Open Test Lane Forms Book

MAN/PAY 1-5 and Related Scenarios

AIRCRAFT SYSTEM

MAKE: _____

MODEL: _____

CONFIG: _____

REMOTE PILOT

CODE: _____ (INITIALS or ANONYMOUS)

NAME: _____

ATTEST: _____

VISUAL OBSERVER

NAME: _____

ATTEST: _____

PROCTOR

NAME: _____

ATTEST: _____

DATE: _____

FACILITY: _____

LOCATION: _____

MAN 1-5 SCORES

TRIAL TIMES: (circle one) 5 | 10 | ___ minutes

1) POSITION: _____ of 100 Points

2) TRAVERSE: _____ of 100 Points

3) ORBIT: _____ of 100 Points

4) SPIRAL: _____ of 100 Points

5) RECON: _____ of 100 Points

of 500 Points

PAY 1-5 SCORES

TRIAL TIMES: (circle one) 10 | 20 | ___ minutes

1) POSITION: _____ of 100 Points

2) TRAVERSE: _____ of 100 Points

3) ORBIT: _____ of 100 Points

4) SPIRAL: _____ of 100 Points

5) RECON: _____ of 100 Points

of 500 Points

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The NIST Team includes:
Adam Jacoff, Raymond Sheh, Kamel Saidi,
Kenny Kimble, and Ann Virts.

Dozens more people have contributed to the development and validation of these test methods. They include FEMA urban search and rescue task force teams, firefighters, law enforcement, collaborating test facilities, other civilian and military organizations, and commercial manufacturers. There are far too many to mention, but some of the ongoing (non-commercial) collaborators are listed below, roughly in order of their involvement.

Disclaimer

Commercial equipment shown in this document are for illustrative purposes only. This does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the products identified are necessarily the best available for the purpose.

Measurement Units

The International System of Units (a.k.a. SI Units) and U.S. Customary Units (a.k.a. Imperial Units) are used throughout this document. Approximate equivalents in each system of units enable use of readily available materials in different countries. This avoids excessive purchasing and fabrication costs. The differences between the stated unit dimensions are insignificant for comparison of test method results, so each set of units are considered standard for the purposes of these test methods.

Download Associated Files

This file and others are available for download from a website. See the links below that are active in electronic pdf versions. Otherwise go to the website to download the electronic version from the Aerial Test Methods page.

WEBSITE: DOWNLOAD FORMS AND STICKER FILES HERE

WEBSITE: WATCH THE VIDEO VERSION WITH FLY THROUGH ANIMATIONS HERE

Collaborators

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Open Test Lane

Maneuvering (MAN 1-5) and Payload Functionality (PAY 1-5)

Safety | Capabilities | Proficiency

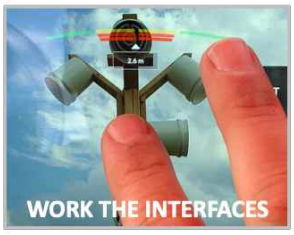
Introduction

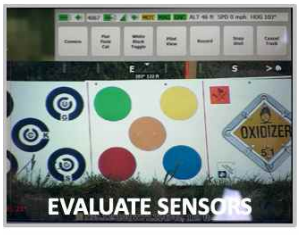
Remotely operated aerial systems enable emergency responders to perform extremely hazardous tasks from safer stand-off distances. The U.S. National Institute of Standards and Technology is leading an international effort to develop standard test methods to help manufacturers, procurement professionals, and users objectively evaluate system capabilities and remote pilot proficiency to align with mission requirements. This improves the safety and effectiveness of emergency responders as they save lives and protect property in our communities

The first step toward credentialing remote pilots is to get everybody onto the same measuring stick. That's where standard test methods can play a key role. These test methods for Basic Maneuvering (MAN 1-5) and Payload Functionality (PAY 1-5) are being replicated across the country and internationally to focus training with quantitative measures of remote pilot proficiency. They are low cost and easy to replicate so everyone can measure their own progress over time and compare their proficiency to regional or national averages on similar systems. Concurrent test lanes can be set up to enable multiple systems and pilots to train or evaluate simultaneously.

They are being standardized through the *ASTM International Standards Committee on Homeland Security Applications; Response Robots (ASTM E54.09)*. They are also referenced as Job Performance Requirements in the *National Fire Protection Association Standard for Small Unmanned Aircraft Systems Used For Public Safety Operations (NFPA 2400)* and the *ASTM Standard Guide for Training for Remote Pilot in Command of Unmanned Aircraft Systems Endorsement (ASTM F38.03).*

These suites of standard test methods provide common measures of capabilities with quantitative results. They can be conducted individually, in sequences, or embedded into operational training scenarios as repeatable tasks with scores to augment qualitative assessments. Organizations using these tests set their own thresholds of acceptable system and pilot performance to align with their airspace, environment, and mission complexities. Those decisions are easier to make and trust when they are based on quantitative performance data captured within standard test methods.





Scope of Systems

These test methods are primarily intended for vertical takeoff and landing systems with an onboard camera and remote pilot display. Some test methods are also applicable to fixed wing systems when the lane dimensions are extended to accommodate the orbit radius of forward flying aircraft.

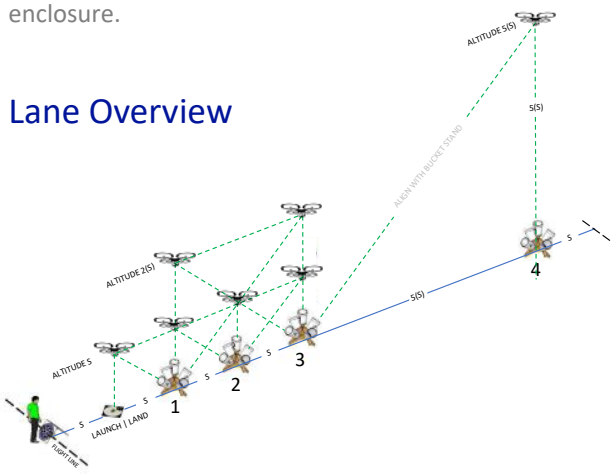
Summary of Tests

These test methods are performed by a remote pilot in direct line of sight of the test lane, or with the pilot's back turned and a visual observer ensuring safe operations. The latter forces reliance on the interface for all situational awareness as required for flying beyond line of sight or indoors.

The aircraft performs the series of maneuvering paths around the apparatuses. Each path includes alignments with one or more cylindrical white buckets to identify recessed targets inside. Successful alignment is achieved when no steering corrections are necessary to verify an unobstructed view of an inscribed ring at the bottom of each bucket. Additional targets inside evaluate camera pointing and zooming capabilities including visual, color, and thermal acuity, hazardous material labels, or other objects of interest.

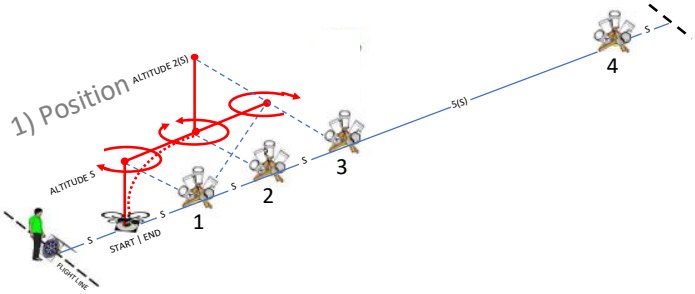
Environmental conditions can be controlled indoors for lighting and wind. Outdoor conditions should be chosen purposefully so not to affect the results. Faults include extreme deviations from the intended flight paths or contact with the apparatus, ground, or safety enclosure.

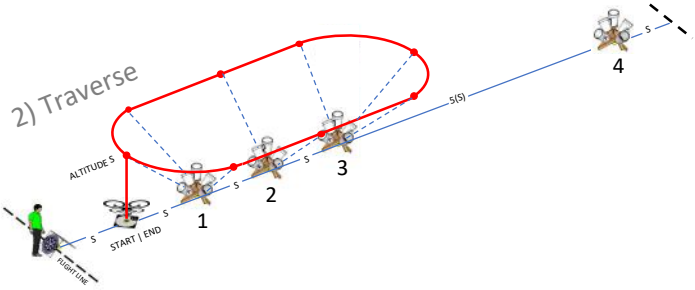
Lane Overview

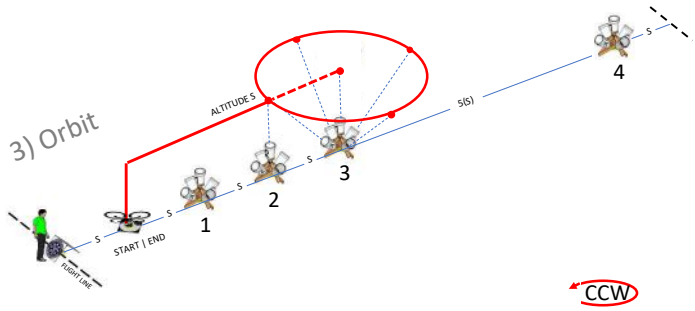


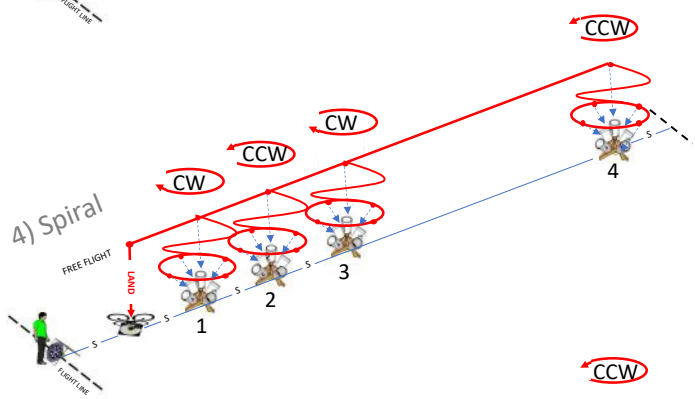
- Pilot flight line and lane marker maintain safety
- Centerline is a long measuring tape
- Spacing (S) equals 10ft, 20ft, 30ft or other
- Overall length 10(S) equals 100ft, 200ft, 300ft or other

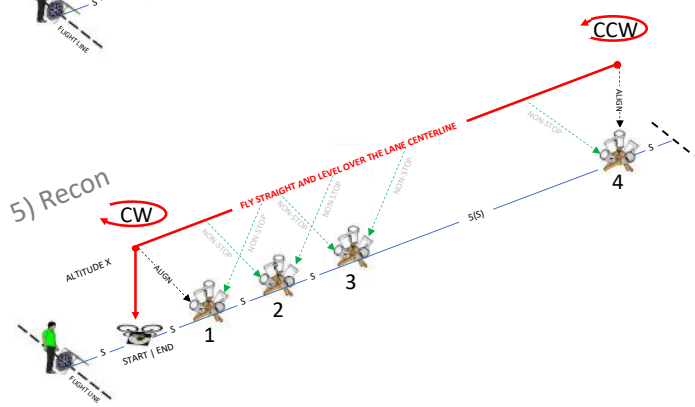
Flight Paths











Conduct Tests Two Ways

Open Test Lane

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS AND LAND ACCURATELY

Align with each bucket long enough to capture a **single alignment image (NO ZOOM)** showing the green ring inside the bucket. Score 5 points for a continuous green ring or 1 point for a partial green ring. Similar scoring for accurate or partial landings.

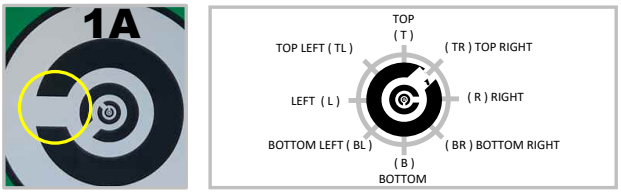
20 ALIGNMENTS TOTAL UP TO 100 POINTS

Payload Functionality (PAY)

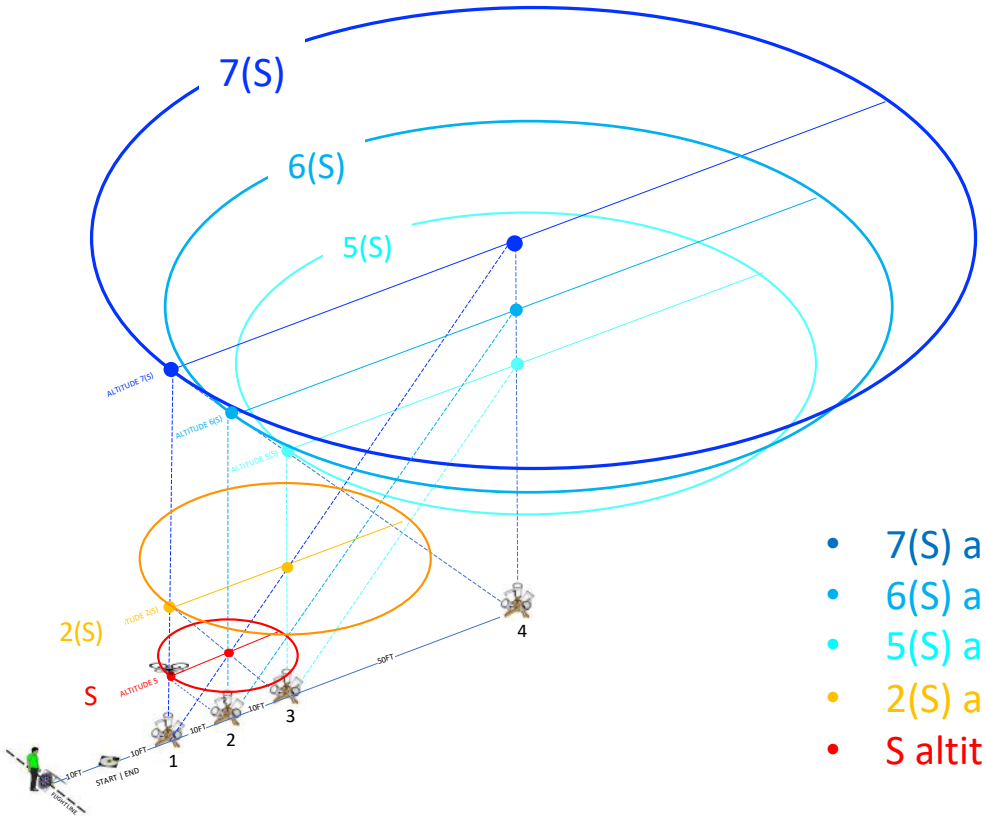
ALIGN AND IDENTIFY ACUITY TARGETS

Align with each bucket long enough to capture a **single alignment image (NO ZOOM)** of each bucket AND a **single acuity image (MAX ZOOM)** of each target. Score 1 point for each correct identification of the 5 increasingly small Concentric C gap directions.

20 TARGETS TOTAL UP TO 100 POINTS

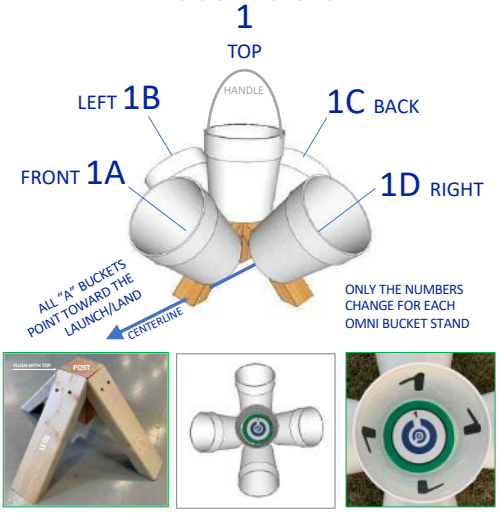


Available Altitudes in Every Scale Lane



- 7(S) altitude
- 6(S) altitude
- 5(S) altitude
- 2(S) altitude
- S altitude

WHITE BUCKETS & GREEN RINGS IN STANDARD TEST LANES



BLACK BUCKETS & COLOR RINGS EMBEDDED INTO SCENARIOS

White buckets are used in the standard test lanes. White or black buckets are used in scenarios. Black buckets hide better in shadows for search tasks. All top buckets are numbered inside so clearly visible from all directions. All angled buckets are lettered A-B-C-D in a leftward (clockwise) direction. This is similar to how firefighters and police designate the sides of houses. The stands need to be level to each other, so the angled buckets at 45 degrees point to locations directly over the nearest bucket stand along the centerline.

