No	Activity (whichever applicable)	Compliance	Section	UAS Response observed	Passed Y/N
1.	Take off and loiter at 100 m AGL for 5 mins	UAS is free from excessive vibration	4.1 (d)		
		UAS is able to maintain a stable flight without pilot input	2.8 (a)		
2.	<p>Take pilot control of UAS from auto-loiter and conduct this manoeuvre:</p> <p>Level fly the UAS along the airstrip, turn from left and return, go to the other side, turn from left, follow the airstrip direction and now turn back from right, go to the other side, turn from right and return back. Put the UAS back in auto-loiter</p>	Pilot is able to control UAS with ease.	2.8 (b)		



**Flight Path for Test Flights**

**C. If UAS is of VTOL Fixed Wing configuration**

No.	Activity (whichever applicable)	Compliance	Section	UAS Response observed	Passed Y/N
1.	Hover at 10 m AGL	UAS is free from excessive vibration	4.1 (d)		
		UAS is able to maintain a stable flight without pilot input	2.8 (a)		
2.	Take pilot control of UAS from auto-hover and move in following directions: Left, Right, Forward, Backward, Up and down	Pilot is able to control UAS with ease in VTOL mode.	2.8 (b)		
3.	Take pilot control of UAS from auto-loiter and conduct this manoeuvre:  Level fly the UAS along the airstrip, turn from left and return, go to the other side, turn from left, follow the airstrip direction and now turn back from right, go to the other side, turn from right and return back. Put the UAS back in auto-loiter	Pilot is able to control UAS with ease in Fixed wing mode	2.8 (b)		



**Flight Path for Test Flights**

**STAGE 4 : Cruise**

**Cruise duration:** Max 70% of the endurance time claimed by the manufacturer or 120 mins whichever is lower for the UAS.



**Cruise mission settings:** For the cruise test stage, the UAS is supposed to be operated as per the given guidelines:

1. A Waypoint or grid-based flight plan must be created such that there is a straight-line path from one turning point to the other turning point. The distance between these points must be such that the time taken by the UAS to travel between them must not be less than 30 seconds.
2. The UAS must always remain in the Visual Line of Sight of the operator.
3. The UAS must not cross the flight altitude of 120 m AGL at any point of time.
4. The UAS must have a way point outside the Geo-fence defined via the Permission Artefact
5. The UAS C2 link must be continuously connected to the C2 link at the ground control station.
6. The UAS geo-location and key flight parameters must stream and display continuously on the Ground Control Software screen running on the Ground control station.

**Cruise flight test schedule and report:**

No.	Activity (whichever applicable)	Compliance / Manufacturer value	Section	UAS Response observed	Passed Y/N
1.	During completion of minimum two swaths of straight-line flight between two farthest point in the flight plan	UAS maximum operating speed/cruise speed is reached but not crossed	2.1 (ii)		
2.	On completion of minimum two swaths of straight-line flight between two farthest point in the flight plan	UAS communication link is fully functional all the time	6.1 (a)		
		Communication range is sufficient to have a permanent connection with the UAS	6.1 (c)		
3.	UAS flight waypoint outside the geo-fence. Did the UAS cross the geo-fence to reach that point?	Geo-fencing capability has been implemented	8.1 (b)		
4.	Towards the end of the cruise duration, disconnect the communication link from the GCS for more than 10 seconds when the UAS is at the farthest point in the flight plan	System alerts the remote pilot with aural and visual signal, for any loss of command and control data link	6.1 (b)		
		System capable to inform remote pilot by means of a warning signal in the event of data link loss	6.1 (e)		
		When data link is lost for more than 10 seconds, the UAS	6.1 (d)		

		follows a predefined path to ensure safe end of flight within the required area restrictions			
5.	<b>On completion of minimum two swaths of straight-line flight between two farthest point in the flight plan</b>	Autonomous Flight Termination System or Return Home (RH) option has been implemented	8.1 (c)		
6.	<b>Throughout the whole flight observe the terrain altitude of UAS on the GCS</b>	The maximum altitude attained throughout should not be more than the declared maximum attainable height (i.e. 200ft or 400ft as applicable)	2.4		

### **STAGE 5 : Return to Home**

Loiter or Hover at home location for pre-programmed duration

### **STAGE 6 : Land**

No.	Activity/compliance	UAS Response observed	Passed Y/N
1.	UAS could land smoothly and softly without any damage to any part.		

### **STAGE 7:Endurance Test**

**Endurance Test procedure:**

1. A fresh flight must be conducted with full battery charge or fuel level for endurance test
2. Suitable calibrated instruments must be used to measure the Battery voltage or fuel level before and after the flight.
3. For UAS with less than or equal to 120 mins of endurance, full endurance flight test must be conducted
4. For UAS with endurance more than 120 mins, battery discharge rate or fuel consumption rate must be measured for: 120 min duration flight or 20% of the endurance time,

Whichever is longer for the UAS.

**For UAS within 120 min Endurance:**

No	Before Flight start		After flight completion		UAS Endurance Observed	Manufacturer Endurance value	Passed Y/N
	Batt. Volt / Fuel level	Time (T0)	Batt. Volt/Fuel level	Time (T1)	(T1-T0)		

**For UAS with more than 120 min Endurance:**

No	Before Flight start		After flight completion		Batt. Discharge / Fuel consumption rate	Manufacturer discharge / fuel consumption rate	Passed Y/N
	Batt. Volt / Fuel level (F0)	Time (T0)	Batt. Volt/Fuel level (F1)	Time (T1)	(F0-F1)/(T1-T0)		

**Declaration of Successful Flight test**

**Applicant name:**  
**UAS Manufacturer:**  
**UAS model:**

This is to declare that the above UAS could / couldn't complete the entire Flight Test without any technical failure, snag or glitch of any manner.  
 The compliance of UAS against each test is separately covered in the test report. This declaration doesn't guarantee the same.

Authorized signatory

Record Ref:  
 PRC.F29 UAS assessment checklist  
 PRC.F29A Flight testing checklist  
 PRC.R01 UAS Audit/evaluation report