

# Aerial Drone Tests and Scorable Scenarios for Evaluating System Capabilities and Remote Pilot Proficiency in Level 3 Open, Level 4 Obstructed, and Level 5 Confined Environments

*Developed by the National Institute of Standards and Technology*



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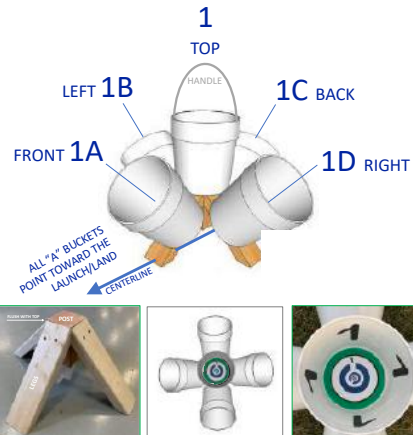
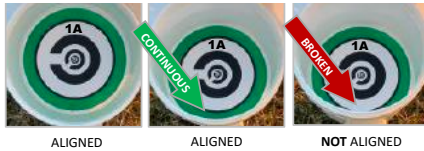
## Level 1-3 Open Environments

## LEVEL 1 | OPEN LANE BASIC PROFICIENCY

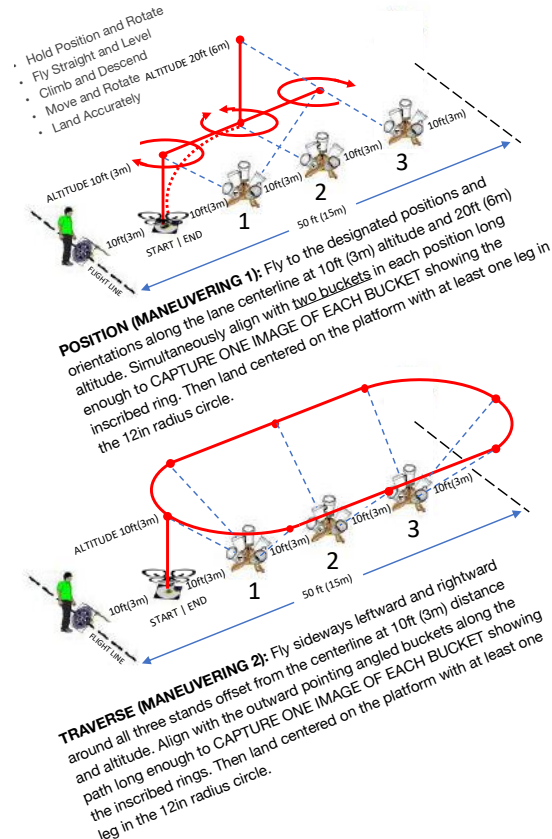
The Position and Traverse tests are performed sequentially by a remote pilot in direct line of sight, or with the pilot's back turned to represent flying beyond visual line of sight with an assisting visual observer. The aircraft flies the designated flight paths to align with one or more white buckets. Each alignment requires a single image of the inscribed green ring inside the bottom of the buckets. Perform all 40 alignments and accurate landings within the designated time limit. Visual acuity targets evaluate camera pointing and zooming capabilities along with color, thermal, hazmat labels, or other objects. Faults resulting in an end-of-trial include extreme deviations from the intended flight path or contact with the apparatus, ground, or safety enclosure.

### FABRICATION

- (QTY 01) 15m (50ft) measuring tape centerline
- (QTY 01) square panel with 30cm (12in) radius circle
- (QTY 03) 10x10x15cm (4x4x6in) posts
- (QTY 12) 5x10x30cm (2x4x12in) legs with 45deg tapers
- (QTY 30) 7.5cm (3in) screws attach legs to post – 2 per
- (QTY 30) 4cm (1-1/2in) screws attach buckets – 2 per
- (QTY 15) 7.5-liter (2-gallon) white buckets
- (QTY 52) 20cm (8in) round polyester weatherproof labels. Download and print targets and lettering from the online [USAGE GUIDE](#) or at [RobotTestMethods.nist.gov](#).
- A thick black marker can also be used to inscribe 2.5cm (1in) rings inside buckets with written letters and numbers.



### FLIGHT PATHS



## LEVEL 1 | OPEN LANE BASIC PROFICIENCY



Pilot LAST Name \_\_\_\_\_

Pilot FIRST Name \_\_\_\_\_

Pilot Organization \_\_\_\_\_

Drone Make \_\_\_\_\_

Drone Model \_\_\_\_\_

Facility Location \_\_\_\_\_

Date (YYYY/MM/DD) \_\_\_\_\_ Team #: \_\_\_\_\_

PROCTOR NAME \_\_\_\_\_

BUCKET DIAM.		LANE SPACING (S)			VISIBILITY		WIND		PILOT VIEW		TIME LIMIT		
4 IN (10 CM)	8 IN (20 CM)	5 FT (1.5 M)	10 FT (3 M)	20 FT (6 M)	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE MPH	GUSTS MPH	LINE OF SIGHT FACINE LANE OPTIONAL V.O.	INTERFACE ONLY BACK TO LANE MANDATORY V.O.	5 MIN	10 MIN	MIN
(CIRCLE ONE)		(CIRCLE ONE)			(CIRCLE ONE)		(FILL IN)		(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

**ALIGNMENT SCORE:** Circle bucket identifiers for images with UNBROKEN RINGS. Strike through all BROKEN RINGS and incomplete buckets.

CAPTURE ONLY ONE IMAGE OF EACH BUCKET – CIRCLE ALIGNED IMAGES AND LANDINGS

CAPTURE PRE-LAUNCH CLOCK IMAGE – LAUNCH TIME (HH:MM:SS)		
<b>POSITION TEST – FLYING ALONG CENTERLINE</b>		<b>CIRCLE ALIGNED</b>
1 LAUNCH AND HOVER OVER STAND #1 TO ALIGN WITH	1 & 2A	2A
2 YAW LEFTWARD 360° OVER STAND #1 TO ALIGN WITH	1 & 2A	2A
3 YAW RIGHTWARD 360° OVER STAND #1 TO ALIGN WITH	1 & 2A	2A
4 CLIMB VERTICALLY OVER STAND #1 TO ALIGN WITH	1 & 3A	3A
5 DESCEND VERTICALLY OVER STAND #1 TO ALIGN WITH	1 & 2A	2A
6 PITCH FORWARD OVER STAND #2 TO ALIGN WITH	2 & 3A	3A
7 PITCH BACKWARD OVER STAND #1 TO ALIGN WITH	1 & 2A	2A
8 PITCH FORWARD OVER STAND #2 THEN YAW LEFT 180°	2 & 1C	1C
9 PITCH FORWARD OVER LANDING THEN YAW RIGHT 180°	1 & 1A	1A
10 LAND IN CIRCLE (ONE OR MORE LEGS) – WORTH 2 POINTS	1pt & 1pt	1pt
<b>TRAVERSE TEST – FLYING LEFTWARD</b>		<b>CIRCLE ALIGNED</b>
11 HOVER OVER THE LAUNCH PLATFORM TO ALIGN WITH	1A	1A
12 ORBIT 90° LEFTWARD AROUND STAND #1 TO ALIGN WITH	1B	1B
13 ROLL LEFTWARD TO STAND #2 TO ALIGN WITH	2B	2B
14 ROLL LEFTWARD TO STAND #3 TO ALIGN WITH	3B	3B
15 ORBIT 90° LEFTWARD AROUND STAND #3 TO ALIGN WITH	3C	3C
16 ORBIT 90° LEFTWARD AROUND STAND #3 TO ALIGN WITH	3D	3D
17 ROLL LEFTWARD TO STAND #2 TO ALIGN WITH	2D	2D
18 ROLL LEFTWARD TO STAND #1 TO ALIGN WITH	1D	1D
19 ORBIT 90° LEFTWARD AROUND STAND #1 TO ALIGN WITH	1A	1A
20 LAND IN CIRCLE (ONE OR MORE LEGS) – WORTH 1 POINT	1pt	1pt
<b>TRAVERSE TEST – FLYING RIGHTWARD</b>		<b>CIRCLE ALIGNED</b>
21 HOVER OVER THE LAUNCH PLATFORM TO ALIGN WITH	1A	1A
22 ORBIT 90° RIGHTWARD AROUND STAND #1 TO ALIGN WITH	1D	1D
23 ROLL RIGHTWARD TO STAND #2 TO ALIGN WITH	2D	2D
24 ROLL RIGHTWARD TO STAND #3 TO ALIGN WITH	3D	3D
25 ORBIT 90° RIGHTWARD AROUND STAND #3 TO ALIGN WITH	3C	3C
26 ORBIT 90° RIGHTWARD AROUND STAND #3 TO ALIGN WITH	3B	3B
27 ROLL RIGHTWARD TO STAND #2 TO ALIGN WITH	2B	2B
28 ROLL RIGHTWARD TO STAND #1 TO ALIGN WITH	1B	1B
29 ORBIT 90° RIGHTWARD AROUND STAND #1 TO ALIGN WITH	1A	1A
30 LAND IN CIRCLE (ONE OR MORE LEGS) – WORTH 1 POINT	1pt	1pt
CAPTURE CLOCK IMAGE AFTER LANDING – LAND TIME (HH:MM:SS)		
STOP THE TIMER OR CALCULATE RESULT – ELAPSED TIME (MM:SS)		
/ 40 MINIMUM PASSING SCORE – TOTAL SCORE (POINTS)		
CIRCLE ONE: <b>FAIL (SCORE   TIME   SAFETY)</b> OR <b>PASS</b>		



# Level 1 Open Lane Setup

Using 4" (10cm) Buckets;

- Open Stands 1-3 with a 5ft-1.5m spacing

Area required 5 x spacing long (25ft-7.5m) x 6 x spacing wide (30ft-9m) x 2.6 x spacing high (13ft-4m)



VERSION 2023A

**M** LEVEL 2 | OPEN LANE  
MANEUVERING ONLY

Perform 5 different flight paths around the omni bucket stands. Each flight path includes as sequence of alignments with one or more buckets. Capture a SINGLE IMAGE of the inscribed ring inside each bucket and land accurately.

- Score ALIGNMENT POINTS after trial from images with UNBROKEN RINGS (5 pts) or BROKEN RINGS (1 pt).
- Land CENTERED (5 pts) with the aircraft center inside the designated 60 cm (24 inch) diameter circle, or OFFSET (1 pt) with at least one propeller motor inside the circle.
- Start timer at launch and end after the last task is completed. Trial time limits are typically 5 minutes each (25 minutes to complete all 5 tests) although organizations may set their own trial time limits and passing scores.
- Extreme deviations from the intended flight path, or contact with any object, ends the trial to ensure safety.

**POSITION**  
MAN 1

- Demonstrate basic flight maneuvers between designated hover positions, orientations, and altitudes along the lane centerline at altitudes S and 2(S).
- Climb, descend, yaw, pitch, and roll to simultaneously align with downward buckets to check position then forward buckets to check altitude.
- Complete 10 positions along the lane centerline with 18 alignments and 1 accurate landing (counts double) to score up to 100 points.**

**TRAVERSE**  
MAN 2

- Fly sideways parallel to objects while looking forward to identify features as if along a road, truck, bus, building, fence, tree line, etc.
- Maintain altitude S flying leftward and rightward around the first three bucket stands to align with all the designated buckets.
- Complete 1 lap leftward then 1 lap rightward with 18 alignments and 2 accurate landings to score up to 100 points.**

**ORBIT**  
MAN 3

- Fly circular orbits around designated bucket stands while looking inward to identify features on all four sides. Fly altitude 2(S) leftward and rightward around stand #3 (white), then altitude S leftward and rightward around stand #2 (black).
- Each orbit has 5 bucket alignments starting with 1 downward radius check then 4 altitude checks around the orbit looking inward at the angled buckets.
- Complete 4 orbits with 20 alignments to score up to 100 points.**

**INSPECT**  
MAN 4

- Fly in closer proximity around objects to inspect detailed features on top and all four sides of the bucket stands.
- Maintain altitude 1/2(S) starting on top of each bucket stand with alternating leftward and rightward rotations to inspect all four sides of each bucket stand.
- Complete all 4 stands with 20 alignments to score up to 100 points.**

**RECON**  
MAN 5

- Fly straight and level over the centerline to establish a stable hover over an object down range to perform reconnaissance tasks.
- Maintain altitude S to align with buckets and the landing at each end of the lane. Reconnaissance tasks are performed every 8(S) over a total distance of 80(S).
- Complete 5 laps (or 10 lane lengths) with 20 alignments to score up to 100 points.**

**M** LEVEL 2 | OPEN LANE  
MANEUVERING ONLY



Pilot LAST Name	_____
Pilot FIRST Name	_____
Pilot Organization	_____
Drone Make	_____
Drone Model	_____
Facility Location	_____
Date (YYYY/MM/DD)	_____ Team #: _____

PROCTOR NAME \_\_\_\_\_

BUCKET DIAM.		LANE SPACING (S)			VISIBILITY		WIND		PILOT VIEW		TIME LIMIT		
4 IN (10 CM)	8 IN (20 CM)	5 FT (1.5 M)	10 FT (3 M)	20 FT (6 M)	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE _____ MPH	GUSTS _____ MPH	LINE OF SIGHT FACINE LANE OPTIONAL V.O.	INTERFACE ONLY BACK TO LANE MANDATORY V.O.	5 MIN	10 MIN	_____ MIN
(CIRCLE ONE)		(CIRCLE ONE)			(CIRCLE ONE)		(FILL IN)		(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

**ALIGNMENT SCORE:** Circle points for images with UNBROKEN RINGS (5 pts) or BROKEN RINGS (1 pt). Draw a line through all incomplete.