Fabrication

Each lane uses (4) omni bucket stands, a Launch/Land Platform, and a measuring tape centerline. The parts required to construct a lane include the following. See the online USAGE GUIDE for fabrication details and pointers:

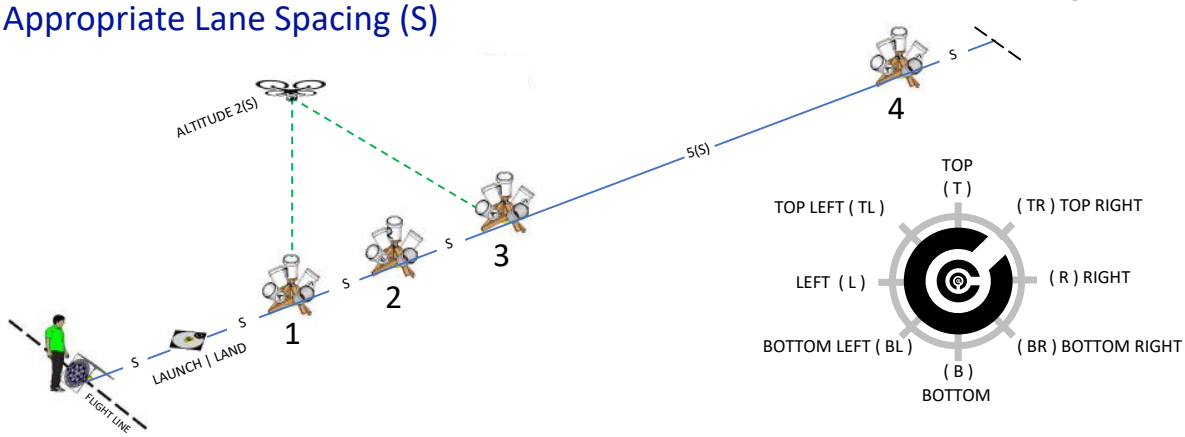
[04] 10x10x15cm (4x4x6in) center post
[16] 5x10x30cm (2x4x12in) legs with 45deg tapers both ends
[50] 7.5cm (3in) screws to affix the legs (2 per leg at top)
[50] 4 cm (1-1/2in) screws to affix the buckets (2 per bucket)
[20] 7.5-l (2-gal) buckets with 20cm (8 in) diameter bottoms
[52] 20cm (8 in) diameter weatherproof polyester stickers. Download and print the stickers from the USAGE GUIDE
[16] Big numbers 1-1-1-1 inside each top bucket
[16] Big letters A-B-C-D around each top bucket
[15] Acuity targets 1A-1B-1C-1D inside bottom of all
[02] Perch acuity targets inside and under 1A only
[03] Launch/Land stickers (center, project logo, NIST logo)

LEAVE THE TOP BUCKET HANDLE TO CARRY THE STAND

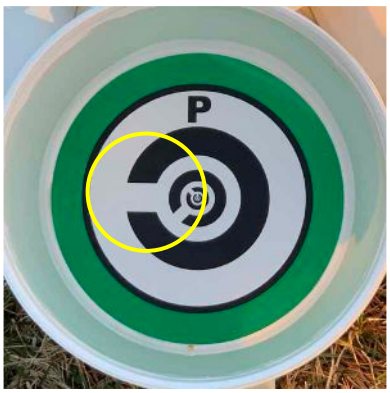
Stand #1 Bucket 1A also has the Perch targets P1 and P2 facing the Launch/Land Platform as shown. The P1 target is inside 1A on the interior top and P2 is on the exterior bottom to represent an underbody object of interest.

Optional Leveling for Uneven Ground:
[01] Post level to orient stand to vertical
[16] Furniture leveling feet with threaded adjustment for
or
[16] VELCRO 2.5x10x30cm (1x4x12in) extensions under the legs to compensate for uneven terrain. Place a block under the stand post to raise all four legs off the ground. Tip it to level and extend all four legs to the ground.
or
[16] Slotted leg extensions with hanger bolts enable sliding adjustment with wing nuts to secure when level.

Choose Appropriate Lane Spacing (S)



An appropriate lane spacing is when a 2(S) hover allows reading at least the outer concentric C target two stands away.



LEFT) Stickers inside each bucket have a GREEN INSCRIBED RING to guide alignment and a visual acuity target with increasingly small Concentric Cs gaps to identify the correct (1 of 8) random orientations. CENTER) This is close enough to be certain of a completely inscribed GREEN ring and the largest visual acuity gap orientation. CENTER) RIGHT) The bucket target should appear to be at least 1/10 of the overall display width or larger.

Circuit Training with Scores

Open Test Lane

BASIC MANEUVERING

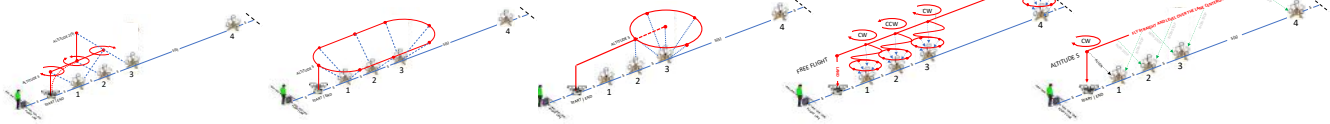
ALIGN WITH BUCKETS

Align with 20 buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside the bucket to determine alignment. The numbers/letters are bucket identifiers.

PAYLOAD FUNCTIONALITY

IDENTIFY ACUITY TARGETS

Align with 20 buckets long enough to capture a single alignment image (NO ZOOM) and a single acuity image (MAX ZOOM) to identify the 5 increasingly small Concentric C gap directions.

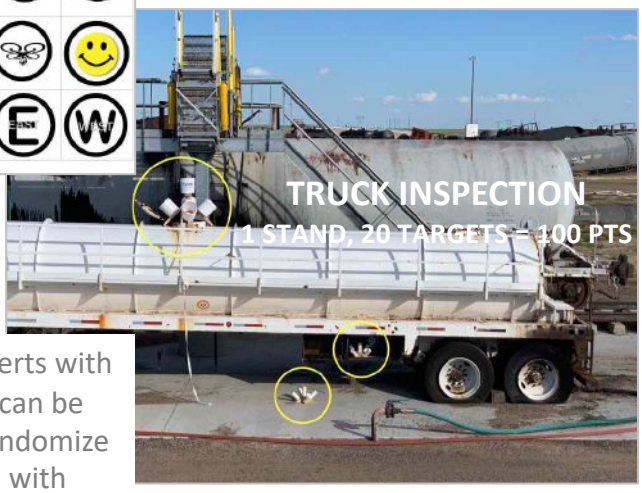


Position	Traverse	Orbit	Spiral	Recon
MAN/PAY 1	MAN/PAY 2	MAN/PAY 3	MAN/PAY 4	MAN/PAY 5
• Hover stably • Basic maneuvers • Landing accuracy • 20 alignments in 1 lap	• Fly sideways along a line • Left and right directions • Landing accuracy • 20 alignments in 2 laps	• Orbit to identify objects • Left and right directions • S and 2(S) altitudes • 20 alignments in 4 laps	• Fly freely to inspect objects • Any proximity (use zooms) • Any altitude • 20 alignments in 1 lap	• Sustain speed over a line • Establish hovers over objects • S altitude, 160(S) distance • 20 alignments in 5 laps
MAN: Align only 5 minutes / 100 points	MAN: Align only 5 minutes / 100 points max	MAN: Align only 5 minutes /100 points	MAN: Align only 5 minutes / 100 points	MAN: Align only 5 minutes / 100 points
PAY: Align and Identify 10 minutes / 100 points	PAY: Align and Identify 10 minutes / 100 points	PAY: Align and Identify 10 minutes / 100 points	PAY: Align and Identify 10 minutes / 100 points	PAY: Align and Identify 10 minutes / 100 points

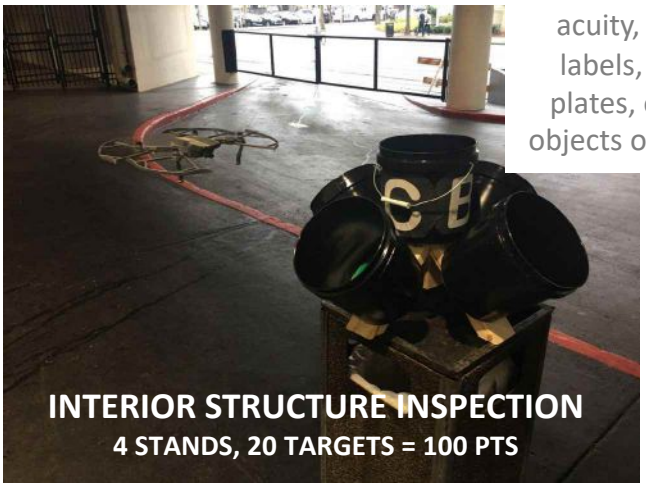
500 PTS

500 PTS

Scenarios with Embedded Scoring



Bucket inserts with stickers can be used to randomize targets with letters, visual acuity, hazmat labels, license plates, or other objects of interest.



Time Limited Trials

Time limited trials are NOT intended to make the tests races. The emphasis should always be on performing each task successfully until the trial is complete. But adding a count-up timer and capturing a statistically significant sample of tasks can enable easy comparison with other pilots or regional averages. You can directly compare scores using similar aircraft on similar tests with similar time limits.

Time limited trials of 5 or 10 minutes each ensures the overall training or evaluation is completed in a deterministic amount of time across multiple tests and scenarios. They can also protect novice pilots from excessive fatigue when they're just not very efficient yet.

The time limits should be ample for an "expert" pilot provided by the manufacturer to complete a trial with a perfect score. They're presumably exhibiting the 100th percentile of proficiency on that system. So the time limits can vary for different systems with different capabilities if necessary.

If a perfect score is completed within the time limit, record the elapsed time as a point of comparison. The average elapsed time of a series of perfect trials can be used to identify the more efficient systems or pilot techniques.

If using a time limit as a Pass/Fail threshold, it should be long enough that a passing pilot can perform at least 10 tasks with a perfect score, which is half a trial. Allowing enough time to complete the entire trial provides more confidence in the resulting system capability or pilot proficiency.

Metrics

Test trials shall produce enough successful repetitions to measure the system capability or remote pilot proficiency with reliability and confidence. There are three performance metrics to consider in order.

1) Completeness (Primary)

If you can't finish a trial without faults, just keep track of how far into the trial sequence you get until you're reliably finishing the trials.

Completion of a statistically significant set of repetitions, twenty or more, is essential to measure the reliability of the task being performed. So a complete trial with twenty task repetitions should be performed to score the trial.

2) Score (Secondary)

For complete trials with 20 task repetitions, the Score is the total of all points earned.

To determine your proficiency, track your scores over time and calculate the average of the most recent five trials. That running average can be compared to others using similar systems in similar test lanes.

Average Score (pts) = (total points in last 5 trials) / 5

3) Efficiency (Tertiary)

If two systems or pilots are consistently completing trials, and their Average Scores are perfect, then the Efficiency can help identify the most effective system or pilot techniques.

The elapsed time of the trials in seconds needs to be tracked as well to calculate the average elapsed time of the last 5 trials.

Average Time (s) = (total seconds of last 5 trials) / 5

The Efficiency, or average rate of successful task completion can then be calculated:

Efficiency (pts/s) = Average Score / Average Time

Trial Forms

The forms are intended to help track and compare performance over time. There are two ways to record the results of a trial:

1) During the trial using the pilot's verbal declarations to a visual observer that also fills in the form.

2) After the trial using images captured at each alignment task. This is how pilots can quickly score their own trials and save documentation to support a credentialing program.

If doing the latter, be aware that images (not video) captured on the aircraft and displayed on secondary monitors may have a BETTER IMAGE QUALITY than that of the pilot using the system interface during the trial. Issues including screen size, glare, distraction, etc. can affect scores. The results should not be compared to one another. There is a check box on the form to identify which approach is being used.

Anybody can watch POV trial video or review the captured images to practice filling in forms.

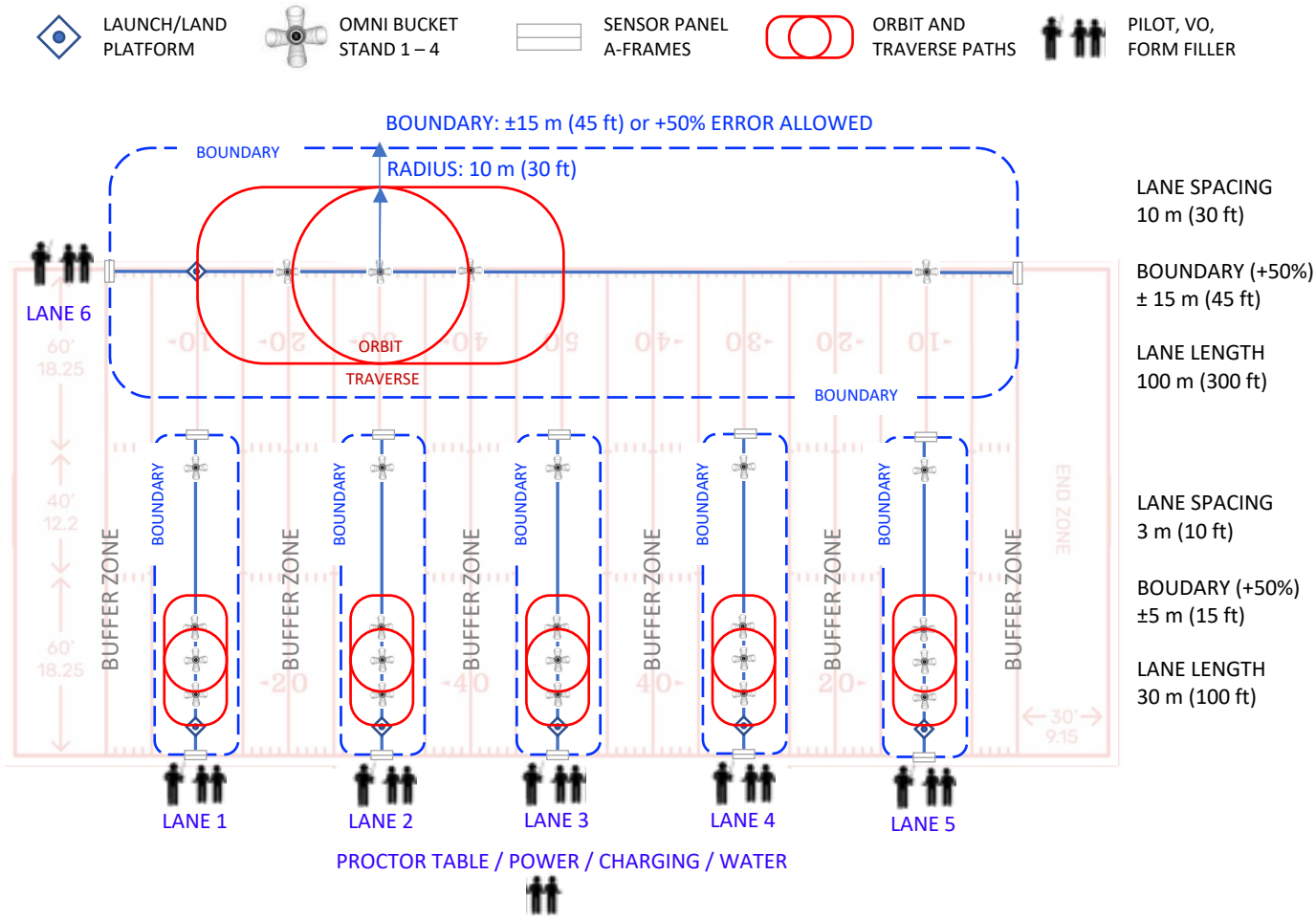
Concurrent Training and Evaluations

FOOTBALL FIELD LAYOUT

A football field is ideal for hosting concurrent training and evaluation exercises. The yard lines enable quick and easy setup using the yard lines as centerlines. They also provide easy to judge boundaries and clear buffers zones between lanes. The number of lanes needed depends on the number of pilots involved. Generally a maximum of 3-4 pilots per lane can be teamed up to help each other conduct their trials and "attest" to each other's scores. The roles at each lane include Pilot, Visual Observer, and Form Filler with an option for an extra Boundary Judge and Battery Retriever. Rotate in 5-minute or 10-minute trials so everybody flies and learns about the test method procedure, forms, and best practices for success.

As shown below, at least five concurrent lanes can be set up with 3 m (10 ft) spacing between bucket stands and 30 m (100 ft) overall lengths. Football fields are about 50 m (160 ft) wide. All lanes start along **one sideline as a clearly defined flightline**. Each lane is then safe to conduct trials independent from the others. Each lane typically needs a big digital clock (preferably synced), a small whiteboard to write the Lane #, Make, Model, Config, and Pilot Code, a table, and 3-4 chairs.

The Admin station should be placed centrially along the sideline, hopefully near power for battery charging. If not, a generator will be needed. A large whiteboard to post scores is also helpful, use Pilot Codes or initials instead of names. One or two Proctors can administer to all the lanes and receive all the data files on memory sticks (labeled by lane and pilot code). Paper forms books can be handed in when all trials are complete.



Concurrent Training and Evaluations

RODEO FORMAT

Pilot groups help each other safely and objectively capture their own scores and "attest" to each other's scores (like golf). They alternate as pilot, visual observer, and forms filler. Groupings should be selected randomly across training sessions and changed for different phases of competitions. Concurrent test lanes and scenarios increase throughput to accommodate more pilots. A plan for 5 groups of 3 pilots is below:

Standard Test Lanes:

- Each lane includes 5 test methods totaling either 100 points for MAN tasks or 500 points for PAY tasks.
- Each test contains 20 visual acuity targets with 5 increasingly small gaps totaling up to 100 points.

Embedded Test Scenarios

- Each scenario includes embedded standard scoring apparatuses and other optionally significant tasks.
- Embedded apparatuses contain 20 visual acuity targets with 5 increasingly small gaps totaling up to 100 points.
- Operationally significant tasks get similar targets to track scoring another 100 points.
- Score up to 200 points total per scenario in 20 minutes.

STANDARD TEST LANES (PRELIMINARIES):
Individual Lanes Conducted Concurrently

Basic Maneuvering (MAN) series of 5 tests.

- **5 min trials** with quick pilot transitions.
- Each lane takes 1 pilot less than 30 minutes to complete.
- Each lane takes 3 pilots 1-1/2 hours to complete.
- 5 lanes increase throughput to 15 pilots in 1-1/2 hours.
- Track scores for each test and totals for all.

Payload Functionality (PAY) series of 5 tests.

- **10 min trials** with quick pilot transitions.
- Each lane takes 1 pilot less than 1 hour to complete.
- Each lane takes 3 pilots 3 hours to complete.
- 5 lanes increase throughput to 15 pilots in 3 hours.
- Track scores for each test and totals for all.

After each round, set a scoring threshold based on performance of all pilots on that day to advance the top half of pilots. Or look for a gap in performance to advance some given the time available. Reset scores to zero between rounds. Pilots fly each subsequent round best score last.

INDIVIDUAL SCENARIOS (SEMI-FINALS):
Conducted Concurrently

- **10 min trials** with quick pilot transitions.
- 5 pilots complete 1-3 scenarios in 1 hour.
- 10 pilots complete 2 scenarios in 2 hours.
- 15 pilots complete 3 scenarios in 3 hours.
- Track scores for each scenario and total for all.

SEQUENCED SCENARIOS (FINALS):
Staggered starts from the same launch point

Perform a sequence of the same scenarios in some prescribed order during a longer duration trial with everybody starting from the same point with staggered start times (everybody needs their own aircraft).

Each pilot spends the same amount of time in each scenario, then moves on to the next scenario when each increment of time expires. Eventually all scenarios are active simultaneously. Total score across all three scenarios wins.

- **20 min trials** across 3 sequential scenarios.
- 10 min start/advance times (00, 10, 20…)
- 5 pilots complete the sequence in 1 hour.
- 10 pilots complete the sequence in 2 hours.
- Track scores for the sequence.

AWARDS:

- Place Awards: 1st, 2nd, 3rd overall score per aircraft system or similar aircraft class.
- Best-in-Class pilots per aircraft class, per test method, or per scenario.

CREDENTIALING:

Proctors need to set up the test lanes and scenarios correctly. Then observe portions of everybody's trials, answer questions, and collect the resulting images and forms. Proctors can also "attest" to the scores after-action based on the time-stamped images captured during trials. The resulting forms and images should be stored centrally in any case. The Proctor can also ensure individual pilot scores are in line with averages from the previous 5 training days captured similarly over time. Graphs of the running averages are very helpful for identifying strengths and weaknesses.

Select Trial Settings for Different Flight Credentials

SET YOUR OWN MINIMUM THRESHOLDS

CREDENTIALS	Daylight/LOS	BVLOS	Night Ops
Standard Lane (Indoor or Outdoor)	Pilot's Eyes On (Available)	Pilot's Back Turned (Interface Only)	Lights Out, Buckets Lit
Embedded Scenario (Indoor or Outdoor)	Pilot's Eyes On (Available)	Pilot's Back Turned (Interface Only)	Lights Out, Buckets Lit

DAYLIGHT / LOS

1) Select test lane and related scenarios based on the intended environment and aircraft capabilities:
   – **Open**
   – **Obstructed**
   – **Indoor**

2) Select test procedure and time limit based on the intended mission:
   – **MAN (5 min. each)**
   – **PAY (10 min. each)**

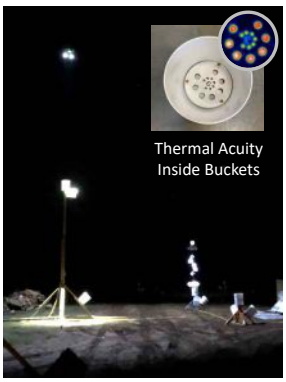
3) Select minimum proficiency based on average and "expert" scores within the same time limit:
   – **Example: 40%, 60%, 80% of "expert"**

ADDITIONAL

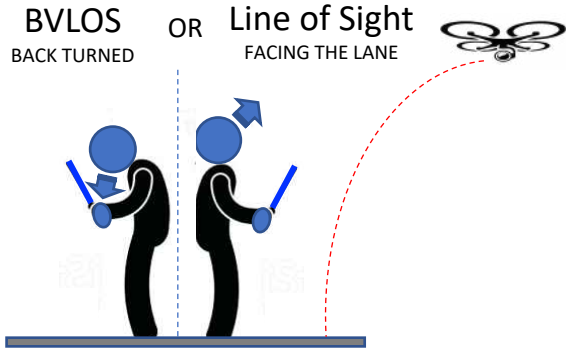
4) Select the pilot view :
   – **Line of Sight or BVLOS (back turned)**

5) Select lighting (indoor or outdoor) for daylight or night credentials:
   – **Lighted/Daylight or Dark**

ILLUMINATED BUCKETS OR PROVIDE POSITIONING AIDS LIKE A WINDOWS IN A HOUSE OR STREET LIGHTS.



OR ILLUMINATE GROUND TARGETS FROM THE AIRCRAFT.

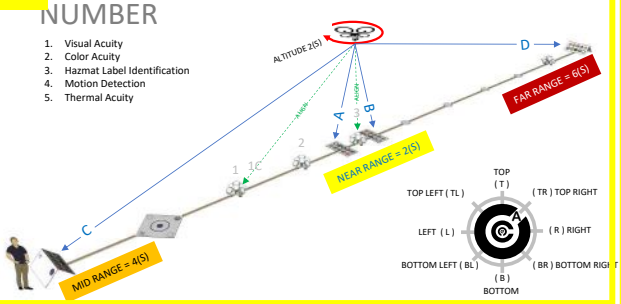


FLYING WITH THE PILOT'S BACK TURNED TO THE LANE FORCES RELIANCE ON THE INTERFACE FOR ALL SITUATIONAL AWARENESS. THIS OPTION REQUIRES A VISUAL OBSERVER.

A TEST NAME

NUMBER

1. Visual Acuity
2. Color Acuity
3. Hazmat Label Identification
4. Motion Detection
5. Thermal Acuity



B

C

Make: _____

Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

D

LANE SPACING S

~~10~~ FT 20 FT 30 FT

_____ FT

(CIRCLE ONE OR FILL IN)

E

LIGHTING

LIGHT	LIGHTED	DARK
1000+ LUX	300+ LUX	< 1 LUX

(CIRCLE ONE)

F

WIND

RAGE GUSTS

_____ MPH _____ MPH

(FILL IN)

G

PILOT VIEW

S ON AVAILABLE

BVLOS INTERFACE ONLY WITH BACK TOWARD LANE AND V.O.

(CIRCLE ONE)

H

IME LIMIT

~~5~~ MIN 10 MIN _____ MIN

I

ROCEDURE | **POSITION**

J

K

	CAPTURE IMAGE OF CLOCK – LAUNCH FROM PLATFORM	CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1	**HOVER AT ALTITUDE (S) OVER STAND 1**	1	T	BL	TR	BR	TL
2	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	2A	L	R	TR	BL	L
3	**ROTATE LEFTWARD 360°**	1	T	BL	TR	BR	TL
4	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	2A	L	R	TR	BL	L
5	**ROTATE RIGHTWARD 360°**	1	T	BL	TR	BR	TL
6	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	2A	L	R	TR	BL	L
7	**CLIMB TO ALTITUDE 2(S)**	1	T	BL	TR	BR	TL
8	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	3A	B	L	T	BL	TL
9	**DESCEND TO ALTITUDE (S)**	1	T	BL	TR	BR	TL
10	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	2A	L	R	TR	BL	L
11	**FORWARD OVER STAND 2**	2	R	L	B	R	T
12	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	3A	B	L	B	L	BR
13	**BACKWARD OVER STAND 1**	1	T	BL	TR	BR	TL
14	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	2A	L	R	TR	BL	L
15	**FORWARD OVER STAND 2 AND ROTATE RIGHT 180°**	2	R	R	T	L	B
16	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	1C	T	BL	T	TR	R
17	**FORWARD OVER LANDING AND ROTATE LEFT 180°**	LANDING	T	R	B	R	BR
18	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	1A	B	TL	TR	BL	BR
19	**LAND CENTERED FACING STANDS** (WORTH 2 POINTS)	CENTERED | PERCH 1	B	TL	TR	BL	BR
20	IMAGE FORWARD PERCH TARGETS P1/P2 IN ORDER	CENTERED | PERCH 2	L	R	TR	BL	L

LAND CENTERED FACING DOWN RANGE – CAPTURE IMAGE OF CLOCK -- END OF TRIAL

IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: APPARATUS GROUND BOUNDARY SAFETY

L

SOURCE

PILOT (CIRCLE ONE) IMAGES

M

EUVERING SCORE

TOTAL ALIGNED

of 20

RELIABILITY

(TOTAL ALIGNED / ATTEMPTED) X 100

%

EFFICIENCY

TOTAL ALIGNED / MINUTES

RATE

N

PAYLOAD SCORE

TOTAL GAPS

of 100

AVERAGE ACUITY

TOTAL GAPS / TOTAL ALIGNED

RINGS

EFFICIENCY

TOTAL GAPS / MINUTES

RATE

O

Form Fill-In Guidance

SCORE DURING FLIGHT OR AFTER TRIAL USING CAPTURED IMAGES

A) Test Name: Select the test form as indicated by the test name, ASTM International standard or work item number, and graphic lane overview. Use the written procedure and a timer to practice informal trials by simply counting the number of buckets successfully completed within the time limit. When several timed practice trials result in similar scores, conduct a formal trial and record the score by completing the entire form with a visual observer to "attest" and sign the back.

B) Markings: Ensure the pilot and others understand what a successful bucket alignment looks like in a captured image. The green ring should look continuous with its inner black edge unbroken. Successful alignments and correct gap orientations get circled. Missed alignments and incorrect gap orientations get slashed through. The circles can be summed quickly after the trial to calculate the score. Slashes may be cause for a failed trial depending on the minimum threshold set by your local organization.

C) Trial Info: Fill in all the key information about the aircraft system being used so that similar systems can be identified for comparison purposes. These include the make, model, configuration (payload, zoom, interface, etc.), personnel, and facility, date, time, and lane number if using concurrent lanes.

D) Lane Spacing: Circle one of the typical LANE SPACING dimensions used or write in your own. Scores should only be compared in similar size lanes. If in a scenario, use this box to identify the name or location of the scenario to differentiate it from similar scenarios.

E) Lighting: Circle one of three lighting conditions used during the trial. Scores should only be compared in similar lighting conditions. DAYLIGHT is considered any outdoor daytime environment. LIGHTED is considered indoor office lighting. DARK is considered outdoor or indoor conditions that are just barely comfortable to walk around without a light.

F) Wind: Fill in the average wind and maximum gusts recorded during the trial. Scores should only be compared in similar wind conditions. The similarity can be rather course, such as within 10 mph lanes. Indoor basketball courts, hockey arenas, or tennis bubbles provide shelter from the environment and are generally available nationwide.

G) Pilot View: Circle EYES ON when the pilot is facing the lane with a direct view of the aircraft, even if assisted by a Visual Observer and conducting the trial mostly through the interface. Circle BVLOS when the pilot has their back toward the lane without a direct view of the aircraft. This shall always be done with assistance from a Visual Observer and can represent situations where the aircraft flies behind a building or treeline for extended periods with a Visual Observer placed down range in constant contact with the pilot.

H) Time Limit: Circle the trial time limit being used as either 5 minutes, 10 minutes, or other. Scores should only be compared in trials with similar time limits. If an organization uses the time limit as a threshold for pass/fail, the entire trial should be completed within that time limit and the actual elapsed time (less than the available time limit) does not need to be calculated.

I) Procedure: Follow the test method procedure as shown. Each line is a command communication that can be translated into different languages. If the V.O. is announcing each step, nothing more should need to be said.

J) Bucket Alignments: Circle the green bucket identifiers when successfully aligned. Slash through them when missed. These can be scored either by a Visual Observer or after the trial using the captured images of each bucket and target.

K) Gap Directions: Circle the blue bucket identifiers when Concentric C gap directions are correct. Slash through them when incorrect. These can be scored either by a Visual Observer or after the trial using the captured images of each bucket and target.

L) Pilot or Images: Circle one depending on the scoring source, either live via the interface or after the trial using captured images.

M) Maneuvering Score: Fill in the totals and calculate the results as described.

N) Payload Score: Fill in the totals and calculate the results as described.

O) Fault Conditions: Circle one if applicable as cause for an end of trial due to safety concerns.

Point and Zoom Cameras

SENSING 1-5

Purpose:

This test method evaluates camera pointing and zooming capabilities using sensor target panels at various distances from a designated position and altitude. It can be used to evaluate system capabilities and ensure the chosen lane Spacing (S) is appropriate for the onboard sensor systems. It can also be used as a repeatable training task for the system interface and evaluation of remote pilot proficiency.

Summary of Test:

The pilot operates within line of sight of the lane and aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety. The aircraft maintains a designated position and altitude while identifying sensor target panels at different distances below and around the aircraft. Each sensor target panel displays a row of five Concentric C visual acuity targets and color acuity rings. There are also five operationally significant tasks for motion detection (rotating), hazardous material label identification, partial license plates or gauges to read, thermal acuity targets, or others.

The lane Spacing (S) is scalable so the panels can be set to distances that exceed the aircraft capabilities. Panels A and B are directly below the aircraft at 2(S) distance, so even systems without zoom capabilities have access to 50% of the points available in the chosen lane spacing. Panel C is up-range at 4(S) distance. Panel D is down-range at 6(S) distance. The aircraft rotates 180 degrees between each sensor panel identification to ensure each repetition involves the same camera pointing and zooming tasks.

There is a *Quick* procedure and a *Comprehensive* procedure. Both score up to 100 points if all concentric Cs can be correctly identified. The metrics include *Completeness* of the trial, *Points* for overall acuity, *Reliability* as the percent of successful tasks performed, and *Efficiency* as the rate of successful tasks performed. Results should not be compared across different lane Spacings (S).

1. Visual Acuity
2. Color Acuity
3. Hazmat Label Identification
4. Motion Detection
5. Thermal Acuity

*If your training aircraft camera has a limited range of motion, align with as many targets as possible. Pilot proficiency should only be compared using similar systems.

Point and Zoom Cameras

SENSING 1-5

Procedure

- Start in a stable hover over Stand 3 at altitude 2(S).
- Align with Buckets 3 and 1C to verify position and altitude.
- Capture images of all target identifications using either procedure below:

- ***Quick: 4 different objects (panels) around the aircraft, each with 5 features to identify (acuity targets).***
  This is a quick test that all systems and pilots should perform no matter the zoom capabilities of the aircraft. It can be used to ensure the aircraft is in an appropriate lane Spacing (S).
  1. Identify ALL TARGETS on **Panel A** then **rotate 180°** to identify ALL TARGETS on **Panel B** and so on.
  2. Target sequence: **A1** – **A2** – **A3** – **A4** – **A5** (ROTATE) **B1** – **B2** – **B3** – **B4** – **B5** (ROTATE) **C1** – **C2**…
  3. Continue through panels **A, B, C, D** in sequence with **180° rotations between panels** until all 20 targets have been completed or the trial time expires.