POSITION (MAN 1)

18 IMAGES TO CAPTURE  
1 Landing Scored Twice

TRAVERSE (MAN 2)

18 IMAGES TO CAPTURE  
2 Landings Scored Separately

ORBIT (MAN 3)

20 IMAGES TO CAPTURE  
No Landing

INSPECT (MAN 4)

20 IMAGES TO CAPTURE  
No Landing

RECON (MAN 5)

20 IMAGES TO CAPTURE  
No Landing

START TIMER

ALIGNMENT

LAUNCH TO ALT S

BUCKET SEQUENCE

IMAGE POINTS

1

5 1

2A

5 1

YAW L-360

1

5 1

2A

5 1

YAW R-360

1

5 1

2A

5 1

CLIMB

1

5 1

3A

5 1

DESCEND

1

5 1

2A

5 1

FORWARD

2

5 1

3A

5 1

BACKWARD

1

5 1

2A

5 1

FORWARD & YAW L-180

7

5 1

1C

5 1

FORWARD & YAW R-180

L

5 1

1A

5 1

LAND

○

5 1

COUNTS DOUBLE

5 1

END TIMER

/100

ELAPSED TIME

PASS FAIL

(CIRCLE ONE)

START TIMER

ALIGNMENT

LAUNCH TO ALT S

BUCKET SEQUENCE

IMAGE POINTS

1A

5 1

1B

5 1

2B

5 1

3B

5 1

3C

5 1

3D

5 1

2D

5 1

1D

5 1

1A

5 1

○

5 1

1A

5 1

1D

5 1

2D

5 1

3D

5 1

3C

5 1

3B

5 1

2B

5 1

1B

5 1

1A

5 1

○

5 1

END TIMER

/100

ELAPSED TIME

PASS FAIL

(CIRCLE ONE)

START TIMER

ALIGNMENT

LAUNCH TO ALT 2(S)

BUCKET SEQUENCE

IMAGE POINTS

1

5 1

3A

5 1

3B

5 1

3C

5 1

3D

5 1

1

5 1

3A

5 1

3D

5 1

3C

5 1

3B

5 1

1

5 1

2A

5 1

2B

5 1

2C

5 1

2D

5 1

1

5 1

2A

5 1

2D

5 1

2C

5 1

2B

5 1

END TIMER

/100

ELAPSED TIME

PASS FAIL

(CIRCLE ONE)

START TIMER

ALIGNMENT

LAUNCH TO ALT 1/2(S)

BUCKET SEQUENCE

IMAGE POINTS

1

5 1

1A

5 1

1B

5 1

1C

5 1

1D

5 1

2

5 1

2A

5 1

2D

5 1

2C

5 1

2B

5 1

3

5 1

3A

5 1

3B

5 1

3C

5 1

3D

5 1

4

5 1

4A

5 1

4D

5 1

4C

5 1

4B

5 1

END TIMER

/100

ELAPSED TIME

PASS FAIL

(CIRCLE ONE)

START TIMER

ALIGNMENT

LAUNCH TO ALT S

BUCKET SEQUENCE

IMAGE POINTS

4

5 1

7

5 1

L

5 1

1A

5 1

4

5 1

7

5 1

L

5 1

1A

5 1

4

5 1

7

5 1

L

5 1

1A

5 1

4

5 1

7

5 1

L

5 1

1A

5 1

END TIMER

/100

ELAPSED TIME

PASS FAIL

(CIRCLE ONE)

# Scoring Alignment Points

Capture images of alignment rings to verify

## ALIGN WITH BUCKETS AND LAND ACURATELY

20 ALIGNMENTS TOTAL UP TO 100 POINTS



- Align with each bucket to capture a SINGLE IMAGE of the inscribed alignment ring. Only the first image is scored.
- Score captured images as:
  - UNBROKEN RINGS (5 points)
  - BROKEN RINGS (1 point)
  - NO RINGS (0 points, strike through line)
- Score accurate landings as:
  - CENTERED (5 pts) with the aircraft center point inside the 60 cm (24 in) diameter circle.
  - OFFSET (1 pts) with at least one propeller motor inside the circle.
- Verification of captured alignment images can be during the trial when obvious or after the trial to eliminate discussions during the trial. Images can also be stored for documentation.



## LEVEL 3 | OPEN LANE

### PAYLOAD FUNCTIONALITY

Perform 5 different flight paths around the omni bucket stands. Each flight path includes a sequence of alignments with one or more buckets. While aligned with each bucket, control camera zoom and exposure to capture a SINGLE IMAGE of the inscribed ring and IDENTIFY TARGETS inside each bucket.

- Score ALIGNMENT POINTS after the trial from images with UNBROKEN RINGS (5 pts) or BROKEN RINGS (1 pt).
- Score ACUITY POINTS by calling out the 5 increasingly small VISUAL ACUITY TARGET GAPS (1 pt each).
- Land CENTERED (5 pts) with the aircraft center inside the designated 60 cm (24 inch) diameter circle, or OFFSET (1 pt) with at least one propeller motor inside the circle.
- Start timer at launch and end after the last task is completed. Trial time limits are typically 5 minutes each (25 minutes to complete all 5 tests) although organizations may set their own trial time limits and passing scores.
- Extreme deviations from the intended flight path, or contact with any object, ends the trial to ensure safety.

#### POSITION

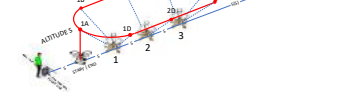
PAY 1



- Demonstrate basic flight maneuvers between designated hover positions, orientations, and altitudes along the lane centerline at altitudes 5 and 2(S).
- Climb, descend, yaw, pitch, and roll to simultaneously align with downward buckets to check position then forward buckets to check altitude.
- Complete 10 positions along the lane centerline with 18 alignments and 1 accurate landing (counts double) to score up to 100 points.

#### TRAVERSE

PAY 2



- Fly sideways parallel to objects while looking forward to identify features as if along a road, truck, bus, building, fence, tree line, etc.
- Maintain altitude 5 flying leftward and rightward around the first three bucket stands to align with all the designated buckets.
- Complete 1 lap leftward then 1 lap rightward with 18 alignments and 2 accurate landings to score up to 100 points.

#### ORBIT

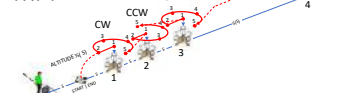
PAY 3



- Fly circular orbits around designated bucket stands while looking inward to identify features on all four sides. Fly altitude 2(S) leftward and rightward around stand #3 (white), then altitude 5 leftward and rightward around stand #2 (black).
- Each orbit has 5 bucket alignments starting with 1 downward radius check then 4 altitude checks around the orbit looking inward at the angled buckets.
- Complete 4 orbits with 20 alignments to score up to 100 points.

#### INSPECT

PAY 4



- Fly in closer proximity around objects to inspect detailed features on top and all four sides of the bucket stands.
- Maintain altitude 1/2(S) starting on top of each bucket stand with alternating leftward and rightward rotations to inspect all four sides of each bucket stand.
- Complete all 4 stands with 20 alignments to score up to 100 points.

#### RECON

PAY 5



- Fly straight and level over the centerline to establish a stable hover over an object down range to perform reconnaissance tasks.
- Maintain altitude 5 to align with buckets and the landing at each end of the lane. Reconnaissance tasks are performed every 8(S) over a total distance of 80(S).
- Complete 5 laps (or 10 lane lengths) with 20 alignments to score up to 100 points.



## LEVEL 3 | OPEN LANE

### PAYLOAD FUNCTIONALITY



Pilot LAST Name \_\_\_\_\_  
Pilot FIRST Name \_\_\_\_\_  
Pilot Organization \_\_\_\_\_  
Drone Make \_\_\_\_\_  
Drone Model \_\_\_\_\_  
Facility Location \_\_\_\_\_  
Date (YYYY/MM/DD) \_\_\_\_\_ Team #: \_\_\_\_\_

PROCTOR NAME \_\_\_\_\_

BUCKET DIAM.		LANE SPACING (S)			VISIBILITY		WIND		PILOT VIEW		TIME LIMIT		
4 IN (10 CM)	8 IN (20 CM)	5 FT (1.5 M)	10 FT (3 M)	20 FT (6 M)	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE MPH	GUSTS MPH	LINE OF SIGHT FACINE LANE OPTIONAL V.O.	INTERFACE ONLY BACK TO LANE MANDATORY V.O.	5 MIN	10 MIN	MIN
(CIRCLE ONE)		(CIRCLE ONE)			(CIRCLE ONE)		(FILL IN)		(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

**ALIGNMENT SCORE:** Circle points for images with UNBROKEN RINGS (5 pts) or BROKEN RINGS (1 pt). Draw a line through all incomplete.  
**ACUITY SCORE:** Circle correctly identified GAP DIRECTIONS in the answer key (1 point each).