- ***Comprehensive: 20 different objects to identify (acuity targets) around the aircraft.***
  This is a comprehensive test is used to fully evaluate either system capabilities or remote pilot proficiency. It is typically conducted without a set time limit.
  1. Identify a SINGLE TARGET on **Panel A** then **rotate 180°** to identify a SINGLE TARGET on **Panel B**, and so on alternating rotations and target identifications.
  2. Target sequence: **A1** (ROTATE) **B1** (ROTATE) **C1** (ROTATE) **D1** (ROTATE) **A2** (ROTATE) **B2** (ROTATE)…
  3. Continue through panels **A, B, C, D** in a repeating sequence with 180° rotations between each target until all 20 targets have been identified or the trial time expires.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Form Fill-In:

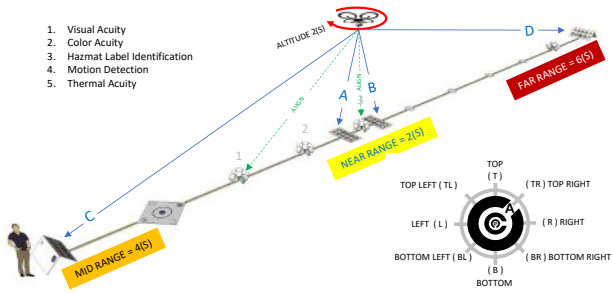
- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

Point/Zoom Cameras

SEN 1-5

1. Visual Acuity
2. Color Acuity
3. Hazmat Label Identification
4. Motion Detection
5. Thermal Acuity

ALTITUDE 2(S)



Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LANE SPACING S

10 FT 20 FT 30 FT

_____ FT

(CIRCLE ONE OR FILL IN)

LIGHTING

DAYLIGHT	LIGHTED	DARK
1000+ LUX	300+ LUX	< 1 LUX

(CIRCLE ONE)

WIND

AVERAGE _____ MPH GUSTS _____ MPH

(FILL IN)

PILOT VIEW

EYES ON FACING LANE WITH INTERFACE AVAILABLE

BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.

(CIRCLE ONE)

TIME LIMIT

5 MIN 10 MIN _____ MIN

(CIRCLE ONE OR FILL IN)

PROCEDURE | POINT AND ZOOM CAMERAS		FORMS ANSWER KEY VERSION 2020B					SOURCE: PILOT				
START THE TIMER -- LAUNCH FROM PLATFORM	TARGET ID	CIRCLE THE RING GAP DIRECTION WHEN CORRECT. DON'T GUESS! IF INCORRECT, STRIKE THE ENTIRE LINE!					COLOR ACUITY	MOTION DETECTION	HAZMAT LABELS	LICENSE PLATES	MISC OBJECTS	THERMAL DIRECTION
1 HOVER OVER STAND #3 AT 2(S) VIEWING UP RANGE	A1	T	BL	R	BR	L		A				
2 ALIGN WITH BUCKETS #3 & 1C	A2	TR	B	TR	L	BR						
3 READ NEAR RANGE PANEL "A"	A3	R	TL	T	BL	B		NONE				DRAW IT
4 TOP ACUITY ROW FIRST, LEFT TO RIGHT	A4	BR	R	TL	L	BR		C-W				
5 BOTTOM OBJECT ROW, LEFT TO RIGHT	A5	B	TL	R	BL	T		C-C-W				
6 ROTATE 180° VIEWING DOWN RANGE	B1	BL	T	BR	R	TL		B				
7 MAINTAIN HOVER POSITION	B2	L	BR	T	TL	R						
8 READ NEAR RANGE PANEL "B"	B3	TL	R	TL	L	BR		NONE				DRAW IT
9 TOP ACUITY ROW FIRST, LEFT TO RIGHT	B4	T	BL	R	TL	B		C-W				
10 BOTTOM OBJECT ROW, LEFT TO RIGHT	B5	TR	B	TL	B	BL		C-C-W				
11 ROTATE 180° VIEWING UP RANGE	C1	R	TL	B	BL	R		C				
12 ALIGN WITH BUCKETS #3 & 1C	C2	BR	T	TL	R	BL						
13 READ MID RANGE PANEL "C"	C3	B	TR	R	BL	T		NONE				DRAW IT
14 TOP ACUITY ROW FIRST, LEFT TO RIGHT	C4	BL	R	BL	T	BR		C-W				
15 BOTTOM OBJECT ROW, LEFT TO RIGHT	C5	L	TL	R	BR	T		C-C-W				
16 ROTATE 180° VIEWING DOWN RANGE	D1	TL	B	TR	R	BR		D				
17 MAINTAIN HOVER POSITION	D2	T	BL	B	TR	L						
18 READ FAR RANGE PANEL "D"	D3	TR	L	BL	R	TL		NONE				DRAW IT
19 TOP ACUITY ROW FIRST, LEFT TO RIGHT	D4	R	BL	T	TR	B		C-W				
20 BOTTOM OBJECT ROW, LEFT TO RIGHT	D5	BR	B	TL	B	TR		C-C-W				
LAND ON PLATFORM -- STOP THE TIMER -- END OF TRIAL	TARGET ID	CORRECT RINGS FOR THE GIVEN LANE SPACING. RESULTS ARE NOT COMPARABLE WITH OTHER LANE SPACINGS.					CORRECT COLORS	CORRECT MOTIONS	CORRECT HAZMATS	CORRECT LICENSES	CORRECT OBJECTS	CORRECT THERMALS
		TOAL CORRECT RINGS: /100					/20	/4	/4	/4	/4	/4

Point and Zoom Cameras

SENSING 1-5

Target#	Trial Notes

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

PILOT NAME	ORGANIZATION	SIGNATURE
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
OTHER NAME	ORGANIZATION	SIGNATURE
PROCTOR NAME	ORGANIZATION	SIGNATURE

Open Lane: Position

MAN/PAY 1

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

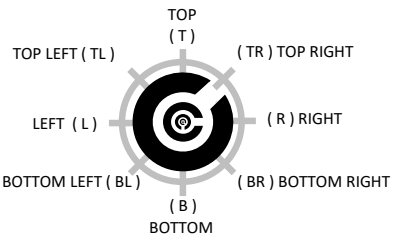
1 point per successfully aligned image
SCORE UP TO 20 POINTS

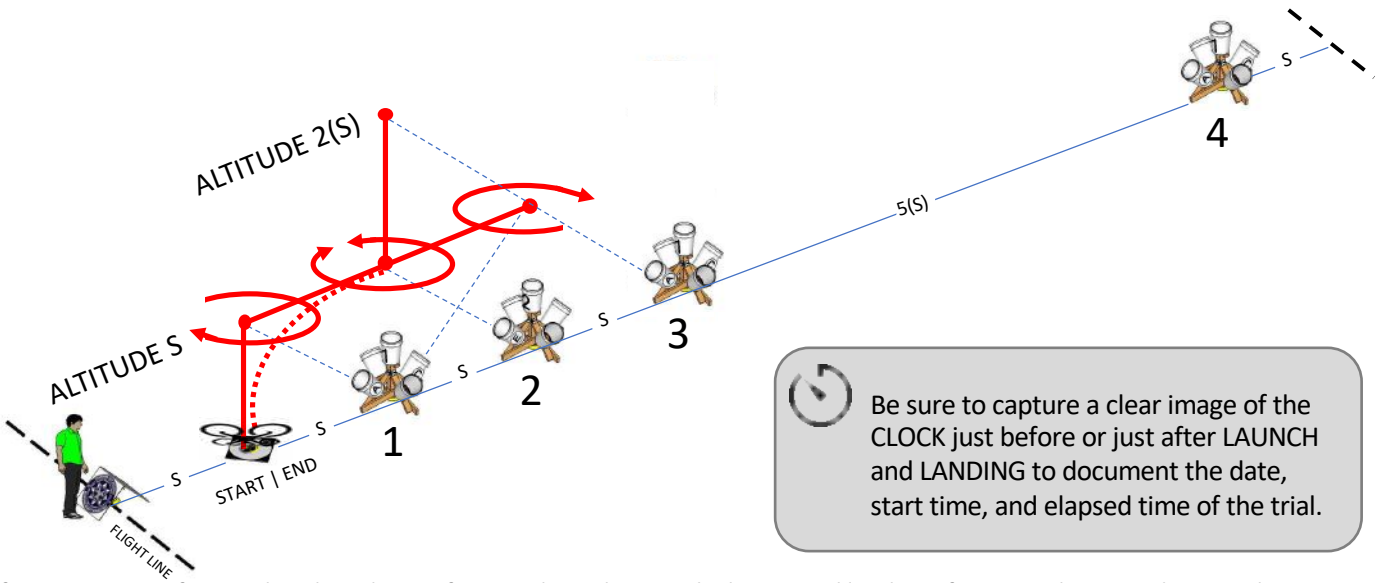
Payload Functionality (PAY)

ALIGN AND IDENTIFY TARGETS

Align with the 20 designated buckets long enough to capture a single image (FULL ZOOM) showing a continuous green ring AND the increasingly small Concentric C gap directions up to 5 deep.

1 point per correct gap shown in the image
SCORE UP TO 100 POINTS





Be sure to capture a clear image of the CLOCK just before or just after LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Open Lane: Position

MAN/PAY 1

Purpose

This test method evaluates positive aircraft control using basic flight maneuvers between designated hover positions, orientations, and altitudes. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft performs a series of basic flight maneuvers to designated positions and orientations along a lane centerline with variable Spacing (S) between omni bucket stands. The aircraft simultaneously aligns with two buckets in each position, orientation and altitude. For each alignment it pauses long enough to capture a single NO ZOOM image showing the inscribed green ring. An additional FULL ZOOM image can also be captured to identify the visual acuity target inside. The aircraft then lands centered on the platform facing the stands with the chassis or ground contact within the 30cm (12in) radius circle. A complete trial includes 1 lap through all the designated positions, orientations, and altitudes and an accurate landing.

The Maneuvering variant of the test requires 20 NO ZOOM alignment images worth 1 point each if successful including the landing, totaling 20 points maximum for a complete trial.

The Payload Functionality variant of the test requires the same 20 NO ZOOM alignment images plus 20 FULL ZOOM images to identify the associated visual acuity targets. The acuity targets have 5 increasingly small Concentric C gaps directions to identify worth up to 5 points per target totaling 100 points maximum for a complete trial.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Reporting:

Fill in the form for complete trials using **22 Maneuvering images** captured (1 pre-launch clock + 20 alignments + 1 post-land clock), or **42 Payload Functionality images** captured (1 pre-launch clock + 20 alignments and 20 targets + 1 post-land clock).

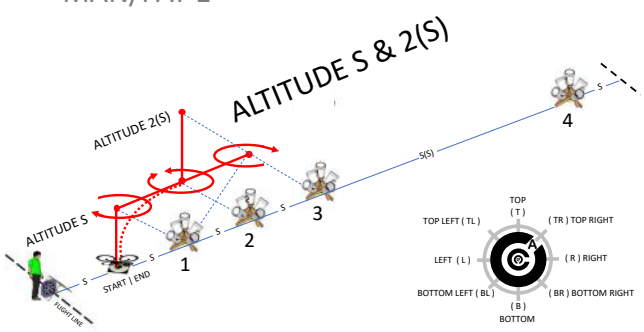
Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible.
Pilot proficiency should only be compared using similar systems.

Open Lane: Position

MAN/PAY 1



Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LANE SPACING S	LIGHTING	WIND	PILOT VIEW	TIME LIMIT
10 FT 20 FT 30 FT _____ FT (CIRCLE ONE OR FILL IN)	DAYLIGHT 1000+ LUX LIGHTED 300+ LUX DARK < 1 LUX (CIRCLE ONE)	AVERAGE _____ MPH GUSTS _____ MPH	EYES ON FACING LANE SOME INTERFACE OPTIONAL V.O. BVLOS BACK TO LANE INTERFACE ONLY WITH V.O. (CIRCLE ONE)	5 MIN 10 MIN _____ MIN (CIRCLE ONE OR FILL IN)

PROCEDURE | POSITION		FORMS ANSWER KEY VERSION 2020B					
CAPTURE IMAGE OF CLOCK – LAUNCH FROM PLATFORM		CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1	**HOVER AT ALTITUDE (S) OVER STAND 1**	1	T	BL	R	BR	L
2	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	2A	L	BR	T	TL	R
3	**YAW LEFT 360°**	1	T	BL	R	BR	L
4	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	2A	L	BR	T	TL	R
5	**YAW RIGHT 360°**	1	T	BL	R	BR	L
6	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	2A	L	BR	T	TL	R
7	**CLIMB TO ALTITUDE 2(S)**	1	T	BL	R	BR	L
8	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	3A	BR	T	TL	R	BL
9	**DESCEND TO ALTITUDE (S)**	1	T	BL	R	BR	L
10	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	2A	L	BR	T	TL	R
11	**FORWARD OVER STAND 2**	2	BL	T	BR	R	TL
12	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	3A	BR	T	TL	R	BL
13	**BACKWARD OVER STAND 1**	1	T	BL	R	BR	L
14	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	2A	L	BR	T	TL	R
15	**FORWARD OVER STAND 2 AND YAW RIGHT 180°**	UPSIDE 2 DOWN	TR	B	TL	L	BR
16	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	1C	BR	R	TL	L	BR
17	**FORWARD OVER LANDING AND YAW LEFT 180°**	L	B	TR	L	BL	T
18	ALIGN/IMAGE DOWNWARD THEN FORWARD IN ORDER	1A	TR	B	TR	L	BR
19	**LAND CENTERED FACING STANDS** (WORTH 2 POINTS)	CENTERED | PERCH 1	BL	R	TL	L	BL
20	IMAGE FORWARD PERCH TARGETS P1/P2 IN ORDER	CENTERED | PERCH 2	L	BR	T	TL	B
LAND CENTERED FACING DOWN RANGE – CAPTURE IMAGE OF CLOCK -- END OF TRIAL							
IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON:			APPARATUS	GROUND	BOUNDARY	SAFETY	

UNDERLINE MEANS YOU'RE READING THE TARGET UPSIDE DOWN

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINUMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

Open Lane: Position

MAN/PAY 1

Bucket #	Trial Notes
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

_____	_____	_____
PILOT NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
OTHER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
PROCTOR NAME	ORGANIZATION	SIGNATURE

Open Lane: Traverse

MAN/PAY 2

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

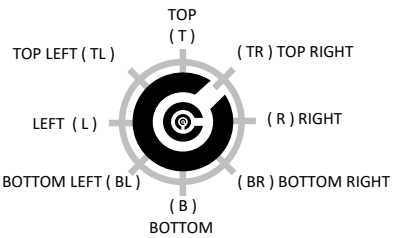
1 point per successfully aligned image
SCORE UP TO 20 POINTS

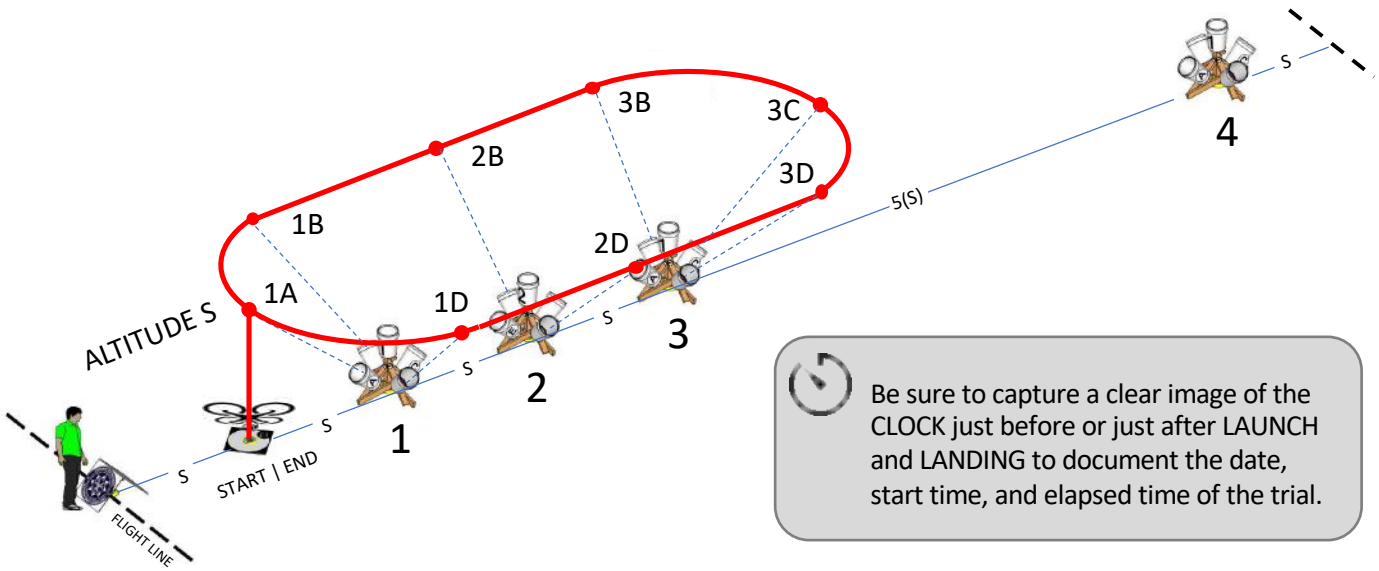
Payload Functionality (PAY)

ALIGN AND IDENTIFY TARGETS

Align with the 20 designated buckets long enough to capture a single image (FULL ZOOM) showing a continuous green ring AND the increasingly small Concentric C gap directions up to 5 deep.

1 point per correct gap shown in the image
SCORE UP TO 100 POINTS





Be sure to capture a clear image of the CLOCK just before or just after LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Open Lane: Traverse

MAN/PAY 2

Purpose

This test method evaluates sideways maneuvers along a designated flight path parallel to a line and around objects at a designated standoff distance and altitude. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft maneuvers sideways leftward and rightward along the designated flight path parallel to a lane centerline with variable Spacing (S) between omni bucket stands. The aircraft aligns with each outward-facing bucket along the flight path. For each alignment it pauses long enough to capture a single NO ZOOM image showing the inscribed green ring. An additional FULL ZOOM image can also be captured to identify the visual acuity target inside. The aircraft then lands centered on the platform facing the stands with the chassis or ground contact within the 30cm (12in) radius circle. A complete trial includes 2 laps around the first 3 omni bucket stands each with accurate landings.

The Maneuvering variant of the test requires 20 NO ZOOM alignment images worth 1 point each if successful including the landing, totaling 20 points maximum for a complete trial.

The Payload Functionality variant of the test requires the same 20 NO ZOOM alignment images plus 20 FULL ZOOM images to identify the associated visual acuity targets. The acuity targets have 5 increasingly small Concentric C gaps directions to identify worth up to 5 points per target totaling 100 points maximum for a complete trial.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Reporting:

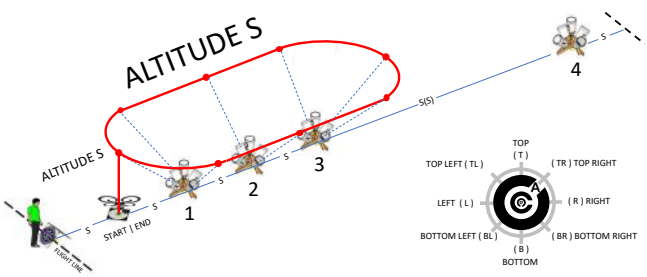
Fill in the form for complete trials using **22 Maneuvering images** captured (1 pre-launch clock + 20 alignments + 1 post-land clock), or **42 Payload Functionality images** captured (1 pre-launch clock + 20 alignments and 20 targets + 1 post-land clock).

Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

Open Lane: Traverse

MAN/PAY 2



Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LANE SPACING S	LIGHTING	WIND	PILOT VIEW	TIME LIMIT
10 FT 20 FT 30 FT _____ FT (CIRCLE ONE OR FILL IN)	DAYLIGHT 1000+ LUX LIGHTED 300+ LUX DARK < 1 LUX (CIRCLE ONE)	AVERAGE _____ MPH GUSTS _____ MPH	EYES ON FACING LANE SOME INTERFACE OPTIONAL V.O. BVLOS BACK TO LANE INTERFACE ONLY WITH V.O. (CIRCLE ONE)	5 MIN 10 MIN _____ MIN (CIRCLE ONE OR FILL IN)

OPEN LANE | TRAVERSE		FORMS ANSWER KEY VERSION 2020B				
CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LAUNCH		CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT			
1	HOVER AT ALTITUDE S OVER THE LAUNCH PLATFORM	1A	TR	B	TR	L	BR
2	TRAVERSE LEFTWARD (CLOCKWISE)	1B	R	TL	T	BL	B
3		2B	TL	R	TR	L	BR
4		3B	B	TR	R	BL	T
5		3C	BL	R	BL	T	BR
6		3D	L	TL	R	BR	T
7		2D	TR	B	TL	B	BL
8		1D	B	TL	R	BL	T
9		1A	TR	B	TR	L	BR
10	LAND CENTERED FACING STANDS	CENTERED | PERCH 1	BL	R	TL	L	BL
REVERSE DIRECTION							
11	HOVER AT ALTITUDE S OVER THE LAUNCH PLATFORM	1A	TR	B	TR	L	BR
12	TRAVERSE RIGHTWARD (COUNTER CLOCKWISE)	1D	B	TL	R	BL	T
13		2D	TR	B	TL	B	BL
14		3D	L	TL	R	BR	T
15		3C	BL	R	BL	T	BR
16		3B	B	TR	R	BL	T
17		2B	TL	R	TR	L	BR
18		1B	R	TL	T	BL	B
19		1A	TR	B	TR	L	BR
20	LAND CENTERED FACING STANDS	CENTERED | PERCH 2	L	BR	T	TL	B
CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LANDING CENTERED FACING STANDS							
IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON:			APPARATUS	GROUND	BOUNDARY	SAFETY	

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINIMUM SCORE
(CIRCLE ONE)

FAIL ____ PASS

Open Lane: Traverse

MAN/PAY 2

Bucket #	Trial Notes
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

_____	_____	_____
PILOT NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
OTHER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
PROCTOR NAME	ORGANIZATION	SIGNATURE

Open Lane: Orbit

MAN/PAY 3

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

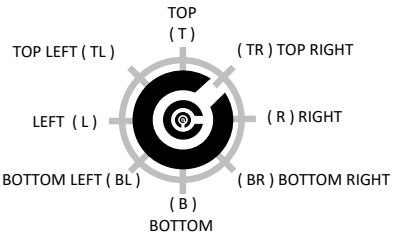
1 point per successfully aligned image
SCORE UP TO 20 POINTS

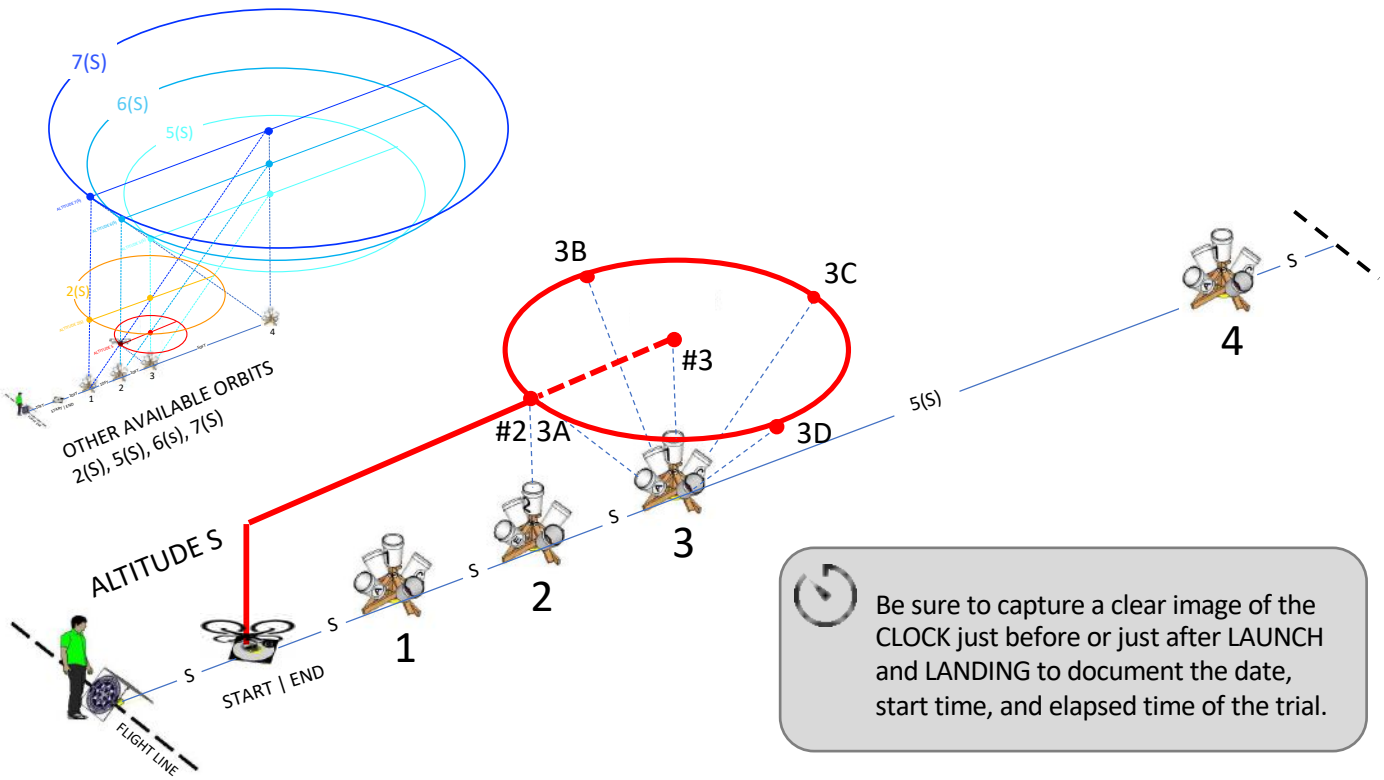
Payload Functionality (PAY)

ALIGN AND IDENTIFY TARGETS

Align with the 20 designated buckets long enough to capture a single image (FULL ZOOM) showing a continuous green ring AND the increasingly small Concentric C gap directions up to 5 deep.

1 point per correct gap shown in the image
SCORE UP TO 100 POINTS





Be sure to capture a clear image of the CLOCK just before or just after LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Open Lane: Orbit

MAN/PAY 3

Purpose

This test method evaluates orbiting maneuvers to identify objects of interest from a designated radius and altitude. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft orbits an object of interest leftward and rightward at a designated radius and altitude in a test lane with variable Spacing (S) between omni bucket stands. The aircraft aligns with a vertical bucket one stands away from the orbit center to set an equal radius S and altitude S, then aligns with the four outward-facing buckets at the orbit center. For each alignment it pauses long enough to capture a single NO ZOOM image showing the inscribed green ring. An additional FULL ZOOM image can also be captured to identify the visual acuity target inside. The aircraft then lands centered on the platform facing the stands with the chassis or ground contact within the 30cm (12in) radius circle. A complete trial includes 4 orbits (2 leftward then 2 rightward).

The Maneuvering variant of the test requires 20 NO ZOOM alignment images worth 1 point each if successful, totaling 20 points maximum for a complete trial.

The Payload Functionality variant of the test requires the same 20 NO ZOOM alignment images plus 20 FULL ZOOM images to identify the associated visual acuity targets. The acuity targets have 5 increasingly small Concentric C gaps directions to identify worth up to 5 points per target totaling 100 points maximum for a complete trial.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Reporting:

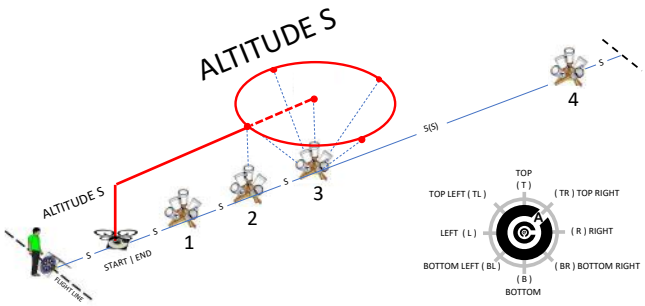
Fill in the form for complete trials using **22 Maneuvering images** captured (1 pre-launch clock + 20 alignments + 1 post-land clock), or **42 Payload Functionality images** captured (1 pre-launch clock + 20 alignments and 20 targets + 1 post-land clock).

Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

Open Lane: Orbit

MAN/PAY 3



Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LANE SPACING S	LIGHTING	WIND	PILOT VIEW	TIME LIMIT
10 FT 20 FT 30 FT _____ FT (CIRCLE ONE OR FILL IN)	DAYLIGHT 1000+ LUX LIGHTED 300+ LUX DARK < 1 LUX (CIRCLE ONE)	AVERAGE _____ MPH GUSTS _____ MPH	EYES ON FACING LANE SOME INTERFACE OPTIONAL V.O. BVLOS BACK TO LANE INTERFACE ONLY WITH V.O. (CIRCLE ONE)	5 MIN 10 MIN ____ MIN (CIRCLE ONE OR FILL IN)

PROCEDURE | ORBIT	FORMS ANSWER KEY VERSION 2020B					
CAPTURE IMAGE OF CLOCK – LAUNCH FROM PLATFORM	CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1 ALIGN OVER STAND 2 AT ATITIDE S TO CHECK RADIUS	2	BL	T	BR	R	TL
2 ALIGN WITH BUCKET 3A TO CHECK ALTITUDE S	3A	BR	T	TL	R	BL
3 ORBIT LEFTWARD (CW)	3B	B	TR	R	BL	T
4 ORBIT LEFTWARD (CW)	3C	BL	R	BL	T	BR
5 ORBIT LEFTWARD (CW)	3D	L	TL	R	BR	T
6 ALIGN OVER STAND 2 AT ATITIDE S TO CHECK RADIUS	2	BL	T	BR	R	TL
7 ALIGN WITH BUCKET 3A TO CHECK ALTITUDE S	3A	BR	T	TL	R	BL
8 ORBIT RIGHTWARD (CCW)	3D	L	TL	R	BR	T
9 ORBIT RIGHTWARD (CCW)	3C	BL	R	BL	T	BR
10 ORBIT RIGHTWARD (CCW)	3B	B	TR	R	BL	T
CHANGE DIRECTION OF ORBITS						
11 ALIGN OVER STAND 2 AT ATITIDE S TO CHECK RADIUS	2	BL	T	BR	R	TL
12 ALIGN WITH BUCKET 3A TO CHECK ALTITUDE S	3A	BR	T	TL	R	BL
13 ORBIT LEFTWARD (CW)	3B	B	TR	R	BL	T
14 ORBIT LEFTWARD (CW)	3C	BL	R	BL	T	BR
15 ORBIT LEFTWARD (CW)	3D	L	TL	R	BR	T
16 ALIGN OVER STAND 2 AT ATITIDE S TO CHECK RADIUS	2	BL	T	BR	R	TL
17 ALIGN WITH BUCKET 3A TO CHECK ALTITUDE S	3A	BR	T	TL	R	BL
18 ORBIT RIGHTWARD (CCW)	3D	L	TL	R	BR	T
19 ORBIT RIGHTWARD (CCW)	3C	BL	R	BL	T	BR
20 ORBIT RIGHTWARD (CCW)	3B	B	TR	R	BL	T
LAND CENTERED FACING DOWN RANGE – CAPTURE IMAGE OF CLOCK -- END OF TRIAL						
IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: APPARATUS GROUND BOUNDARY SAFETY						

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINUMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

Open Lane: Orbit

MAN/PAY 3

Bucket #	Trial Notes
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

_____	_____	_____
PILOT NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
OTHER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
PROCTOR NAME	ORGANIZATION	SIGNATURE

Open Lane: Spiral

MAN/PAY 4

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

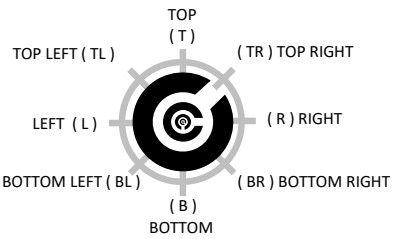
1 point per successfully aligned image
SCORE UP TO 20 POINTS