POSITION (PAY 1)										TRAVERSE (PAY 2)										ORBIT (PAY 3)										INSPECT (PAY 4)										RECON (PAY 5)									
20 IMAGES TO CAPTURE • 18 ALIGNMENTS • 2 PERCH TARGETS										20 IMAGES TO CAPTURE • 18 ALIGNMENTS • 2 PERCH TARGETS										20 IMAGES TO CAPTURE • 20 ALIGNMENTS • NO LANDING										20 IMAGES TO CAPTURE • 20 ALIGNMENTS • NO LANDING										20 IMAGES TO CAPTURE • 20 ALIGNMENTS • NO LANDING									
ALIGNMENT					ACUITY					ALIGNMENT					ACUITY					ALIGNMENT					ACUITY					ALIGNMENT					ACUITY					ALIGNMENT					ACUITY				
ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)				ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)				ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)				ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)				ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)				ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)																	
WACH	1A	5	1	T	BL	R	BR	L		1A	5	1	TR	B	TR	L	BR		AT 1/20 - LEFTWARD	1	5	1	T	BL	R	BR	L		AT 1/20 - LEFTWARD	1A	5	1	TR	B	TR	L	BR												
	1B	5	1	L	BR	T	TL	R		1B	5	1	R	TL	T	BL	B		AT 1/20 - RIGHTWARD	3A	5	1	BR	T	TL	R	BL		AT 1/20 - RIGHTWARD	1B	5	1	R	TL	T	BL	B												
DECAVA	2A	5	1	L	BR	T	TL	R		2B	5	1	TL	R	TR	L	BR		AT 1/20 - LEFTWARD	3B	5	1	B	TR	R	BL	T		AT 1/20 - LEFTWARD	1C	5	1	BR	R	TL	L	BR												
	2A	5	1	L	BR	T	TL	R		3B	5	1	B	TR	R	BL	T		AT 1/20 - RIGHTWARD	3C	5	1	BL	R	BL	T	BR		AT 1/20 - RIGHTWARD	1D	5	1	B	TR	R	BL	T												
GWAHVA	1	5	1	T	BL	R	BR	L		3C	5	1	BL	R	BL	T	BR		AT 1/20 - LEFTWARD	3D	5	1	L	TL	R	BR	T		AT 1/20 - LEFTWARD	2	5	1	B	L	TR	B	BL												
	2A	5	1	L	BR	T	TL	R		3D	5	1	L	TL	R	BR	T		AT 1/20 - RIGHTWARD	3A	5	1	BR	T	TL	R	BL		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R												
WACH	1	5	1	T	BL	R	BR	L		1D	5	1	B	TL	R	BL	T		AT 1/20 - LEFTWARD	3C	5	1	L	TL	R	BR	T		AT 1/20 - LEFTWARD	2D	5	1	TR	B	TL	B	BL												
	3A	5	1	BR	T	TL	R	BL		1A	5	1	TR	B	TR	L	BR		AT 1/20 - RIGHTWARD	3B	5	1	B	TR	R	BL	T		AT 1/20 - RIGHTWARD	2B	5	1	T	BL	R	TL	B												
GWAHVA	1	5	1	T	BL	R	BR	L		2A	5	1	BL	R	BL	T	BR		AT 1/20 - LEFTWARD	1	5	1	T	BL	R	BR	L		AT 1/20 - LEFTWARD	3	5	1	R	TL	B	BL	R												
	2A	5	1	L	BR	T	TL	R		1D	5	1	B	TL	R	BL	T		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R		AT 1/20 - RIGHTWARD	3A	5	1	BR	T	TL	R	BL												
GWAHVA	2	5	1	BL	T	BR	R	TL		2D	5	1	TR	B	TL	B	BL		AT 1/20 - LEFTWARD	2B	5	1	T	BL	R	TL	B		AT 1/20 - LEFTWARD	3B	5	1	B	TR	R	BL	T												
	3A	5	1	BR	T	TL	R	BL		3D	5	1	L	TL	R	BR	T		AT 1/20 - RIGHTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - RIGHTWARD	3C	5	1	BL	R	BL	T	BR												
GWAHVA	1	5	1	T	BL	R	BR	L		1A	5	1	TR	B	TR	L	BR		AT 1/20 - LEFTWARD	2D	5	1	TR	B	TL	B	BL		AT 1/20 - LEFTWARD	3D	5	1	L	TL	R	BR	T												
	2A	5	1	L	BR	T	TL	R		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R		AT 1/20 - RIGHTWARD	4A	5	1	T	BL	B	TR	L											
GWAHVA	1	5	1	T	BL	R	BR	L		3C	5	1	BL	R	BL	T	BR		AT 1/20 - LEFTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - LEFTWARD	4D	5	1	BR	B	TL	B	TR												
	2A	5	1	L	BR	T	TL	R		3B	5	1	B	TR	R	BL	T		AT 1/20 - RIGHTWARD	2D	5	1	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD	4C	5	1	R	BL	T	TR	B												
GWAHVA	2	5	1	BL	T	BR	R	TL		1A	5	1	TR	B	TR	L	BR		AT 1/20 - LEFTWARD	2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD	4B	5	1	TR	L	BL	R	TL											
	3A	5	1	BR	T	TL	R	BL		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - RIGHTWARD																			
GWAHVA	1	5	1	T	BL	R	BR	L		3C	5	1	BL	R	BL	T	BR		AT 1/20 - LEFTWARD	1	5	1	T	BL	R	BR	L		AT 1/20 - LEFTWARD																				
	2A	5	1	L	BR	T	TL	R		1A	5	1	TR	B	TR	L	BR		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R		AT 1/20 - RIGHTWARD																				
GWAHVA	1	5	1	T	BL	R	BR	L		2D	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - LEFTWARD																			
	2A	5	1	L	BR	T	TL	R		3B	5	1	B	TR	R	BL	T		AT 1/20 - RIGHTWARD	2D	5	1	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD																				
GWAHVA	2	5	1	BL	T	BR	R	TL		1A	5	1	TR	B	TR	L	BR		AT 1/20 - LEFTWARD	1	5	1	T	BL	R	BR	L		AT 1/20 - LEFTWARD																				
	3A	5	1	BR	T	TL	R	BL		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R		AT 1/20 - RIGHTWARD																			
GWAHVA	1	5	1	T	BL	R	BR	L		3C	5	1	BL	R	BL	T	BR		AT 1/20 - LEFTWARD	2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD																			
	2A	5	1	L	BR	T	TL	R		1A	5	1	TR	B	TR	L	BR		AT 1/20 - RIGHTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - RIGHTWARD																				
GWAHVA	2	5	1	BL	T	BR	R	TL		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD	2D	5	1	TR	B	TL	B	BL		AT 1/20 - LEFTWARD																			
	3A	5	1	BR	T	TL	R	BL		3C	5	1	BL	R	BL	T	BR		AT 1/20 - RIGHTWARD	2D	5	1	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD																				
GWAHVA	1	5	1	T	BL	R	BR	L		1A	5	1	TR	B	TR	L	BR		AT 1/20 - LEFTWARD	1	5	1	T	BL	R	BR	L		AT 1/20 - LEFTWARD																				
	2A	5	1	L	BR	T	TL	R		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R		AT 1/20 - RIGHTWARD																			
GWAHVA	2	5	1	BL	T	BR	R	TL		3C	5	1	BL	R	BL	T	BR		AT 1/20 - LEFTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - LEFTWARD																				
	3A	5	1	BR	T	TL	R	BL		1A	5	1	TR	B	TR	L	BR		AT 1/20 - RIGHTWARD	2D	5	1	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD																				
GWAHVA	1	5	1	T	BL	R	BR	L		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD	1	5	1	T	BL	R	BR	L		AT 1/20 - LEFTWARD																			
	2A	5	1	L	BR	T	TL	R		3C	5	1	BL	R	BL	T	BR		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R		AT 1/20 - RIGHTWARD																				
GWAHVA	2	5	1	BL	T	BR	R	TL		1A	5	1	TR	B	TR	L	BR		AT 1/20 - LEFTWARD	2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD																			
	3A	5	1	BR	T	TL	R	BL		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - RIGHTWARD																			
GWAHVA	1	5	1	T	BL	R	BR	L		3C	5	1	BL	R	BL	T	BR		AT 1/20 - LEFTWARD	1	5	1	T	BL	R	BR	L		AT 1/20 - LEFTWARD																				
	2A	5	1	L	BR	T	TL	R		1A	5	1	TR	B	TR	L	BR		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R		AT 1/20 - RIGHTWARD																				
GWAHVA	2	5	1	BL	T	BR	R	TL		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - LEFTWARD																			
	3A	5	1	BR	T	TL	R	BL		3C	5	1	BL	R	BL	T	BR		AT 1/20 - RIGHTWARD	2D	5	1	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD																				
GWAHVA	1	5	1	T	BL	R	BR	L		1A	5	1	TR	B	TR	L	BR		AT 1/20 - LEFTWARD	1	5	1	T	BL	R	BR	L		AT 1/20 - LEFTWARD																				
	2A	5	1	L	BR	T	TL	R		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R		AT 1/20 - RIGHTWARD																			
GWAHVA	2	5	1	BL	T	BR	R	TL		3C	5	1	BL	R	BL	T	BR		AT 1/20 - LEFTWARD	2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD																			
	3A	5	1	BR	T	TL	R	BL		1A	5	1	TR	B	TR	L	BR		AT 1/20 - RIGHTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - RIGHTWARD																				
GWAHVA	1	5	1	T	BL	R	BR	L		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD	1	5	1	T	BL	R	BR	L		AT 1/20 - LEFTWARD																			
	2A	5	1	L	BR	T	TL	R		3C	5	1	BL	R	BL	T	BR		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R		AT 1/20 - RIGHTWARD																				
GWAHVA	2	5	1	BL	T	BR	R	TL		1A	5	1	TR	B	TR	L	BR		AT 1/20 - LEFTWARD	2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD																			
	3A	5	1	BR	T	TL	R	BL		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - RIGHTWARD																			
GWAHVA	1	5	1	T	BL	R	BR	L		3C	5	1	BL	R	BL	T	BR		AT 1/20 - LEFTWARD	1	5	1	T	BL	R	BR	L		AT 1/20 - LEFTWARD																				
	2A	5	1	L	BR	T	TL	R		1A	5	1	TR	B	TR	L	BR		AT 1/20 - RIGHTWARD	2A	5	1	L	BR	T	TL	R		AT 1/20 - RIGHTWARD																				
GWAHVA	2	5	1	BL	T	BR	R	TL		2B	5	1	L	TR	B	TL	B	BL		AT 1/20 - LEFTWARD	2C	5	1	T	BL	R	TL	B		AT 1/20 - LEFTWARD																			
	3A	5	1	BR	T	TL	R	BL		3C	5	1	BL	R	BL	T	BR		AT 1/20 - RIGHTWARD	2D	5	1	TR	B	TL	B	BL		AT 1/20 - RIGHTWARD																				
GWAHVA	1	5	1																																														

## Scoring Alignment Points

Capture images of alignment rings to verify

### ALIGN WITH BUCKETS AND LAND ACURATELY

20 ALIGNMENTS TOTAL UP TO 100 POINTS



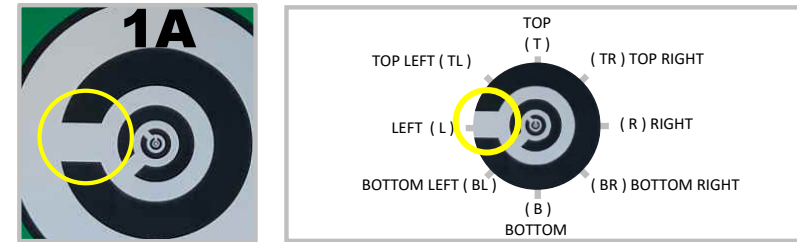
- Align with each bucket to capture a SINGLE IMAGE of the inscribed alignment ring. Only the first image is scored.
- Score captured images as:
  - UNBROKEN RINGS (5 points)
  - BROKEN RINGS (1 point)
  - NO RINGS (0 points, strike through line)
- Score accurate landings as:
  - CENTERED (5 pts) with the aircraft center point inside the 60 cm (24 in) diameter circle.
  - OFFSET (1 pts) with at least one propeller motor inside the circle.
- Verification of captured alignment images can be during the trial when obvious or after the trial to eliminate discussions during the trial. Images can also be stored for documentation.

## Scoring Acuity Points

Identify increasingly small visual acuity targets

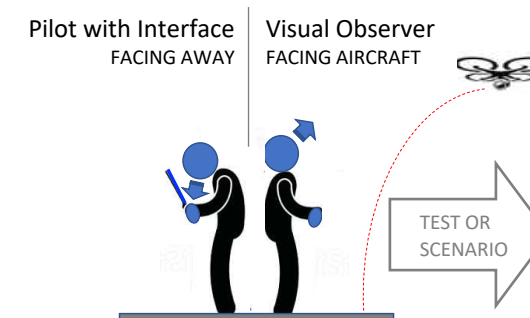
### ALIGN THEN CONTROL ZOOM AND EXPOSURE

20 TARGETS TOTAL UP TO 100 POINTS



REPORT GAP DIRECTIONS RELATIVE TO THE BUCKET NUMBER (TOP)

- While aligned with each bucket, IDENTIFY ACUITY TARGETS using camera zoom and exposure controls.
- Verbally call out as many of the Concentric C gap directions as possible (1 pt each) with a Proctor.
- Fly facing away from the test lane or scenario (with a Visual Observer) to evaluate flying interface only as if beyond visual line of sight (BVLOS).





## Level 2 & 3 Open Lane Setup

Using 4" (10cm) Buckets;

- Open Stands 1-4 with a 5ft-1.5m spacing

Area required 10 x spacing long (50ft-15m) x 6 x spacing wide (30ft-9m) x 2.6 x spacing high (13ft-4m)



# Level 3 Open Lane

## Payload Functionality Trials

- Fill in the header information completely!

- PROCTOR ATTESTATION**  
(The Proctor's printed name)

- Bucket Size
- Lane Spacing
- Lighting
- Wind
- Pilot view
- Time limit

**NIST** NATIONAL INSTITUTE OF  
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U.S. DEPARTMENT OF COMMERCE

Test Methods for Evaluating Aerial Drones  
**Safety | Capabilities | Proficiency**  
RobotTestMethods.nist.gov

VERSION 2023A

Pilot LAST Name \_\_\_\_\_

Pilot FIRST Name \_\_\_\_\_

Pilot Organization \_\_\_\_\_


Drone Make \_\_\_\_\_

Drone Model \_\_\_\_\_

Facility Location \_\_\_\_\_


Date (YYYY/MM/DD) \_\_\_\_\_ Team #: \_\_\_\_\_

**PROCTOR NAME** \_\_\_\_\_




### LEVEL 3 | OPEN LANE


## PAYLOAD FUNCTIONALITY



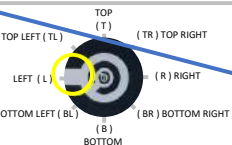
ALIGNED (5 PTS)

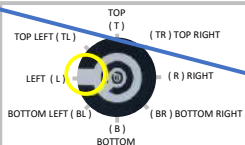


BROKEN (1 PT)



ACCURATE (5 PTS)





BUCKET DIAM.		LANE SPACING (S)			VISIBILITY		WIND		PILOT VIEW		TIME LIMIT		
4 IN (10 CM)	8 IN (20 CM)	5 FT (1.5 M)	10 FT (3 M)	20 FT (6 M)	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE MPH	GUSTS MPH	LINE OF SIGHT FACILE LANE OPTIONAL V.O.	INTERFACE ONLY BACK TO LANE MANDATORY V.O.	5 MIN	10 MIN	____ MIN
(CIRCLE ONE)		(CIRCLE ONE)			(CIRCLE ONE)		(FILL IN)		(CIRCLE ONE)		(CIRCLE ONE or FILL IN)		

# Level 3 Open Lane

## Payload Functionality Trials

Review scoring guidance.

Reminders to help understand mistakes

White and black bucket shading

Circle ALIGNMENT points from images.