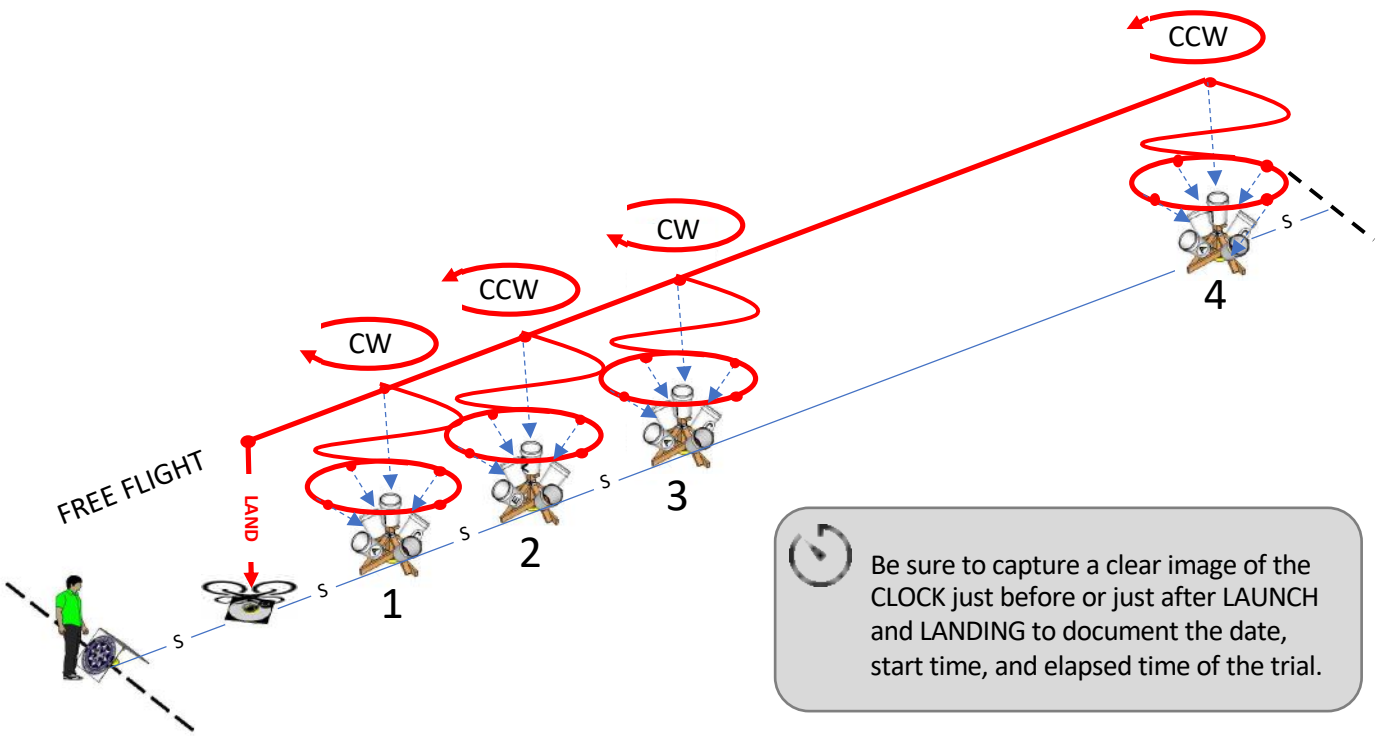
Payload Functionality (PAY)

ALIGN AND IDENTIFY TARGETS

Align with the 20 designated buckets long enough to capture a single image (FULL ZOOM) showing a continuous green ring AND the increasingly small Concentric C gap directions up to 5 deep.

1 point per correct gap shown in the image
SCORE UP TO 100 POINTS





Be sure to capture a clear image of the CLOCK just before or just after LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Open Lane: Spiral

MAN/PAY 4

Purpose

This test method evaluates free flight maneuvers to inspect objects of interest from any radius and altitude. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft maneuvers along any flight path to inspect objects of interest in designated leftward and rightward directions at any radius and altitude in a test lane with variable Spacing (S) between omni bucket stands. The aircraft aligns each bucket in a designated order on every every omni bucket stand. For each alignment it pauses long enough to capture a single NO ZOOM image showing the inscribed green ring. An additional FULL ZOOM image can also be captured to identify the visual acuity target inside. The aircraft then lands centered on the platform facing the stands with the chassis or ground contact within the 30cm (12in) radius circle. A complete trial includes inspecting all 4 omni bucket stands.

The Maneuvering variant of the test requires 20 NO ZOOM alignment images worth 1 point each if successful, totaling 20 points maximum for a complete trial.

The Payload Functionality variant of the test requires the same 20 NO ZOOM alignment images plus 20 FULL ZOOM images to identify the associated visual acuity targets. The acuity targets have 5 increasingly small Concentric C gaps directions to identify worth up to 5 points per target totaling 100 points maximum for a complete trial.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Reporting:

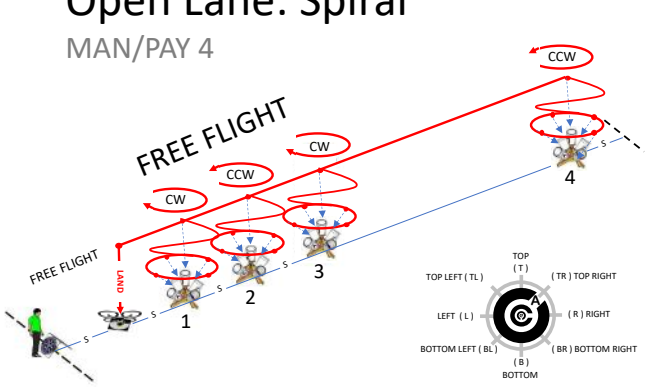
Fill in the form for complete trials using **22 Maneuvering images** captured (1 pre-launch clock + 20 alignments + 1 post-land clock), or **42 Payload Functionality images** captured (1 pre-launch clock + 20 alignments and 20 targets + 1 post-land clock).

Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

Open Lane: Spiral

MAN/PAY 4



Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LANE SPACING S	LIGHTING	WIND	PILOT VIEW	TIME LIMIT
10 FT 20 FT 30 FT _____ FT (CIRCLE ONE OR FILL IN)	DAYLIGHT 1000+ LUX LIGHTED 300+ LUX DARK < 1 LUX (CIRCLE ONE)	AVERAGE _____ MPH GUSTS _____ MPH	EYES ON FACING LANE SOME INTERFACE OPTIONAL V.O. BVLOS BACK TO LANE INTERFACE ONLY WITH V.O. (CIRCLE ONE)	5 MIN 10 MIN _____ MIN (CIRCLE ONE OR FILL IN)

PROCEDURE | SPIRAL		FORMS ANSWER KEY VERSION 2020B					
	CAPTURE IMAGE OF CLOCK – LAUNCH FROM PLATFORM	CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1	INSPECT SPIRAL STAND 1 LEFTWARD (CW)	1	T	BL	R	BR	L
2	IN ORDER: TOP – A – B – C – D	1A	TR	B	TR	L	BR
3	FREE FLIGHT BUT ALIGN WITH BUCKETS IN ORDER	1B	R	TL	T	BL	B
4		1C	BR	R	TL	L	BR
5		1D	B	TL	R	BL	T
6	INSPECT SPIRAL STAND 2 RIGHTWARD (CCW)	2	BL	T	BR	R	TL
7	IN ORDER: TOP – A – C – B – D	2A	L	BR	T	TL	R
8	FREE FLIGHT BUT ALIGN WITH BUCKETS IN ORDER	2D	TR	B	TL	B	BL
9		2C	T	BL	R	TL	B
10		2B	TL	R	TR	L	BR
11	INSPECT SPIRAL STAND 3 LEFTWARD (CW)	3	R	TL	B	BL	R
12	IN ORDER: TOP – A – B – C – D	3A	BR	T	TL	R	BL
13	FREE FLIGHT BUT ALIGN WITH BUCKETS IN ORDER	3B	B	TR	R	BL	T
14		3C	BL	R	BL	T	BR
15		3D	L	TL	R	BR	T
16	INSPECT SPIRAL STAND 4 RIGHTWARD (CCW)	4	TL	B	TR	R	BR
17	IN ORDER: TOP – A – C – B – D	4A	T	BL	B	TR	L
18	FREE FLIGHT BUT ALIGN WITH BUCKETS IN ORDER	4D	BR	B	TL	B	TR
19		4C	R	BL	T	TR	B
20		4B	TR	L	BL	R	TL
	LAND CENTERED FACING DOWN RANGE – CAPTURE IMAGE OF CLOCK -- END OF TRIAL						
	IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON:	APPARATUS	GROUND	BOUNDARY	SAFETY		

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINUMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

Open Lane: Spiral

MAN/PAY 4

Bucket #	Trial Notes

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

PILOT NAME	ORGANIZATION	SIGNATURE
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
OTHER NAME	ORGANIZATION	SIGNATURE
PROCTOR NAME	ORGANIZATION	SIGNATURE

Open Lane: Recon

MAN/PAY 5

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

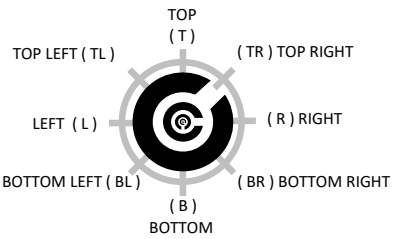
1 point per successfully aligned image
SCORE UP TO 20 POINTS

Payload Functionality (PAY)

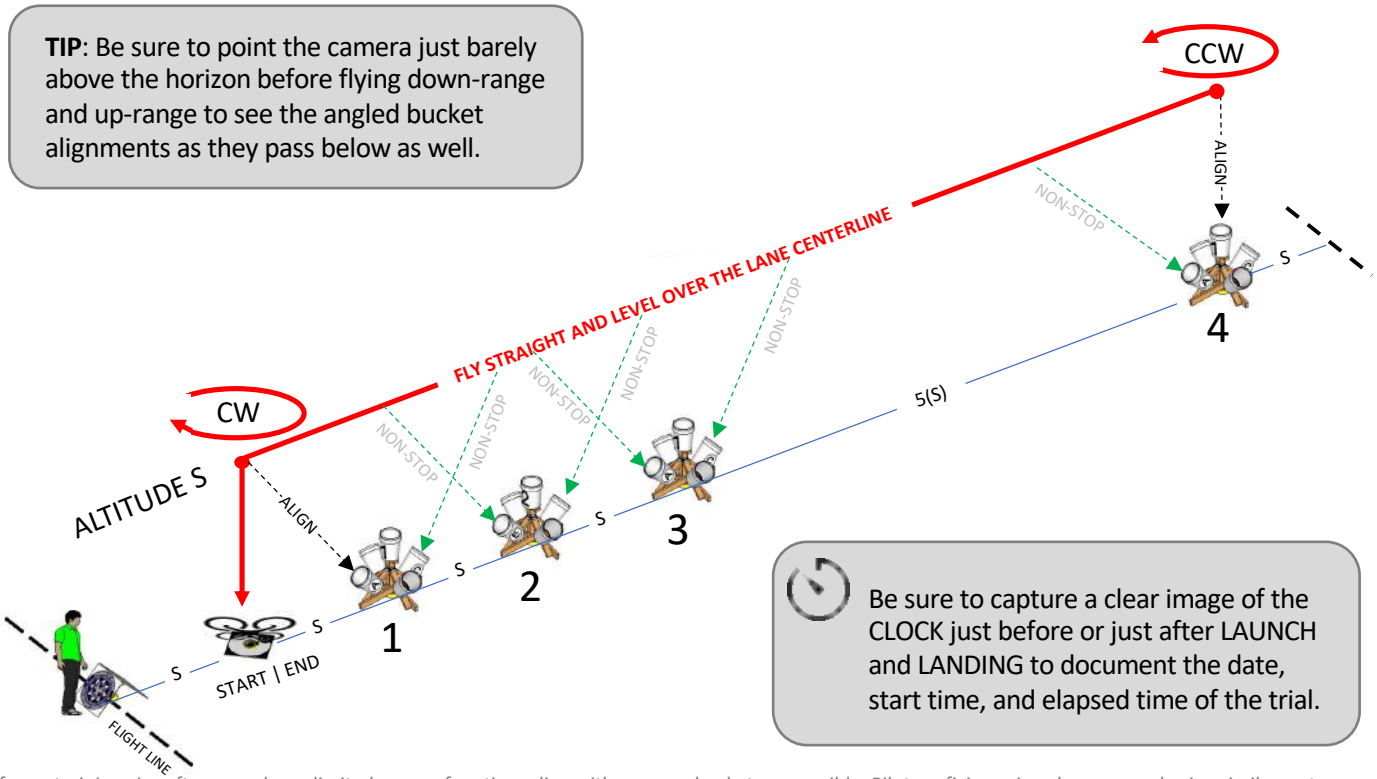
ALIGN AND IDENTIFY TARGETS

Align with the 20 designated buckets long enough to capture a single image (FULL ZOOM) showing a continuous green ring AND the increasingly small Concentric C gap directions up to 5 deep.

1 point per correct gap shown in the image
SCORE UP TO 100 POINTS



TIP: Be sure to point the camera just barely above the horizon before flying down-range and up-range to see the angled bucket alignments as they pass below as well.



Be sure to capture a clear image of the CLOCK just before or just after LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Open Lane: Recon

MAN/PAY 5

Purpose

This test method evaluates straight and level accelerations and decelerations in and out of stable hovers over objects of interest at a designated altitude. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft flies straight and level at a sustainable speed directly over the centerline of a test lane with variable Spacing (S) between omni bucket stands. The aircraft aligns with the landing and buckets at both ends of the lane. For each alignment it pauses long enough to capture a single NO ZOOM image showing the inscribed ring. An additional FULL ZOOM image can also be captured to identify the visual acuity target. The aircraft then lands centered on the platform facing the stands with the chassis or ground contact within the 30cm (12in) radius circle. A complete trial includes 5 laps (10 lengths) of the lane totaling 80(S) distance.

The Maneuvering variant of the test requires 20 NO ZOOM alignment images worth 1 point each if successful, totaling 20 points maximum for a complete trial.

The Payload Functionality variant of the test requires the same 20 NO ZOOM alignment images plus 20 FULL ZOOM images to identify the associated visual acuity targets. The acuity targets have 5 increasingly small Concentric C gaps directions to identify worth up to 5 points per target totaling 100 points maximum for a complete trial.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Reporting:

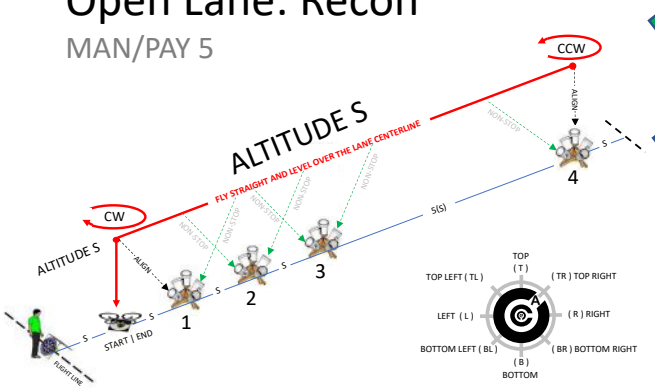
Fill in the form for complete trials using **22 Maneuvering images** captured (1 pre-launch clock + 20 alignments + 1 post-land clock), or **42 Payload Functionality images** captured (1 pre-launch clock + 20 alignments and 20 targets + 1 post-land clock).

Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

Open Lane: Recon

MAN/PAY 5



Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LANE SPACING S	LIGHTING	WIND	PILOT VIEW	TIME LIMIT
10 FT 20 FT 30 FT _____ FT (CIRCLE ONE OR FILL IN)	DAYLIGHT 1000+ LUX LIGHTED 300+ LUX DARK < 1 LUX (CIRCLE ONE)	AVERAGE _____ MPH GUSTS _____ MPH	EYES ON FACING LANE SOME INTERFACE OPTIONAL V.O. BVLOS BACK TO LANE INTERFACE ONLY WITH V.O. (CIRCLE ONE)	5 MIN 10 MIN _____ MIN (CIRCLE ONE OR FILL IN)

PROCEDURE | RECON		FORMS ANSWER KEY VERSION 2020B					
	CAPTURE IMAGE OF CLOCK – LAUNCH FROM PLATFORM	CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1	FLY DOWN RANGE STRAIGHT & LEVEL, ALIGN BUCKET 4	4	TL	BL	TR	R	BR
2	YAW 180°, ALIGN BUCKET 4 (UPSIDE DOWN)	UPSIDE 4 DOWN	BR	TR	BL	L	TL
3	FLY UP RANGE STRAIGHT & LEVEL, ALIGN LANDING	L	B	TR	L	BL	T
4	YAW 180° LOOKING DOWN, ALIGN BUCKET 1A	1A	TR	B	TR	L	BR
5	REPEAT DOWN RANGE	4	TL	BL	TR	R	BR
6		UPSIDE 4 DOWN	BR	TR	BL	L	TL
7	REPEAT UP RANGE	L	B	TR	L	BL	T
8		1A	TR	B	TR	L	BR
9	REPEAT DOWN RANGE	4	TL	BL	TR	R	BR
10		UPSIDE 4 DOWN	BR	TR	BL	L	TL
11	REPEAT UP RANGE	L	B	TR	L	BL	T
12		1A	TR	B	TR	L	BR
13	REPEAT DOWN RANGE	4	TL	BL	TR	R	BR
14		UPSIDE 4 DOWN	BR	TR	BL	L	TL
15	REPEAT UP RANGE	L	B	TR	L	BL	T
16		1A	TR	B	TR	L	BR
17	REPEAT DOWN RANGE	4	TL	BL	TR	R	BR
18		UPSIDE 4 DOWN	BR	TR	BL	L	TL
19	REPEAT UP RANGE	L	B	TR	L	BL	T
20		1A	TR	B	TR	L	BR

LAND CENTERED FACING DOWN RANGE – CAPTURE IMAGE OF CLOCK -- END OF TRIAL

IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: APPARATUS GROUND BOUNDARY SAFETY

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINUMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

Open Lane: Recon

MAN/PAY 5

Bucket #	Trial Notes
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

_____	_____	_____
PILOT NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
OTHER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
PROCTOR NAME	ORGANIZATION	SIGNATURE

Obstructed Test Lane Forms Book

MAN/PAY 6-10 and Related Scenarios

AIRCRAFT SYSTEM

MAKE: _____

MODEL: _____

CONFIG: _____

REMOTE PILOT

CODE: _____ (INITIALS or ANONYMOUS)

NAME: _____

ATTEST: _____

VISUAL OBSERVER

NAME: _____

ATTEST: _____

PROCTOR

NAME: _____

ATTEST: _____

DATE: _____

FACILITY: _____

LOCATION: _____

MAN 6-10 SCORES

TRIAL TIMES: 10 | 20 | ____ minutes (circle one)

6) WALL 90°: _____ of 20 Points

7) WALL 45°: _____ of 20 Points

8) GROUND: _____ of 20 Points

9) POST: _____ of 20 Points

10) AVOID: _____ of 20 Points

of 100 Points

PAY 6-10 SCORES

TRIAL TIMES: 10 | 20 | ____ minutes (circle one)

6) WALL 90°: _____ of 100 Points

7) WALL 45°: _____ of 100 Points

8) GROUND: _____ of 100 Points

9) POST: _____ of 100 Points

10) AVOID: _____ of 100 Points

of 500 Points

Test Director:
Adam Jacoff
Intelligent Systems Division
National Institute of Standards and Technology
U.S. Department of Commerce

DHS Sponsor:
Science and Technology Directorate
U.S. Department of Homeland Security
standards@hq.dhs.gov

Obstructed Lane: Wall (90°)

MAN/PAY 6

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

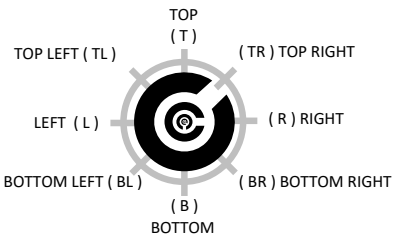
1 point per successfully aligned image
SCORE UP TO 20 POINTS

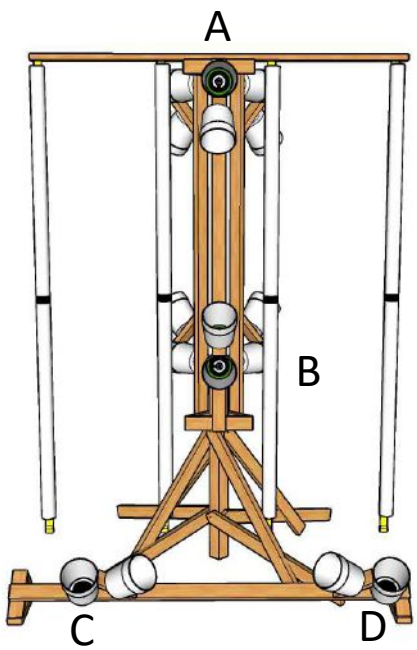
Payload Functionality (PAY)

ALIGN AND IDENTIFY TARGETS

Align with the 20 designated buckets long enough to capture a single image (FULL ZOOM) showing a continuous green ring AND the increasingly small Concentric C gap directions up to 5 deep.

1 point per correct gap shown in the image
SCORE UP TO 100 POINTS





Be sure to capture a clear image of the CLOCK JUST BEFORE OR AFTER LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Obstructed Lane: Wall (90°)

MAN/PAY 6

Purpose

This test method evaluates maneuvering and payload functionality within proximity to vertical wall obstacles at orientations of 90 degrees. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft performs dual bucket alignments to identify targets inside. The perpendicular buckets are identified first, then the associated angled buckets with visual acuity targets. The position at which both buckets are simultaneously aligned is 2 m (6ft) from the obstacle.

The aircraft must pause long enough aligned with each bucket to capture a single image showing the entire inscribed ring. The perpendicular bucket alignments are NO ZOOM images. The associated angled bucket alignments are FULL ZOOM images to identify the visual acuity targets. The aircraft then lands centered on the platform facing the stands with the chassis or ground contact within the 30cm (12in) radius circle to identify low and high perch targets at FULL ZOOM.

A complete trial includes a sequence in order of bucket lettering with perch targets then in reverse order with perch targets to capture 20 images. Perpendicular buckets are scored 5 points for a successful alignment image and angled acuity buckets are scored up to 5 points for an aligned image showing each increasingly small Concentric C gap directions successfully identified. The maximum score for a trial is 100 points.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Reporting:

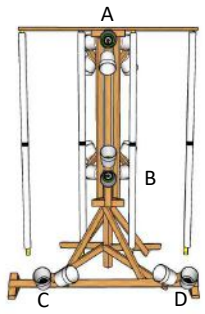
Fill in the form for complete trials using **22 Maneuvering images** captured (1 pre-launch clock + 20 alignments + 1 post-land clock), or **42 Payload Functionality images** captured (1 pre-launch clock + 20 alignments and 20 targets + 1 post-land clock).

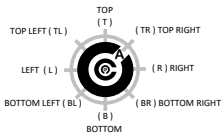
Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

Obstructed Lane: Wall (90°)

MAN/PAY 6





Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

BUCKET DIAM.	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
10 CM (4 IN)	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE SOME INTERFACE OPTIONAL V.O.	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	5 MIN	10 MIN	____ MIN
20 CM (8 IN)				____ MPH	____ MPH					
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)					(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

OBSTRUCTED LANE | WALL 90°		FORMS ANSWER KEY VERSION 2020B					
	CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LAUNCH	CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1	ALIGN TO TOP CENTER BUCKET A – CAPTURE IMAGE	6A (Straight)	5 POINTS FOR ALIGNMENT				
2	ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	6A (Angled)	TR	B	TR	L	BR
3	DESCEND AND ALIGN TO BUCKET B – CAPTURE IMAGE	6B (Straight)	5 POINTS FOR ALIGNMENT				
4	ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	6B (Angled)	R	TL	T	BL	B
5	TRAVERSE LEFT AND ALIGN TO BUCKET C – CAPTURE IMAGE	6C (Straight)	5 POINTS FOR ALIGNMENT				
6	ALIGN TO ANGLED BUCKET C ACUITY – CAPTURE IMAGE	6C (Angled)	BR	R	TL	L	BR
7	TRAVERSE RIGHT AND ALIGN TO BUCKET D – CAPTURE IMAGE	6D (Straight)	5 POINTS FOR ALIGNMENT				
8	ALIGN TO ANGLED BUCKET D ACUITY – CAPTURE IMAGE	6D (Angled)	B	TL	R	BL	T
9	LAND CENTERED FOR LOW PERCH TARGET – CAPTURE IMAGE	6P LOW Perch	T	BL	R	BR	L
10	LAND CENTERED FOR HIGH PERCH TARGET – CAPTURE IMAGE	6A HIGH Perch	TR	B	TR	L	BR
	REVERSE DIRECTION						
11	ALIGN TO BOTTOM/RIGHT BUCKET D – CAPTURE IMAGE	6D (Straight)	5 POINTS FOR ALIGNMENT				
12	ALIGN TO ANGLED BUCKET D ACUITY – CAPTURE IMAGE	6D (Angled)	B	TL	R	BL	T
13	TRAVERSE LEFT AND ALIGN TO BUCKET C – CAPTURE IMAGE	6C (Straight)	5 POINTS FOR ALIGNMENT				
14	ALIGN TO ANGLED BUCKET C ACUITY – CAPTURE IMAGE	6C (Angled)	BR	R	TL	L	BR
15	TRAVERSE RIGHT AND ALIGN TO BUCKET B – CAPTURE IMAGE	6B (Straight)	5 POINTS FOR ALIGNMENT				
16	ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	6B (Angled)	R	TL	T	BL	B
17	CLIMB AND ALIGN TO BUCKET A – CAPTURE IMAGE	6A (Straight)	5 POINTS FOR ALIGNMENT				
18	ALIGN TO ANGLED BUCKET A ACUIITY – CAPTURE IMAGE	6A (Angled)	TR	B	TR	L	BR
19	LAND CENTERED FOR LOW PERCH TARGET – CAPTURE IMAGE	6P LOW Perch	T	BL	R	BR	L
20	LAND CENTERED FOR HIGH PERCH TARGET – CAPTURE IMAGE	6A HIGH Perch	TR	B	TR	L	BR
	CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LANDING CENTERED FACING STANDS						

IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: APPARATUS GROUND BOUNDARY SAFETY

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINIMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

Obstructed Lane: Wall (90°)

MAN/PAY 6

Bucket #	Trial Notes
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

_____	_____	_____
PILOT NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
OTHER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
PROCTOR NAME	ORGANIZATION	SIGNATURE

Obstructed Lane: Wall (45°)

MAN/PAY 7

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

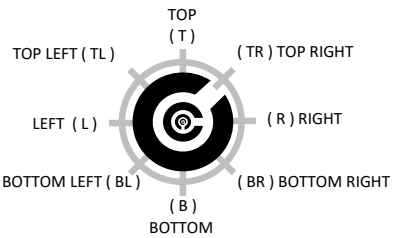
1 point per successfully aligned image
SCORE UP TO 20 POINTS

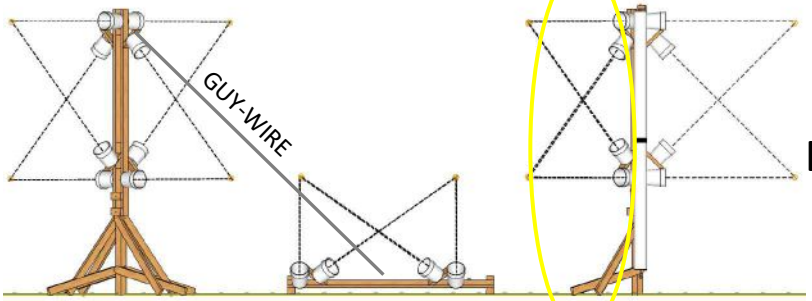
Payload Functionality (PAY)

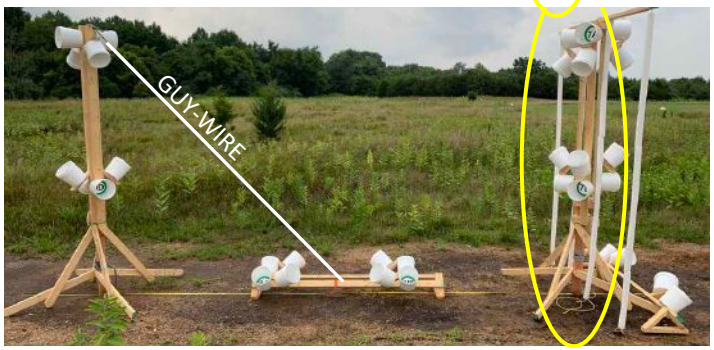
ALIGN AND IDENTIFY TARGETS

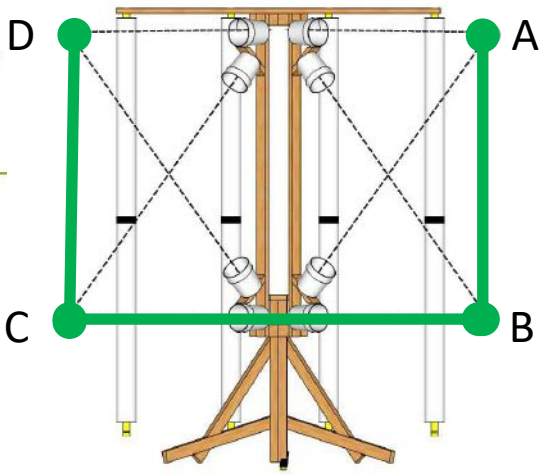
Align with the 20 designated buckets long enough to capture a single image (FULL ZOOM) showing a continuous green ring AND the increasingly small Concentric C gap directions up to 5 deep.

1 point per correct gap shown in the image
SCORE UP TO 100 POINTS









Be sure to capture a clear image of the CLOCK JUST BEFORE OR AFTER LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Obstructed Lane: Wall (45°)

MAN/PAY 7

Purpose

This test method evaluates maneuvering and payload functionality within proximity to vertical wall obstacles at orientations of 45 degrees. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft performs dual bucket alignments to identify targets inside. The perpendicular buckets are identified first, then the associated angled buckets with visual acuity targets. The position at which both buckets are simultaneously aligned is 2 m (6ft) from the obstacle.

The aircraft must pause long enough aligned with each bucket to capture a single image showing the entire inscribed ring. The perpendicular bucket alignments are NO ZOOM images. The associated angled bucket alignments are FULL ZOOM images to identify the visual acuity targets. The aircraft then lands centered on the platform facing the stands with the chassis or ground contact within the 30cm (12in) radius circle to identify low and high perch targets at FULL ZOOM.

A complete trial includes a sequence in order of bucket lettering with perch targets then in reverse order with perch targets to capture 20 images. Perpendicular buckets are scored 5 points for a successful alignment image and angled acuity buckets are scored up to 5 points for an aligned image showing each increasingly small Concentric C gap directions successfully identified. The maximum score for a trial is 100 points.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Reporting:

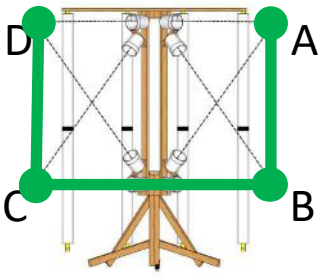
Fill in the form for complete trials using **22 Maneuvering images** captured (1 pre-launch clock + 20 alignments + 1 post-land clock), or **42 Payload Functionality images** captured (1 pre-launch clock + 20 alignments and 20 targets + 1 post-land clock).