Circle ACUITY points from answer key.

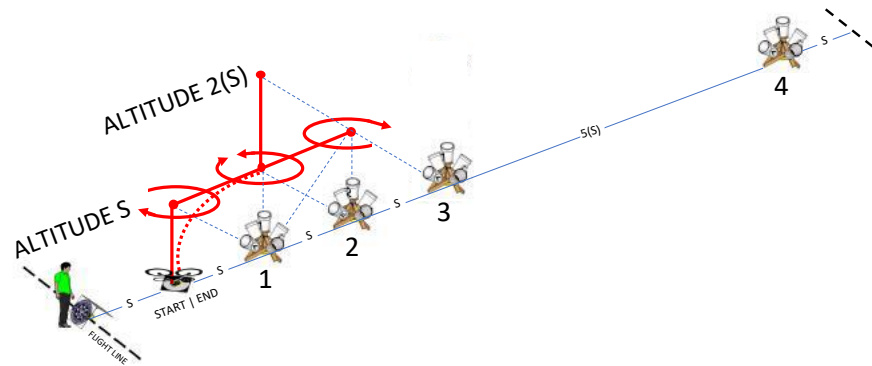
Separate totals for ALIGNMENT and  
ACUITY points (100 points each).

Any organization can select their own  
passing score and elapsed time.

POSITION (PAY 1)	TRAVERSE (PAY 2)	ORBIT (PAY 3)	INSPECT (PAY 4)	RECON (PAY 5)
<b>20 IMAGES TO CAPTURE</b> <ul style="list-style-type: none"> <li>18 ALIGNMENTS</li> <li>2 PERCH TARGETS</li> </ul>	<b>20 IMAGES TO CAPTURE</b> <ul style="list-style-type: none"> <li>18 ALIGNMENTS</li> <li>2 PERCH TARGETS</li> </ul>	<b>20 IMAGES TO CAPTURE</b> <ul style="list-style-type: none"> <li>20 ALIGNMENTS</li> <li>NO LANDING</li> </ul>	<b>20 IMAGES TO CAPTURE</b> <ul style="list-style-type: none"> <li>20 ALIGNMENTS</li> <li>NO LANDING</li> </ul>	<b>20 IMAGES TO CAPTURE</b> <ul style="list-style-type: none"> <li>20 ALIGNMENTS</li> <li>NO LANDING</li> </ul>
ALIGNMENT	ALIGNMENT	ALIGNMENT	ALIGNMENT	ALIGNMENT
ACUITY	ACUITY	ACUITY	ACUITY	ACUITY
ALIGN BUCKET	ALIGN BUCKET	ALIGN BUCKET	ALIGN BUCKET	ALIGN BUCKET
IMAGE POINTS	IMAGE POINTS	IMAGE POINTS	IMAGE POINTS	IMAGE POINTS
CORRECT GAPS (1 POINT EACH)	CORRECT GAPS (1 POINT EACH)	CORRECT GAPS (1 POINT EACH)	CORRECT GAPS (1 POINT EACH)	CORRECT GAPS (1 POINT EACH)
HOVER 1 5 1 T BL R BR L 2A 5 1 L BR T TL R YAW/ROLL 1 5 1 T BL R BR L 2A 5 1 L BR T TL R CLIMB 1 5 1 T BL R BR L 3A 5 1 BR T TL R BL DESCEND 1 5 1 T BL R BR L 2A 5 1 L BR T TL R FORWARD 1 5 1 BL T BR R TL 3A 5 1 BR T TL R BL BACKWARD 1 5 1 T BL R BR L 2A 5 1 L BR T TL R PITCH/ROLL 1 5 1 BL T BL L BR 1C 5 1 BR R TL L BR LAND 1 5 1 TR B TR L BR 1A 5 1 BL R TL L BL 2 5 1 L BR T TL B	LEFTWARD 1A 5 1 TR B TR L BR 1B 5 1 R TL T BL B 2B 5 1 TL R TR L BR 3C 5 1 BL R BL T BR 3D 5 1 L TL R BR T RIGHTWARD 2D 5 1 TR B TL B BL 1D 5 1 B TL R BL T 1A 5 1 TR B TL L BR P1 5 1 BL R TL L BL LEFTWARD 1A 5 1 TR B TR L BR 1D 5 1 B TL R BL T 2D 5 1 TR B TL B BL 3D 5 1 L TL R BR T 3C 5 1 BL R BL T BR 3B 5 1 B TR R BL T RIGHTWARD 2B 5 1 TL R TR L BR 1B 5 1 R TL T BL B 1A 5 1 BL R TL L BL P2 5 1 L BR T TL B	ALT/25°-LEFTWARD 1 5 1 T BL R BR L 3A 5 1 BR T TL R BL 3B 5 1 B TR R BL T 3C 5 1 BL R BL T BR 3D 5 1 L TL R BR T ALT/25°-RIGHTWARD 1 5 1 T BL R BR L 3A 5 1 BR T TL R BL 3D 5 1 L TL R BR T 3C 5 1 BL R BL T BR 3B 5 1 B TR R BL T ALT/75°-LEFTWARD 1 5 1 T BL R BR L 2A 5 1 L BR T TL R 2B 5 1 TL R TR L BR 2C 5 1 T BL R TL B 2D 5 1 TR B TL B BL ALT/75°-RIGHTWARD 1 5 1 T BL R BR L 2A 5 1 L BR T TL R 2D 5 1 TR B TL B BL 2C 5 1 T BL R TL B 2B 5 1 TL R TR L BR	ALT/25°-LEFTWARD 1 5 1 T BL R BR L 1A 5 1 TR B TR L BR 1B 5 1 R TL T BL B 1C 5 1 BR R TL L BR 1D 5 1 B TL R BR L ALT/25°-RIGHTWARD 2 5 1 BL T BR R TL 2A 5 1 L BR T TL R 2D 5 1 TR B TL B BL 2C 5 1 T BL R TL B 2B 5 1 TL R TR L BR ALT/75°-LEFTWARD 3 5 1 R TL B BL R 3A 5 1 BR T TL R BL 3B 5 1 B TR R BL T 3C 5 1 BL R BL T BR 3D 5 1 L TL R BR T ALT/75°-RIGHTWARD 4 5 1 TL B TR R BR 4A 5 1 T BL B TR L 4C 5 1 BR B TL B TR 4D 5 1 R BL T TR B 4B 5 1 TR L BL R BR	IMP 1 4 5 1 TL B TR R BR L 5 1 BL L BL T 1A 5 1 TR B TR L BR IMP 2 4 5 1 TL B TR R BR L 5 1 B TR L BL T 1A 5 1 TR B TR L BR IMP 3 4 5 1 TL B TR R BR L 5 1 B TR L BL T 1A 5 1 TR B TR L BR IMP 4 4 5 1 TL B TR R BR L 5 1 B TR L BL T 1A 5 1 TR B TR L BR IMP 5 4 5 1 TL B TR R BR L 5 1 B TR L BL T 1A 5 1 TR B TR L BR
/100	/100	/100	/100	/100
ELAPSED TIME (MM : SS)	ELAPSED TIME (MM : SS)	ELAPSED TIME (MM : SS)	ELAPSED TIME (MM : SS)	ELAPSED TIME (MM : SS)
PASS CIRCLE ONE FAIL	PASS CIRCLE ONE FAIL	PASS CIRCLE ONE FAIL	PASS CIRCLE ONE FAIL	PASS CIRCLE ONE FAIL

# Position (MAN/PAY 1)

## Open Test Lane

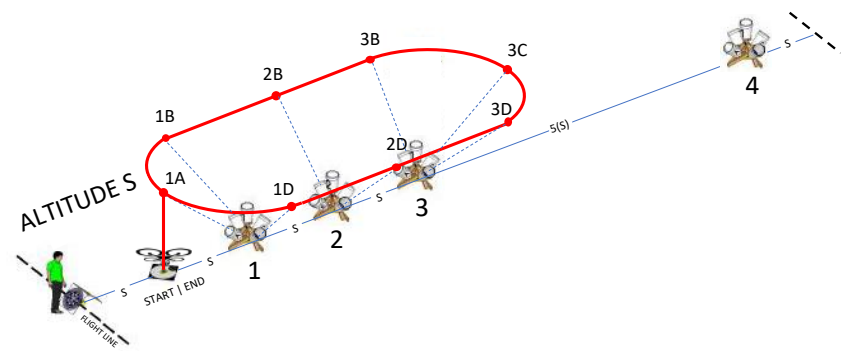


- Demonstrate positive aircraft control using basic flight maneuvers between designated hover positions, orientations, and altitudes along the lane centerline.
- Perform a series of maneuvers including climb, descend, yaw, pitch, and roll to simultaneously align with downward and forward buckets in each position.
- Land accurately on the platform with the chassis **CENTERED** (5 pts) within the 60 cm (24 in) diameter circle, or **OFFSET** (1 pt) at least one motor in the circle.
- Alignment Points:** Capture a **SINGLE IMAGE** of each alignment ring throughout 1 lap through 10 positions with 20 buckets and accurate landings to score up to 100 alignment points.
- Acuity Points:** While aligned with each bucket, identify as many acuity target gaps as possible to score up to 100 acuity points.

OPEN TEST LANE   POSITION		ALIGNMENT		ACUITY	
START TIMER		ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)	
1	LAUNCH AND HOVER OVER STAND #1 ALIGN WITH BOTH BUCKETS CAPTURE ONE IMAGE DOWNWARD THEN ONE IMAGE FORWARD	HOVER	1	5 1	T BL R BR L
2			2A	5 1	L BR T TL R
3	YAW LEFT 360° OVER STAND #1 ALIGN WITH BOTH BUCKETS CAPTURE ONE IMAGE DOWNWARD THEN ONE IMAGE FORWARD	YAW L-360	1	5 1	T BL R BR L
4			2A	5 1	L BR T TL R
5	YAW RIGHT 360° OVER STAND #1 ALIGN WITH BOTH BUCKETS CAPTURE ONE IMAGE DOWNWARD THEN ONE IMAGE FORWARD	YAW R-360	1	5 1	T BL R BR L
6			2A	5 1	L BR T TL R
7	CLIMB VERTICALLY OVER STAND #1 ALIGN WITH BOTH BUCKETS CAPTURE ONE IMAGE DOWNWARD THEN ONE IMAGE FORWARD	CLIMB	1	5 1	T BL R BR L
8			3A	5 1	BR T TL R BL
9	DESCEND VERTICALLY OVER STAND #1 ALIGN WITH BOTH BUCKETS CAPTURE ONE IMAGE DOWNWARD THEN ONE IMAGE FORWARD	DESCEND	1	5 1	T BL R BR L
10			2A	5 1	L BR T TL R
11	PITCH FORWARD TO STAND #2 ALIGN WITH BOTH BUCKETS CAPTURE ONE IMAGE DOWNWARD THEN ONE IMAGE FORWARD	FWD	2	5 1	BL T BR R TL
12			3A	5 1	BR T TL R BL
13	PITCH BACKWARD TO STAND #1 ALIGN WITH BOTH BUCKETS CAPTURE ONE IMAGE DOWNWARD THEN ONE IMAGE FORWARD	BKWD	1	5 1	T BL R BR L
14			2A	5 1	L BR T TL R
15	PITCH FWD TO STAND #2 THEN YAW LEFT 180° ALIGN WITH BOTH BUCKETS CAPTURE ONE IMAGE DOWNWARD THEN ONE IMAGE FORWARD	FWD-L180	Z	5 1	TR B TL L BR
16			1C	5 1	BR R TL L BR
17	PITCH FWD TO LANDING THEN YAW RIGHT 180° ALIGN WITH BOTH BUCKETS CAPTURE ONE IMAGE DOWNWARD THEN ONE IMAGE FORWARD	FWD-R180	L	5 1	B TR L BL T
18			1A	5 1	TR B TR L BR
19	LAND IN CIRCLE CENTERED (5 PTS) OR OFFSET (1 PT) COUNT SINGLE LANDING TWICE FOR ALIGNMENT SCORE CAPTURE ONE IMAGE OF P1 AND P2 ACUITY TARGETS	LAND	P1	5 1	BL R TL L BL
20			P2	5 1	L BR T TL B
STOP TIMER				/100	/100
ELAPSED TIME ( MM : SS )		PASS   FAIL (CIRCLE ONE)		PASS   FAIL (CIRCLE ONE)	

Traverse (MAN/PAY 2)

Open Test Lane

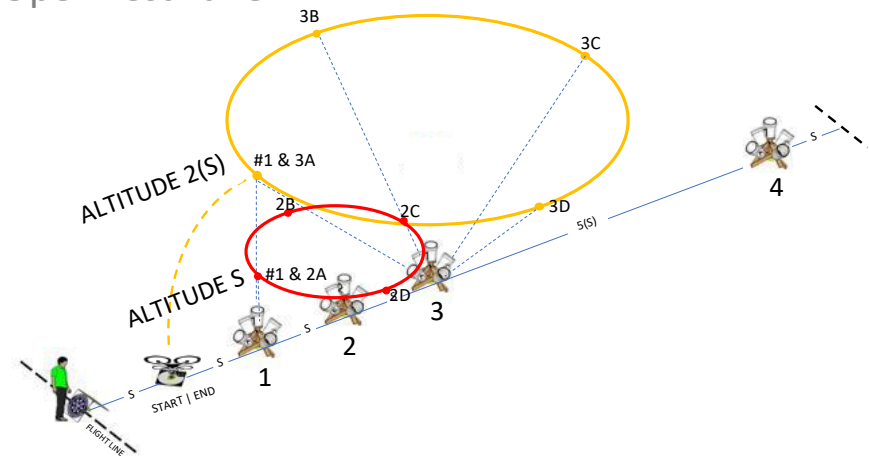


- Fly sideways parallel to objects while looking forward to identify features as if along a road, truck, bus, building, fence, tree line, etc.
- Maintain altitude (S) throughout to complete two laps in both directions around the first three omni stands.
- Land accurately on the platform with the chassis CENTERED (5 pts) within the 60 cm (24 in) diameter circle, or OFFSET (1 pt) at least one motor in the circle.
- **Alignment Points:** Capture a SINGLE IMAGE of each alignment ring throughout 2 laps with 20 buckets and accurate landings to score up to 100 alignment points.
- **Acuity Points:** While aligned with each bucket, identify as many acuity target gaps as possible to score up to 100 acuity points.

OPEN TEST LANE   TRAVERSE		ALIGNMENT		ACUITY	
START TIMER		ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)	
1	HOVER OVER THE LAUNCH AT ALTITUDE S	1A	5 1	TR	B TR L BR
2	ORBIT 90° LEFTWARD AROUND STAND #1	1B	5 1	R	TL T BL B
3	ROLL LEFTWARD TO STAND #2	2B	5 1	TL	R TR L BR
4	ROLL LEFTWARD TO STAND #3	3B	5 1	B	TR R BL T
5	ORBIT 90° LEFTWARD AROUND STAND #3	3C	5 1	BL	R BL T BR
6	ORBIT 90° LEFTWARD AROUND STAND #3	3D	5 1	L	TL R BR T
7	ROLL LEFTWARD TO STAND #2	2D	5 1	TR	B TL B BL
8	ROLL LEFTWARD TO STAND #1	1D	5 1	B	TL R BL T
9	ORBIT 90° LEFTWARD AROUND STAND #1	1A	5 1	TR	B TR L BR
10	LAND IN CIRCLE (5 PTS CENTERED, 1 PT OFFSET)	P1	5 1	BL	R TL L BL
11	HOVER OVER THE LAUNCH PLATFORM	1A	5 1	TR	B TR L BR
12	ORBIT 90° RIGHTWARD AROUND STAND #1	1D	5 1	B	TL R BL T
13	ROLL RIGHTWARD TO STAND #2	2D	5 1	TR	B TL B BL
14	ROLL RIGHTWARD TO STAND #3	3D	5 1	L	TL R BR T
15	ORBIT 90° RIGHTWARD AROUND STAND #3	3C	5 1	BL	R BL T BR
16	ORBIT 90° RIGHTWARD AROUND STAND #3	3B	5 1	B	TR R BL T
17	ROLL RIGHTWARD TO STAND #2	2B	5 1	TL	R TR L BR
18	ROLL RIGHTWARD TO STAND #1	1B	5 1	R	TL T BL B
19	ORBIT 90° RIGHTWARD AROUND STAND #1	1A	5 1	TR	B TR L BR
20	LAND IN CIRCLE (5 PTS CENTERED, 1 PT OFFSET)	P2	5 1	L	BR T TL B
STOP TIMER		/100		/100	
ELAPSED TIME ( MM : SS )		PASS   FAIL (CIRCLE ONE)		PASS   FAIL (CIRCLE ONE)	

# Orbit (MAN/PAY 3)

## Open Test Lane



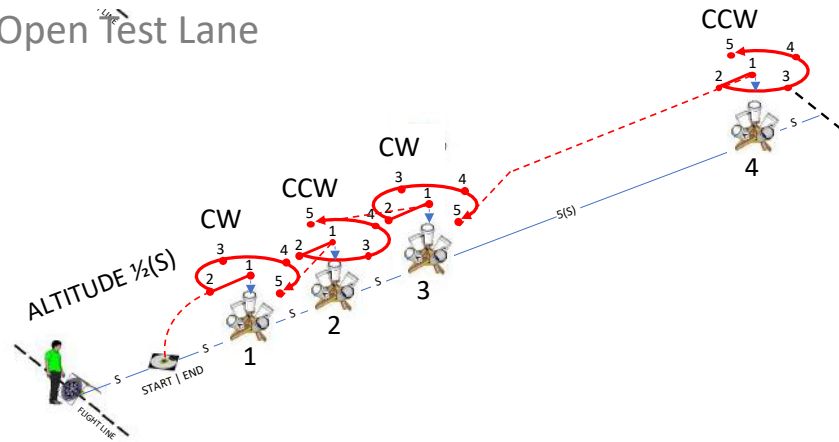
- Orbit an object at an equal altitude and radius while looking inward to identify features on four sides.
- Each orbit includes 5 bucket alignments: 1 downward radius check plus 4 angled buckets all around.
- Start aligned over omni stand #1 at altitude 2(S) to set the orbit radius around omni stand #3. Orbit both directions ending at the start point.
- Descend over omni stand #1 to altitude S to set the orbit radius around omni stand #2. Orbit both directions. Accurate landings are not included.
- **Alignment Points:** Capture a SINGLE IMAGE of each alignment ring throughout 4 orbits (leftward and rightward at each altitude) with 20 buckets to score up to 100 alignment points.
- **Acuity Points:** While aligned with each bucket, identify as many acuity target gaps as possible to score up to 100 acuity points.

OPEN TEST LANE   ORBIT		ALIGNMENT		ACUITY						
START TIMER		ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)						
1	ALIGN OVER STAND #1 AT ALT 2(S) CHECK RADIUS	ALT 2(S) – LEFTWARD	1	5	1	T	BL	R	BR	L
2	ALIGN WITH BUCKET 3A CHECK ALTITUDE		3A	5	1	BR	T	TL	R	BL
3	ORBIT LEFTWARD 90°		3B	5	1	B	TR	R	BL	T
4	ORBIT LEFTWARD 90°		3C	5	1	BL	R	BL	T	BR
5	ORBIT LEFTWARD 90°		3D	5	1	L	TL	R	BR	T
6	ALIGN OVER STAND #1 AT ALT 2(S) CHECK RADIUS	ALT 2(S) – RIGHTWARD	1	5	1	T	BL	R	BR	L
7	ALIGN WITH BUCKET 3A CHECK ALTITUDE		3A	5	1	BR	T	TL	R	BL
8	ORBIT RIGHTWARD 90°		3D	5	1	L	TL	R	BR	T
9	ORBIT RIGHTWARD 90°		3C	5	1	BL	R	BL	T	BR
10	ORBIT RIGHTWARD 90°		3B	5	1	B	TR	R	BL	T
11	ALIGN OVER STAND #1 AT ALT S CHECK RADIUS	ALT S – LEFTWARD	1	5	1	T	BL	R	BR	L
12	ALIGN WITH BUCKET 2A CHECK ALTITUDE		2A	5	1	L	BR	T	TL	R
13	ORBIT LEFTWARD 90°		2B	5	1	TL	R	TR	L	BR
14	ORBIT LEFTWARD 90°		2C	5	1	T	BL	R	TL	B
15	ORBIT LEFTWARD 90°		2D	5	1	TR	B	TL	B	BL
16	ALIGN OVER STAND #1 AT ALT S CHECK RADIUS	ALT S – RIGHTWARD	1	5	1	T	BL	R	BR	L
17	ALIGN WITH BUCKET 2A CHECK ALTITUDE		2A	5	1	L	BR	T	TL	R
18	ORBIT RIGHTWARD 90°		2D	5	1	TR	B	TL	B	BL
19	ORBIT RIGHTWARD 90°		2C	5	1	T	BL	R	TL	B
20	ORBIT RIGHTWARD 90°		2B	5	1	TL	R	TR	L	BR
STOP TIMER										
ELAPSED TIME		PASS   FAIL		PASS   FAIL						
( MM : SS )		(CIRCLE ONE)		(CIRCLE ONE)						



# Inspect (MAN/PAY 4)

## Open Test Lane

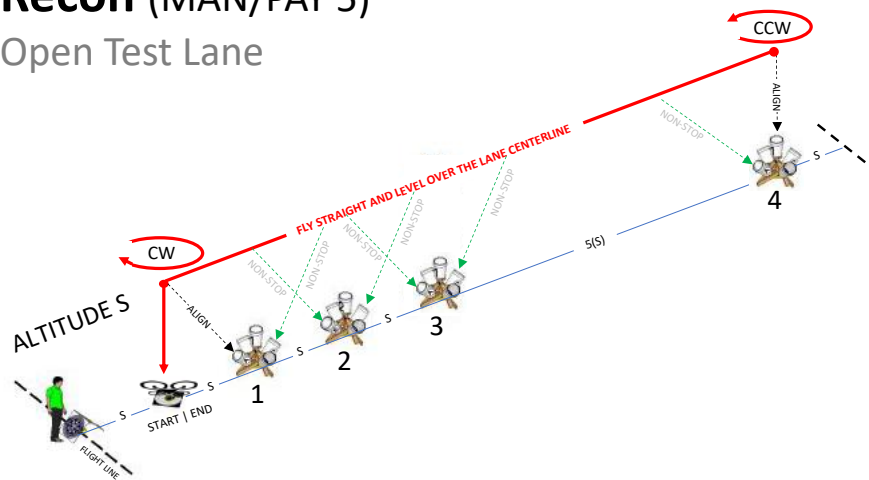


- Fly around objects in close proximity to inspect detailed features on the top and all four sides.
- Maintain altitude 1/2(S) throughout starting on top of each omni stand then rotate around all four omni bucket stands in alternating clockwise (A-B-C-D) and counter clockwise (A-D-C-B) directions.
- Accurate landings are not included.
- Alignment Points:** Capture a SINGLE IMAGE of each alignment ring throughout 4 omni stands with 20 buckets to score up to 100 alignment points.
- Acuity Points:** While aligned with each bucket, identify as many acuity target gaps as possible to score up to 100 acuity points.

OPEN TEST LANE   INSPECT		ALIGNMENT		ACUITY	
START TIMER		ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)	
1	HOVER OVER STAND #1 AT ALTITUDE 1/2(S)	ALT 1/2(S) - LEFTWARD	1	5 1	T BL R BR L
2	PITCH BACKWARD		1A	5 1	TR B TR L BR
3	ORBIT LEFTWARD 90°		1B	5 1	R TL T BL B
4	ORBIT LEFTWARD 90°		1C	5 1	BR R TL L BR
5	ORBIT LEFTWARD 90°		1D	5 1	B TL R BL T
6	HOVER OVER STAND #2 AT ALTITUDE 1/2(S)	ALT 1/2(S) - RIGHTWARD	2	5 1	BL T BR R TL
7	PITCH BACKWARD		2A	5 1	L BR T TL R
8	ORBIT RIGHTWARD 90°		2D	5 1	TR B TL B BL
9	ORBIT RIGHTWARD 90°		2C	5 1	T BL R TL B
10	ORBIT RIGHTWARD 90° T		2B	5 1	TL R TR L BR
11	HOVER OVER STAND #3 AT ALTITUDE 1/2(S)	ALT 1/2(S) - LEFTWARD	3	5 1	R TL B BL R
12	PITCH BACKWARD		3A	5 1	BR T TL R BL
13	ORBIT LEFTWARD 90°		3B	5 1	B TR R BL T
14	ORBIT LEFTWARD 90°		3C	5 1	BL R BL T BR
15	ORBIT LEFTWARD 90°		3D	5 1	L TL R BR T
16	HOVER OVER STAND #4 AT ALTITUDE 1/2(S)	ALT 1/2(S) - RIGHTWARD	4	5 1	TL B TR R BR
17	PITCH BACKWARD		4A	5 1	T BL B TR L
18	ORBIT RIGHTWARD 90°		4D	5 1	BR B TL B TR
19	ORBIT RIGHTWARD 90°		4C	5 1	R BL T TR B
20	ORBIT RIGHTWARD 90°		4B	5 1	TR L BL R TL
STOP TIMER				/100	/100
ELAPSED TIME ( MM : SS )		PASS   FAIL (CIRCLE ONE)		PASS   FAIL (CIRCLE ONE)	

Recon (MAN/PAY 5)

Open Test Lane



- Fly straight and level at a sustainable speed directly over the lane centerline to establish a stable hover over an object and perform quick reconnaissance tasks.
- Maintain altitude (S) throughout starting over the launch/land platform to align with the designated targets at both ends of the lane.
- A complete trial totals a distance of 80(S).
- Accurate landings are not included.
- **Alignment Points:** Capture a SINGLE IMAGE of each alignment ring throughout 5 laps with 20 buckets to score up to 100 alignment points.
- **Acuity Points:** While aligned with each bucket, identify as many acuity target gaps as possible to score up to 100 acuity points.

OPEN TEST LANE   RECON		ALIGNMENT		ACUITY						
START TIMER		ALIGN BUCKET	IMAGE POINTS	CORRECT GAPS (1 POINT EACH)						
1	FLY AT ALTITUDE S TO STAND #4	LAP 1	4	5	1	TL	B	TR	R	BR
2	YAW LEFT 180°		7	5	1	BR	I	BL	L	TL
3	FLY TO THE LAUNCH AND YAW RIGHT 180°		L	5	1	B	TR	L	BL	T
4	HOVER IN PLACE CHECK ALTITUDE S		1A	5	1	TR	B	TR	L	BR
5	FLY AT ALTITUDE S TO STAND #4	LAP 2	4	5	1	TL	B	TR	R	BR
6	YAW LEFT 180°		7	5	1	BR	I	BL	L	TL
7	FLY TO THE LAUNCH AND YAW RIGHT 180°		L	5	1	B	TR	L	BL	T
8	HOVER IN PLACE CHECK ALTITUDE S		1A	5	1	TR	B	TR	L	BR
9	FLY AT ALTITUDE S TO STAND #4	LAP 3	4	5	1	TL	B	TR	R	BR
10	YAW LEFT 180°		7	5	1	BR	I	BL	L	TL
11	FLY TO THE LAUNCH AND YAW RIGHT 180°		L	5	1	B	TR	L	BL	T
12	HOVER IN PLACE CHECK ALTITUDE S		1A	5	1	TR	B	TR	L	BR
13	FLY AT ALTITUDE S TO STAND #4	LAP 4	4	5	1	TL	B	TR	R	BR
14	YAW LEFT 180°		7	5	1	BR	I	BL	L	TL
15	FLY TO THE LAUNCH AND YAW RIGHT 180°		L	5	1	B	TR	L	BL	T
16	HOVER IN PLACE CHECK ALTITUDE S		1A	5	1	TR	B	TR	L	BR
17	FLY AT ALTITUDE S TO STAND #4	LAP 5	4	5	1	TL	B	TR	R	BR
18	YAW LEFT 180°		7	5	1	BR	I	BL	L	TL
19	FLY TO THE LAUNCH AND YAW RIGHT 180°		L	5	1	B	TR	L	BL	T
20	HOVER IN PLACE CHECK ALTITUDE S		1A	5	1	TR	B	TR	L	BR
STOP TIMER										
		/100			/100					
ELAPSED TIME ( MM : SS )		PASS   FAIL (CIRCLE ONE)			PASS   FAIL (CIRCLE ONE)					



# Level 3 Open Lanes for Large Platforms

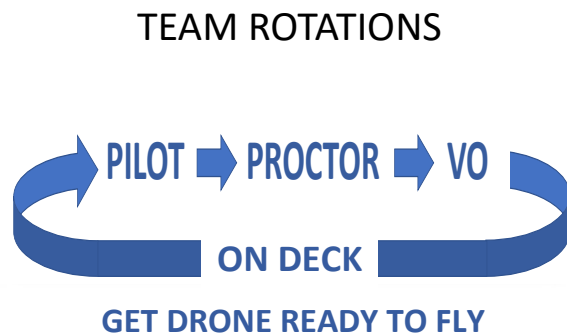
Using 4"(10cm) Buckets;

- Open Stands 1-3 with a 20ft(6m) spacing - Area required 6 x spacing long (120ft-36m) x 6 x spacing wide (120ft-36m) x 2.5 x spacing high (50ft-15m)
- Flight Paths - Position, Traverse, and Orbit
- 10-minute time limit for each Flight Path

This provides the training necessary for the Large Platform's mission set

## Teams Rotate Through Each Role

Each Pilot flies a 5-minute trial with help from other team members.  
A 3-4 person team completes all 5 tests in 2 hours.



Four person teams always have one person getting their aircraft ready to launch right after the previous lands.

Three person teams work too, but require some time between each rotation to prepare the next aircraft.

### PILOT

- Maintain control of the aircraft.
- Call out each intention of movement before doing so.
- Call out each bucket alignment and acuity target gap.

### PROCTOR

- Fill in the form header.
- Read the test procedures to the Pilot.
- Confirm, record, and attest to scoring after the trial.

### VISUAL OBSERVER (VO)

- Maintain sight with the aircraft and surroundings.
- Repeat the Pilot's intention of movement to confirm.
- Call out corrections and warnings as necessary.

# Metrics to Track Over Time

Measure System Capabilities and Pilot Proficiency

**Completeness:** Align with every bucket in the sequence and land accurately according to the procedure. The objective is scoring ALL points possible for your aircraft without making mistakes.

**Score:** For complete trials, track your scores over time. The average of your last five trials is an excellent measure of your proficiency on the aircraft and interface used.

**Efficiency (Optional):** For complete trials with maximum scores for a particular aircraft, the elapsed time can help identify the most efficient systems and techniques. Time limited trials can be used across multiple tests to maintain a schedule and similarly fatigue novices and experts.

# Day and Night Operations

Evaluate using repeatable hovers and orbits



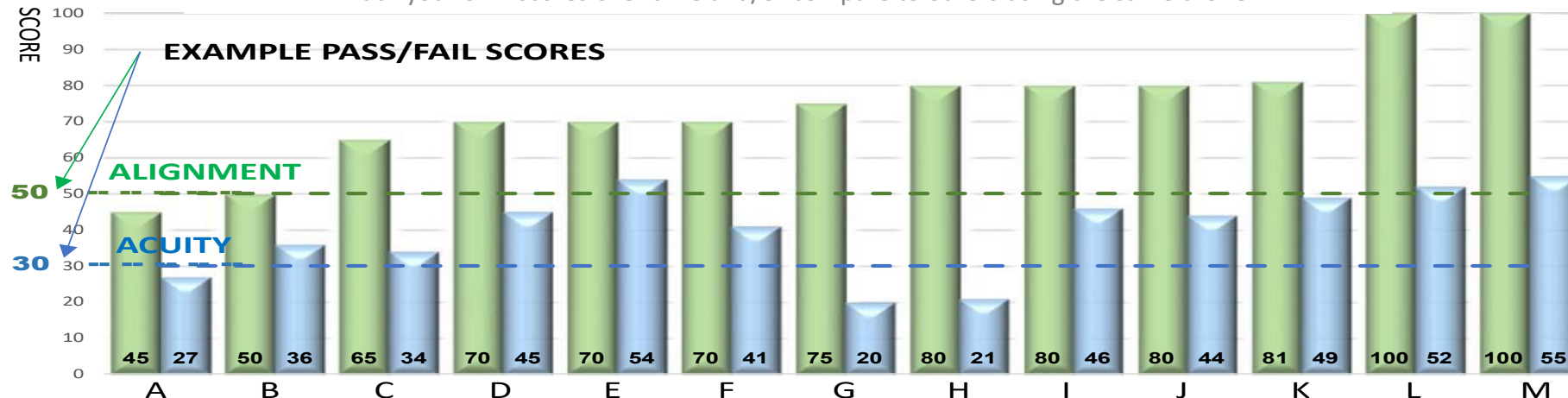
Shown with all white bucket stands for Basic Maneuvering (MAN).



Alternating black and white buckets stands for Payload Functionality (PAY).

## Separate Scores for ALIGNMENT and ACUITY

Track your own scores over time and/or compare to others using the same drone.







# Level 3 Open Lane Proctoring

## Scoring Alignment Points

Capture images of alignment rings to verify

### ALIGN WITH BUCKETS AND LAND ACURATELY

20 ALIGNMENTS TOTAL UP TO 100 POINTS



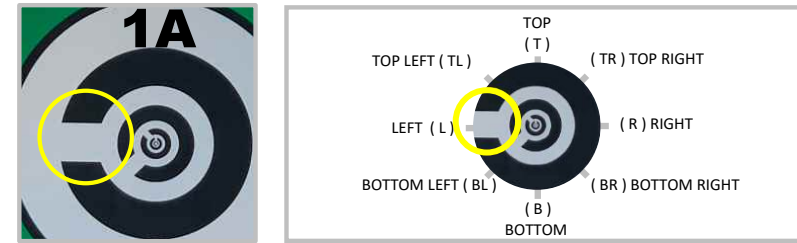
- Align with each bucket to capture a SINGLE IMAGE of the inscribed alignment ring. Only the first image is scored.
- Score captured images as:
  - UNBROKEN RINGS (5 points)
  - BROKEN RINGS (1 point)
  - NO RINGS (0 points, strike through line)
- Score accurate landings as:
  - CENTERED (5 pts) with the aircraft center point inside the 60 cm (24 in) diameter circle.
  - OFFSET (1 pts) with at least one propeller motor inside the circle.
- Verification of captured alignment images can be during the trial when obvious or after the trial to eliminate discussions during the trial. Images can also be stored for documentation.

## Scoring Acuity Points

Identify increasingly small visual acuity targets

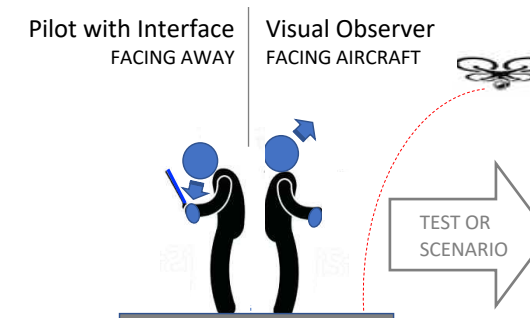
### ALIGN THEN CONTROL ZOOM AND EXPOSURE

20 TARGETS TOTAL UP TO 100 POINTS



REPORT GAP DIRECTIONS RELATIVE TO THE BUCKET NUMBER (TOP)

- While aligned with each bucket, IDENTIFY ACUITY TARGETS using camera zoom and exposure controls.
- Verbally call out as many of the Concentric C gap directions as possible (1 pt each) with a Proctor.
- Fly facing away from the test lane or scenario (with a Visual Observer) to evaluate flying interface only as if beyond visual line of sight (BVLOS).



# Level 3 Open Lane

## Payload Functionality Trials

- Fill in the header information completely!

- PROCTOR ATTESTATION**  
(The Proctor's printed name)

- Bucket Size
- Lane Spacing
- Lighting
- Wind
- Pilot view
- Time limit

**NIST** NATIONAL INSTITUTE OF  
STANDARDS AND TECHNOLOGY  
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Test Methods for Evaluating Aerial Drones  
**Safety | Capabilities | Proficiency**  
RobotTestMethods.nist.gov

VERSION 2023A

Pilot LAST Name \_\_\_\_\_

Pilot FIRST Name \_\_\_\_\_

Pilot Organization \_\_\_\_\_




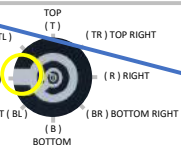
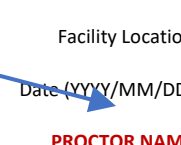
Drone Make \_\_\_\_\_

Drone Model \_\_\_\_\_

Facility Location \_\_\_\_\_

Date (YYYY/MM/DD) \_\_\_\_\_ Team #: \_\_\_\_\_

**PROCTOR NAME** \_\_\_\_\_

BUCKET DIAM.		LANE SPACING (S)			VISIBILITY		WIND		PILOT VIEW		TIME LIMIT		
4 IN (10 CM)	8 IN (20 CM)	5 FT (1.5 M)	10 FT (3 M)	20 FT (6 M)	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE MPH	GUSTS MPH	LINE OF SIGHT FACILE LANE OPTIONAL V.O.	INTERFACE ONLY BACK TO LANE MANDATORY V.O.	5 MIN	10 MIN	____ MIN
(CIRCLE ONE)		(CIRCLE ONE)			(CIRCLE ONE)		(FILL IN)		(CIRCLE ONE)		(CIRCLE ONE or FILL IN)		

# Level 3 Open Lane

## Payload Functionality Trials

Review scoring guidance.

Reminders to help understand mistakes

White and black bucket shading

Circle ALIGNMENT points from images.

Circle ACUITY points from answer key.

Separate totals for ALIGNMENT and ACUITY points (100 points each).

Any organization can select their own passing score and elapsed time.

POSITION (PAY 1)		TRAVERSE (PAY 2)		ORBIT (PAY 3)		INSPECT (PAY 4)		RECON (PAY 5)																																																																																																																																																																																															
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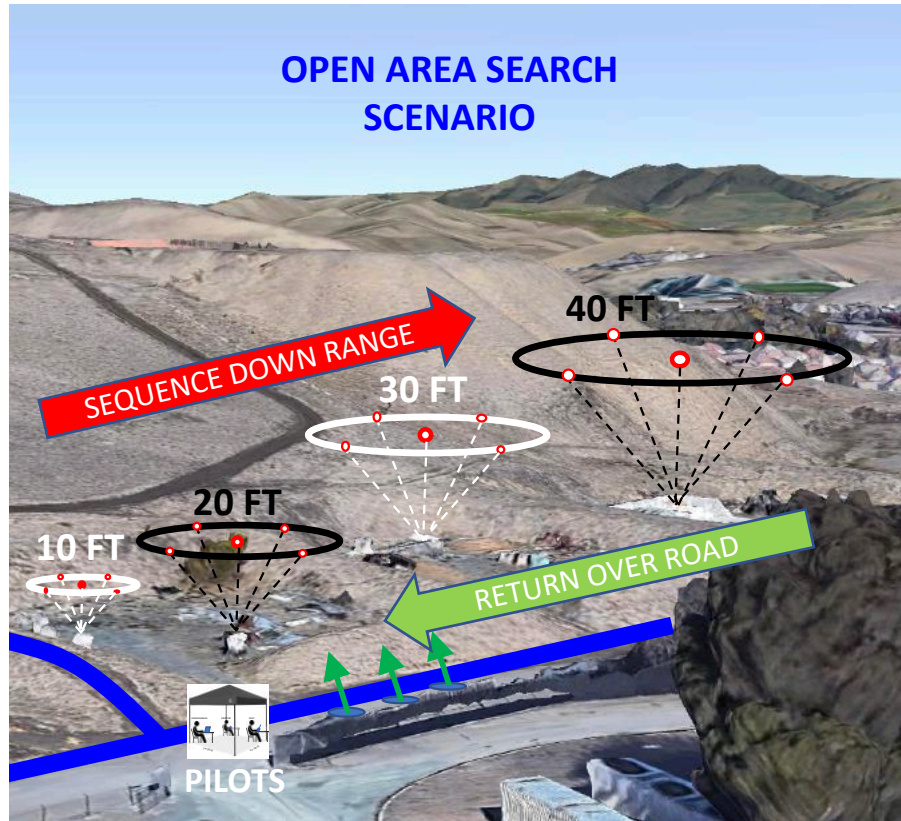


## Level 3 Open Scenarios



# Open Area Search Scenarios

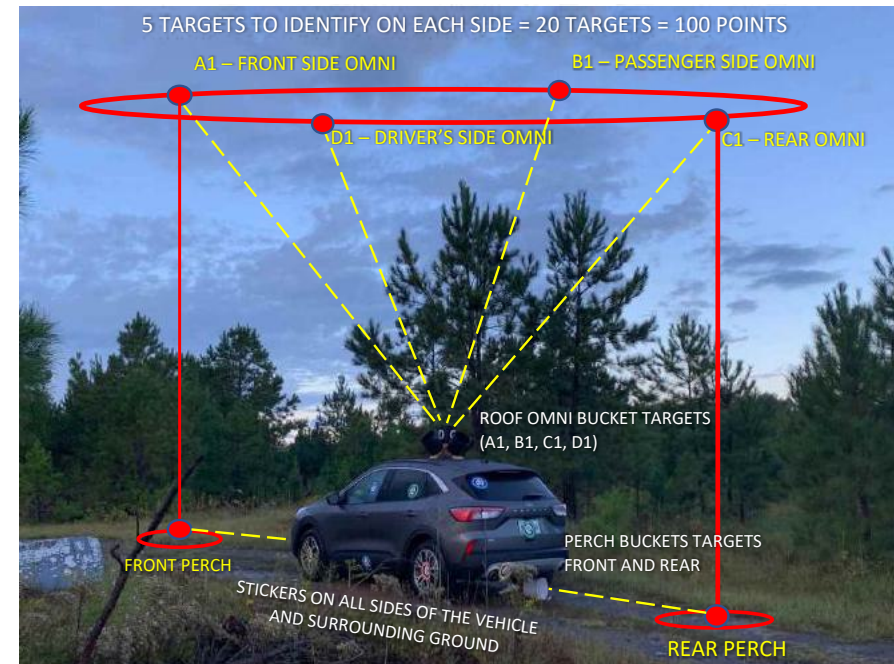
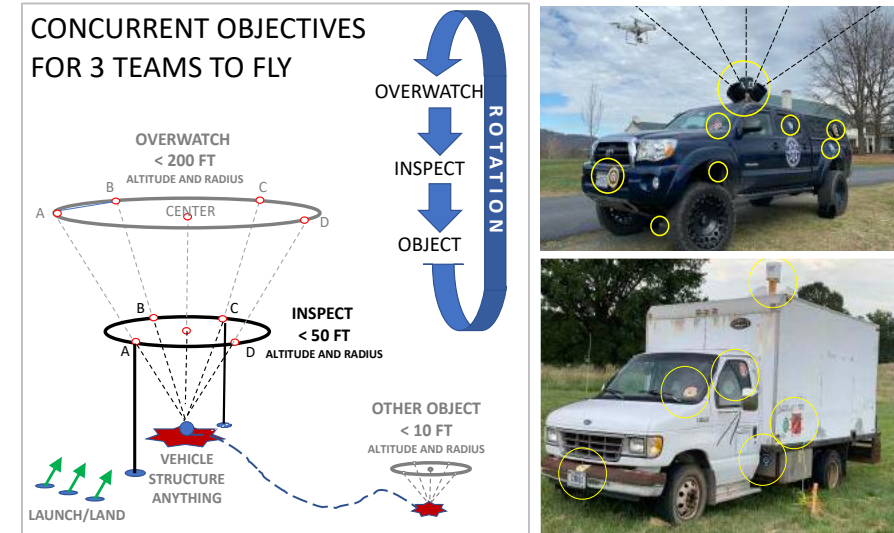
Day and Night Trials



- Teams concurrently fly separate objectives set up at safe distances and/or altitudes apart (with a clearly designated and safe return path).
- Each pilot flies for 15 minutes across 3 different objectives for 5 minutes each. Teams move as necessary to maintain sight lines and communication.
- Scenarios restart with a different rotation of Pilot, Proctor, and VO.

# Open Vehicle Identification Scenarios

Day and Night Trials





## Level 1-3 Quiz Review

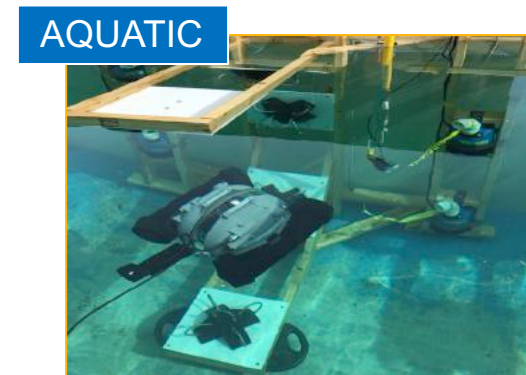
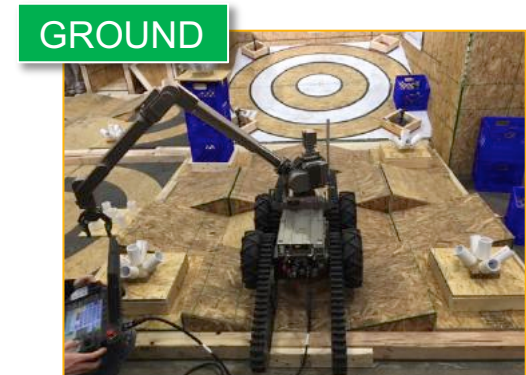
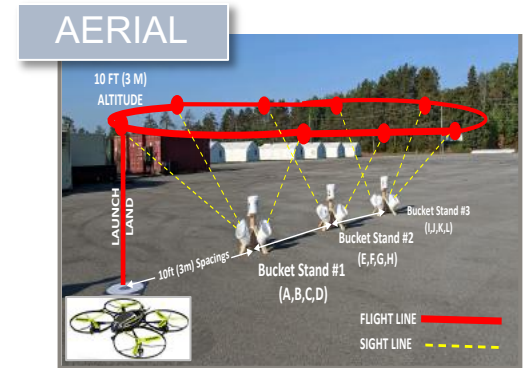
# Standards Enable Credentialing of Proctors and Remote Pilots

Safety | Capabilities | Proficiency

## NIST Develops and Validates Test Methods

- **Apparatus** that can be reproducible by others.
- **Procedures** that are repeatable to conduct test trials.
- **Performance Metrics** that are quantitative and can be compared over time, across locations and internationally
- **Evaluate Systems** using expert pilots conducting complete trials
- **Operator proficiency** is compared with similar systems on the same lane spacing in similar environmental conditions with either complete or time limited trials

Compare time limited trials that are incomplete by total points for similar elapsed times or calculate and compare the scoring rate as points per minute for different elapsed times



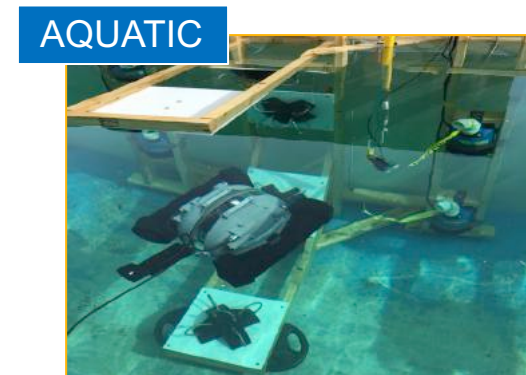
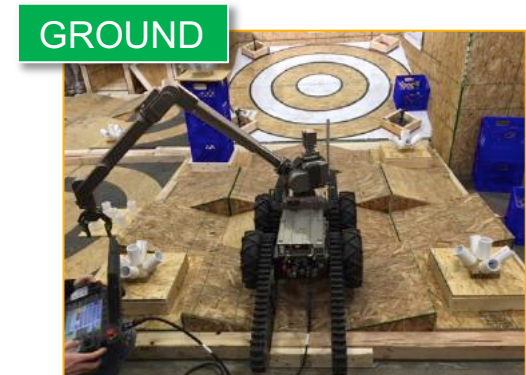
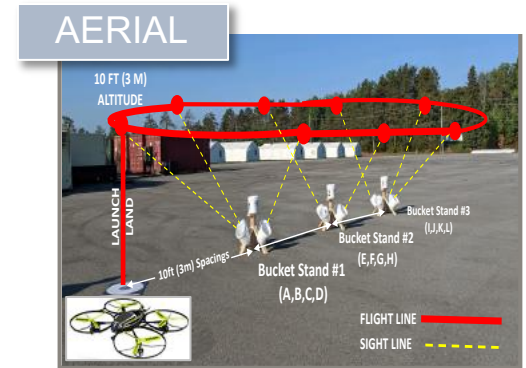


# Standards Enable Credentialing of Proctors and Remote Pilots

Safety | Capabilities | Proficiency

When conducting evaluations with these Test Methods the results should only be compared to similar environmental conditions.

Night or dark trials can be conducted with white or red headlamps illuminating the white buckets or only using the lights and sensors onboard the drone.

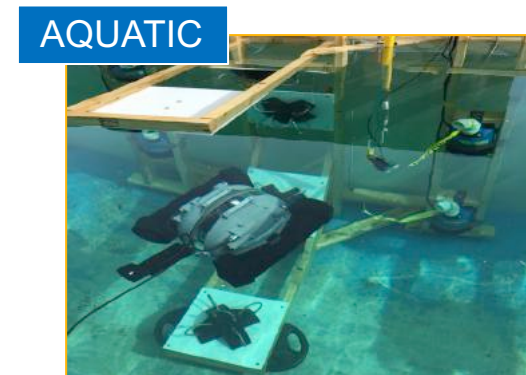
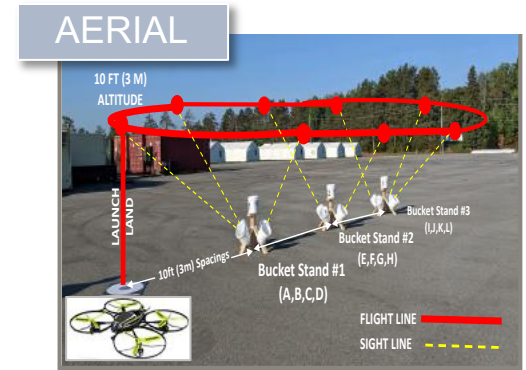


# Standards Enable Credentialing of Proctors and Remote Pilots

Safety | Capabilities | Proficiency

*When Credentialing operators an organization can;*

- Set their own pass/fail scoring threshold
- Adopt a pass/fail scoring threshold set by a regional or national association with which the organization collaborates
- Adopt a pass/fail scoring threshold set by a similar organization





# Choose Appropriate Lane Spacing Based on Optics and Safety

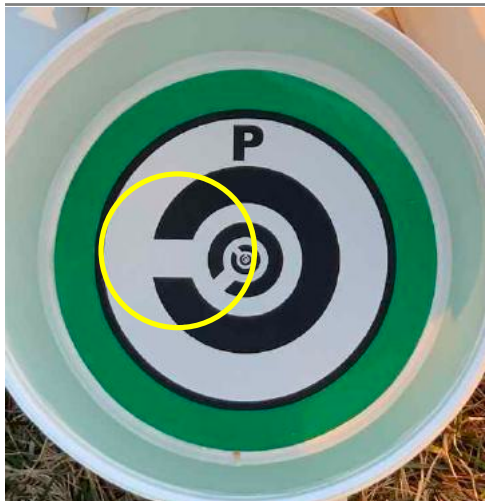
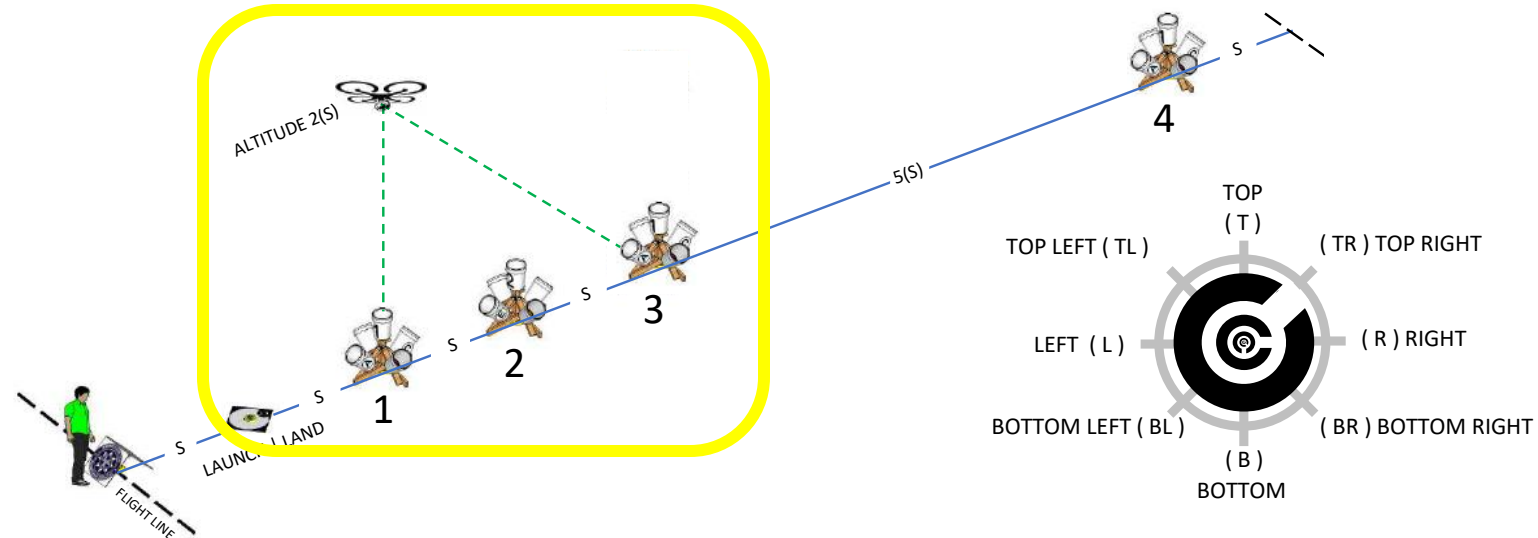
## Open Test Lane

### ALWAYS:

- Acuity from 2(S) so the targets must be visible

### INDOORS:

- Lane Length = 10(S)
- Lane Width = 6(S)
- Elevation = 2(S)  
PLUS SAFETY MARGIN



## Scoring Alignment Points

Capture images of alignment rings to verify

### ALIGN WITH BUCKETS AND LAND ACURATELY

20 ALIGNMENTS TOTAL UP TO 100 POINTS



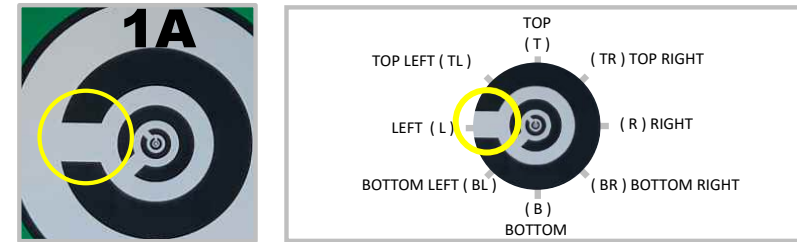
- Align with each bucket to capture a SINGLE IMAGE of the inscribed alignment ring. Only the first image is scored.
- Score captured images as:
  - UNBROKEN RINGS (5 points)
  - BROKEN RINGS (1 point)
  - NO RINGS (0 points, strike through line)
- Score accurate landings as:
  - CENTERED (5 pts) with the aircraft center point inside the 60 cm (24 in) diameter circle.
  - OFFSET (1 pts) with at least one propeller motor inside the circle.
- Verification of captured alignment images can be during the trial when obvious or after the trial to eliminate discussions during the trial. Images can also be stored for documentation.

## Scoring Acuity Points

Identify increasingly small visual acuity targets

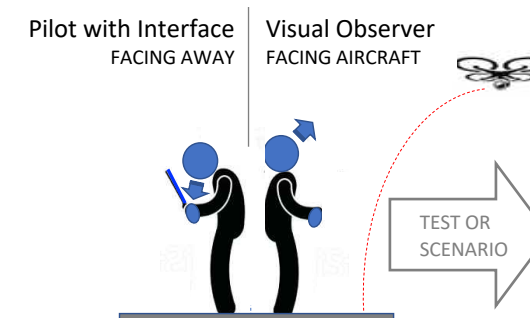
### ALIGN THEN CONTROL ZOOM AND EXPOSURE

20 TARGETS TOTAL UP TO 100 POINTS



REPORT GAP DIRECTIONS RELATIVE TO THE BUCKET NUMBER (TOP)

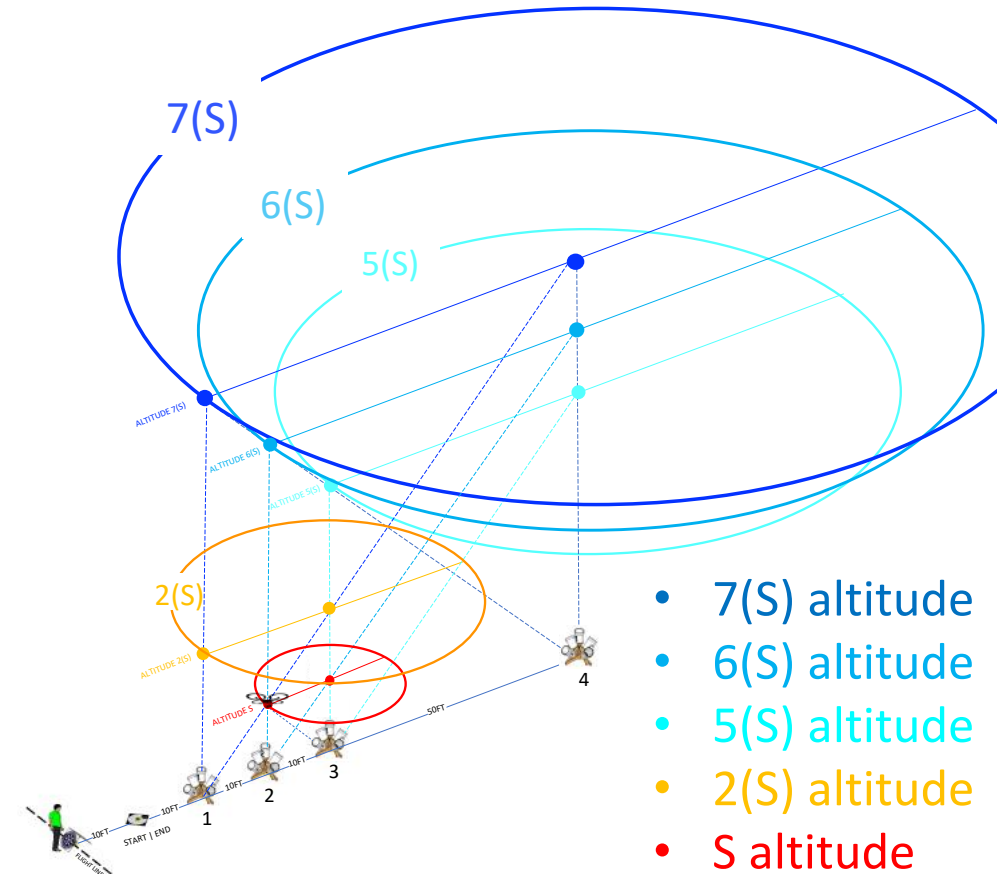
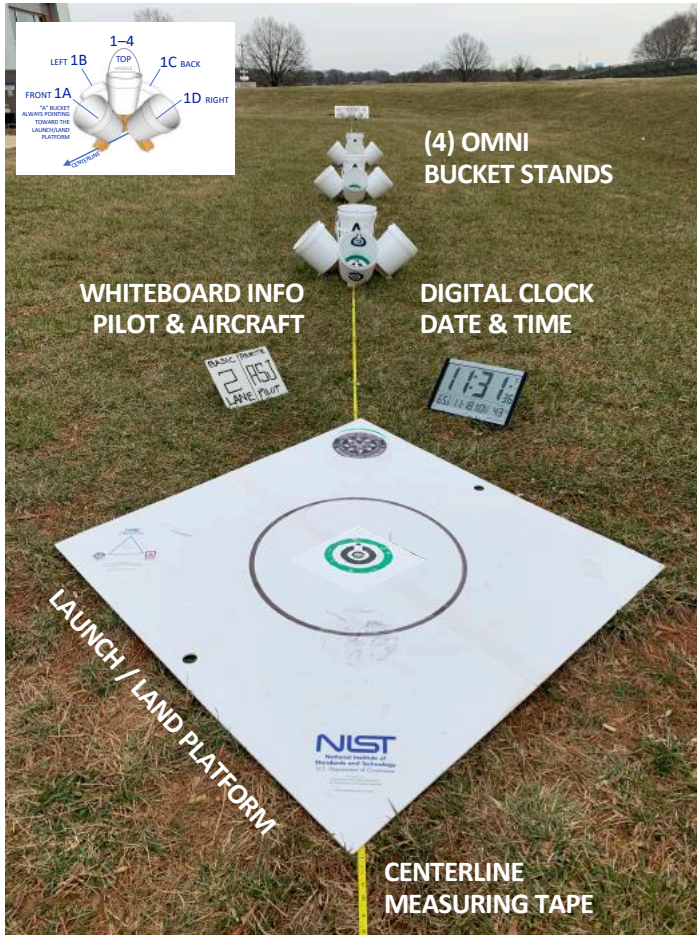
- While aligned with each bucket, IDENTIFY ACUITY TARGETS using camera zoom and exposure controls.
- Verbally call out as many of the Concentric C gap directions as possible (1 pt each) with a Proctor.
- Fly facing away from the test lane or scenario (with a Visual Observer) to evaluate flying interface only as if beyond visual line of sight (BVLOS).



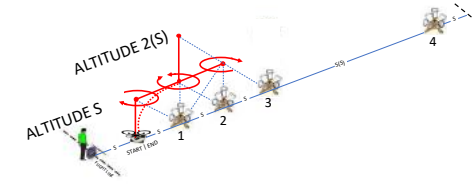
# Same Lane Supports Other Flight Paths

## Open Test Lane

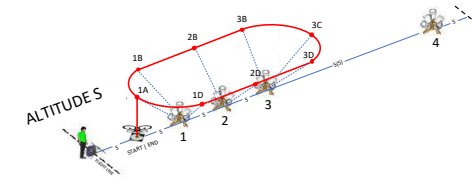
5 Different Orbits in Every Lane Spacing  
(S) = 10ft, 20ft, 30ft, or other



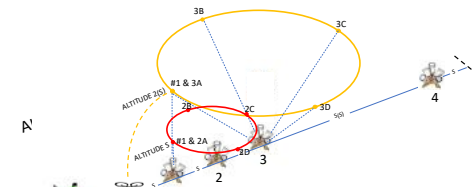
**POSITION**  
MAN/PAY 1



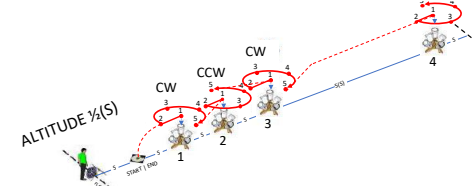
**TRAVERSE**  
MAN/PAY 2



**ORBIT**  
MAN/PAY 3



**INSPECT**  
MAN/PAY 4



**RECON**  
MAN/PAY 5