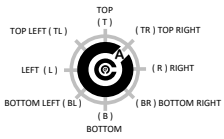
Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

Obstructed Lane: Wall (45°)

MAN/PAY 7





Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

BUCKET DIAM.	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
10 CM (4 IN)	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE SOME INTERFACE OPTIONAL V.O.	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	5 MIN	10 MIN	____ MIN
20 CM (8 IN)				____ MPH	____ MPH					
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)					(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

OBSTRUCTED LANE | WALL 45°		FORMS ANSWER KEY VERSION 2020B					
CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LAUNCH		CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1	ALIGN TO TOP BUCKET A – CAPTURE IMAGE	7A (Straight)	5 POINTS FOR ALIGNMENT				
2	ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	7A (Angled)	L	BR	T	TL	R
3	DESCEND AND ALIGN TO BUCKET B – CAPTURE IMAGE	7B (Straight)	5 POINTS FOR ALIGNMENT				
4	ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	7B (Angled)	TL	R	TR	L	BR
5	TRAVERSE LEFT AND ALIGN TO BUCKET C – CAPTURE IMAGE	7C (Straight)	5 POINTS FOR ALIGNMENT				
6	ALIGN TO ANGLED BUCKET C ACUITY – CAPTURE IMAGE	7C (Angled)	T	BL	R	TL	B
7	CLIMB AND ALIGN TO BUCKET D – CAPTURE IMAGE	7D (Straight)	5 POINTS FOR ALIGNMENT				
8	ALIGN TO ANGLED BUCKET D ACUITY – CAPTURE IMAGE	7D (Angled)	TR	B	TL	B	BL
9	LAND CENTERED FOR LOW PERCH TARGET – CAPTURE IMAGE	6P LOW Perch	T	BL	R	BR	L
10	LAND CENTERED FOR HIGH PERCH TARGET – CAPTURE IMAGE	6A HIGH Perch	TR	B	TR	L	BR
REVERSE DIRECTION							
11	ALIGN TO TOP BUCKET D – CAPTURE IMAGE	7D (Straight)	5 POINTS FOR ALIGNMENT				
12	ALIGN TO ANGLED BUCKET D ACUITY – CAPTURE IMAGE	7D (Angled)	TR	B	TL	B	BL
13	DESCEND AND ALIGN TO BUCKET C – CAPTURE IMAGE	7C (Straight)	5 POINTS FOR ALIGNMENT				
14	ALIGN TO ANGLED BUCKET C ACUITY – CAPTURE IMAGE	7C (Angled)	T	BL	R	TL	B
15	TRAVERSE RIGHT AND ALIGN TO BUCKET B – CAPTURE IMAGE	7B (Straight)	5 POINTS FOR ALIGNMENT				
16	ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	7B (Angled)	TL	R	TR	L	BR
17	CLIMB AND ALIGN TO BUCKET A – CAPTURE IMAGE	7A (Straight)	5 POINTS FOR ALIGNMENT				
18	ALIGN TO ANGLED BUCKET A ACUIITY – CAPTURE IMAGE	7A (Angled)	L	BR	T	TL	R
19	LAND CENTERED FOR LOW PERCH TARGET – CAPTURE IMAGE	6P LOW Perch	T	BL	R	BR	L
20	LAND CENTERED FOR HIGH PERCH TARGET – CAPTURE IMAGE	6A HIGH Perch	TR	B	TR	L	BR
CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LANDING CENTERED FACING STANDS							
IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: APPARATUS GROUND BOUNDARY SAFETY							

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINIMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

Obstructed Lane: Wall (45°)

MAN/PAY 7

Bucket #	Trial Notes
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

_____	_____	_____
PILOT NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
OTHER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
PROCTOR NAME	ORGANIZATION	SIGNATURE

Obstructed Lane: Ground

MAN/PAY 8

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

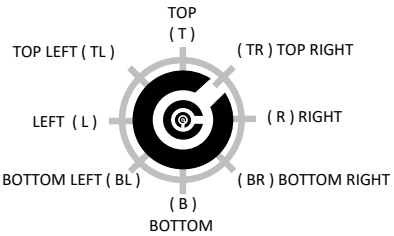
1 point per successfully aligned image
SCORE UP TO 20 POINTS

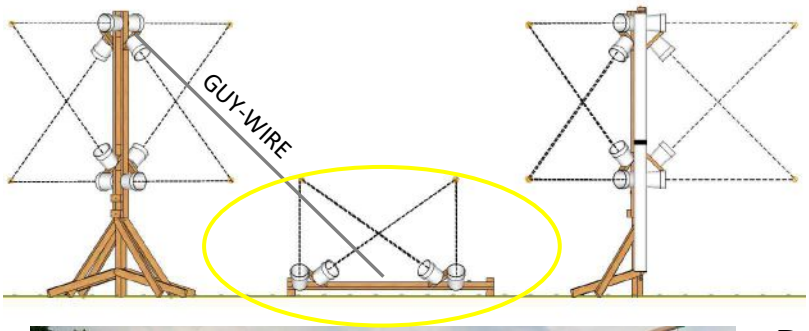
Payload Functionality (PAY)

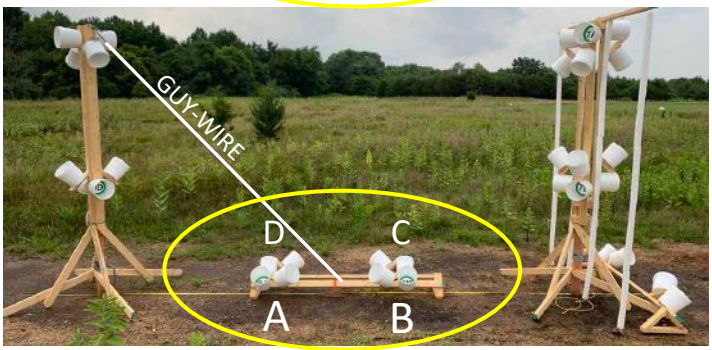
ALIGN AND IDENTIFY TARGETS

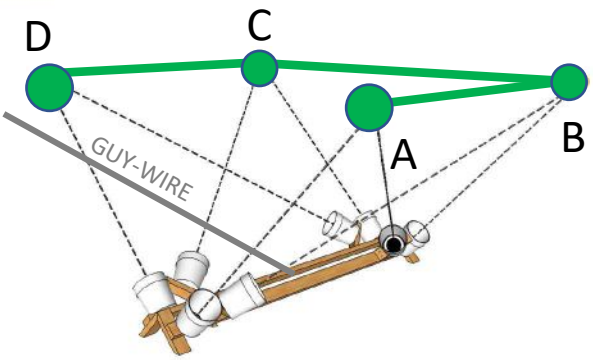
Align with the 20 designated buckets long enough to capture a single image (FULL ZOOM) showing a continuous green ring AND the increasingly small Concentric C gap directions up to 5 deep.

1 point per correct gap shown in the image
SCORE UP TO 100 POINTS









Be sure to capture a clear image of the CLOCK JUST BEFORE OR AFTER LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Obstructed Lane: Ground

MAN/PAY 8

Purpose

This test method evaluates maneuvering and payload functionality within proximity to horizontal ground obstacles at orientations of 45 degrees. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft performs dual bucket alignments to identify targets inside. The perpendicular buckets are identified first, then the associated angled buckets with visual acuity targets. The position at which both buckets are simultaneously aligned is 2 m (6ft) from the obstacle.

The aircraft must pause long enough aligned with each bucket to capture a single image showing the entire inscribed ring. The perpendicular bucket alignments are NO ZOOM images. The associated angled bucket alignments are FULL ZOOM images to identify the visual acuity targets. The aircraft then lands centered on the platform facing the stands with the chassis or ground contact within the 30cm (12in) radius circle to identify low and high perch targets at FULL ZOOM.

A complete trial includes a sequence in order of bucket lettering with perch targets then in reverse order with perch targets to capture 20 images. Perpendicular buckets are scored 5 points for a successful alignment image and angled acuity buckets are scored up to 5 points for an aligned image showing each increasingly small Concentric C gap directions successfully identified. The maximum score for a trial is 100 points.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Reporting:

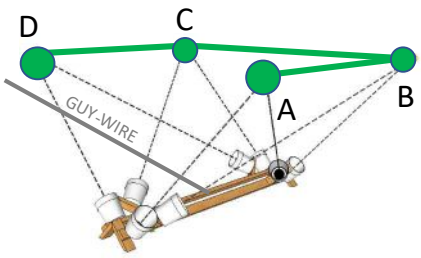
Fill in the form for complete trials using **22 Maneuvering images** captured (1 pre-launch clock + 20 alignments + 1 post-land clock), or **42 Payload Functionality images** captured (1 pre-launch clock + 20 alignments and 20 targets + 1 post-land clock).

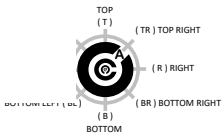
Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

Obstructed Lane: Ground

MAN/PAY 8





Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

BUCKET DIAM.	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
10 CM (4 IN)	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE SOME INTERFACE OPTIONAL V.O.	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	5 MIN	10 MIN	____ MIN
20 CM (8 IN)				____ MPH	____ MPH					
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)					(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

OBSTRUCTED LANE | GROUND		FORMS ANSWER KEY VERSION 2020B					
	CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LAUNCH	CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1	ALIGN TO BUCKET A NEAR GUY-WIRE – CAPTURE IMAGE	8A (Straight)	5 POINTS FOR ALIGNMENT				
2	ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	8A (Angled)	BR	T	TL	R	BL
3	TRAVERSE AND ALIGN TO BUCKET B – CAPTURE IMAGE	8B (Straight)	5 POINTS FOR ALIGNMENT				
4	ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	8B (Angled)	B	TR	R	BL	T
5	MOVE/ROTATE AND ALIGN TO BUCKET C – CAPTURE IMAGE	8C (Straight)	5 POINTS FOR ALIGNMENT				
6	ALIGN TO ANGLED BUCKET C ACUITY – CAPTURE IMAGE	8C (Angled)	BL	R	BL	T	BR
7	TRAVERSE AND ALIGN TO BUCKET D – CAPTURE IMAGE	8D (Straight)	5 POINTS FOR ALIGNMENT				
8	ALIGN TO ANGLED BUCKET D ACUITY – CAPTURE IMAGE	8D (Angled)	L	TL	R	BR	T
9	LAND CENTERED FOR LOW PERCH TARGET – CAPTURE IMAGE	6P LOW Perch	T	BL	R	BR	L
10	LAND CENTERED FOR HIGH PERCH TARGET – CAPTURE IMAGE	6A HIGH Perch	TR	B	TR	L	BR
	REVERSE DIRECTION						
11	ALIGN TO BUCKET D NEAR GUY-WIRE – CAPTURE IMAGE	8D (Straight)	5 POINTS FOR ALIGNMENT				
12	ALIGN TO ANGLED BUCKET D ACUITY – CAPTURE IMAGE	8D (Angled)	L	TL	R	BR	T
13	TRAVERSE AND ALIGN TO BUCKET C – CAPTURE IMAGE	8C (Straight)	5 POINTS FOR ALIGNMENT				
14	ALIGN TO ANGLED BUCKET C ACUITY – CAPTURE IMAGE	8C (Angled)	BL	R	BL	T	BR
15	MOVE/ROTATE AND ALIGN TO BUCKET B – CAPTURE IMAGE	8B (Straight)	5 POINTS FOR ALIGNMENT				
16	ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	8B (Angled)	B	TR	R	BL	T
17	TRAVERSE AND ALIGN TO BUCKET A – CAPTURE IMAGE	8A (Straight)	5 POINTS FOR ALIGNMENT				
18	ALIGN TO ANGLED BUCKET A ACUIITY – CAPTURE IMAGE	8A (Angled)	BR	T	TL	R	BL
19	LAND CENTERED FOR LOW PERCH TARGET – CAPTURE IMAGE	6P LOW Perch	T	BL	R	BR	L
20	LAND CENTERED FOR HIGH PERCH TARGET – CAPTURE IMAGE	6A HIGH Perch	TR	B	TR	L	BR
	CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LANDING CENTERED FACING STANDS						
	IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: APPARATUS GROUND BOUNDARY SAFETY						

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINIMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

Obstructed Lane: Ground

MAN/PAY 8

Bucket #	Trial Notes
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

_____	_____	_____
PILOT NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
OTHER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
PROCTOR NAME	ORGANIZATION	SIGNATURE

Obstructed Lane: Post

MAN/PAY 9

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

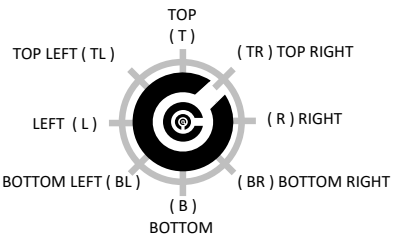
1 point per successfully aligned image
SCORE UP TO 20 POINTS

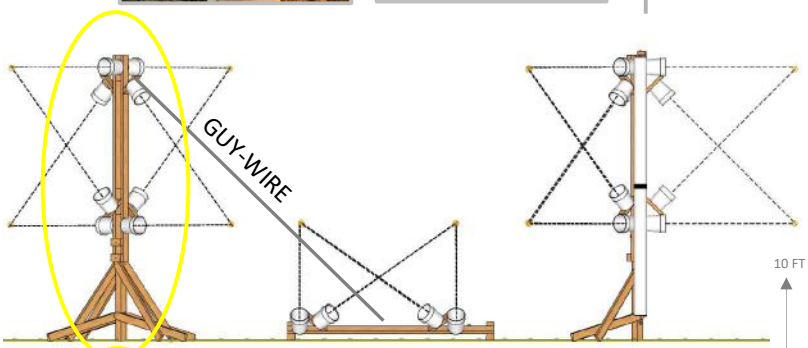
Payload Functionality (PAY)

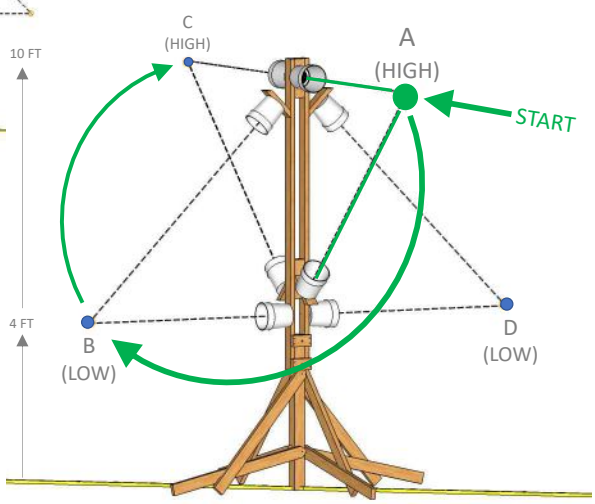
ALIGN AND IDENTIFY TARGETS

Align with the 20 designated buckets long enough to capture a single image (FULL ZOOM) showing a continuous green ring AND the increasingly small Concentric C gap directions up to 5 deep.

1 point per correct gap shown in the image
SCORE UP TO 100 POINTS







Be sure to capture a clear image of the CLOCK JUST BEFORE OR AFTER LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Obstructed Lane: Post

MAN/PAY 9

Purpose

This test method evaluates maneuvering and payload functionality within proximity to vertical post obstacles at orientations of 90 degrees. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft performs dual bucket alignments to identify targets inside. The perpendicular buckets are identified first, then the associated angled buckets with visual acuity targets. The position at which both buckets are simultaneously aligned is 2 m (6ft) from the obstacle.

The aircraft must pause long enough aligned with each bucket to capture a single image showing the entire inscribed ring. The perpendicular bucket alignments are NO ZOOM images. The associated angled bucket alignments are FULL ZOOM images to identify the visual acuity targets. The aircraft then lands centered on the platform facing the stands with the chassis or ground contact within the 30cm (12in) radius circle to identify low and high perch targets at FULL ZOOM.

A complete trial includes a sequence in order of bucket lettering with perch targets then in reverse order with perch targets to capture 20 images. Perpendicular buckets are scored 5 points for a successful alignment image and angled acuity buckets are scored up to 5 points for an aligned image showing each increasingly small Concentric C gap directions successfully identified. The maximum score for a trial is 100 points.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Reporting:

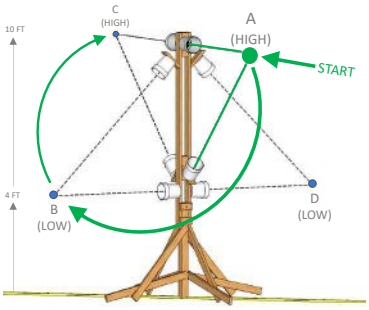
Fill in the form for complete trials using **22 Maneuvering images** captured (1 pre-launch clock + 20 alignments + 1 post-land clock), or **42 Payload Functionality images** captured (1 pre-launch clock + 20 alignments and 20 targets + 1 post-land clock).

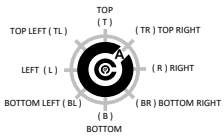
Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

Obstructed Lane: Post

MAN/PAY 9





Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

BUCKET DIAM.	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
10 CM (4 IN)	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE SOME INTERFACE OPTIONAL V.O.	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	5 MIN	10 MIN	____ MIN
20 CM (8 IN)				____ MPH	____ MPH					
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)					(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

OBSTRUCTED LANE | POST	FORMS ANSWER KEY VERSION 2020B					
CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LAUNCH	CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1 ALIGN TO TOP BUCKET A NEAR GUY-WIRE – CAPTURE IMAGE	9A (Straight)	5 POINTS FOR ALIGNMENT				
2 ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	9A (Angled)	T	BL	B	TR	L
3 DESCEND/SPIRAL LEFT AND ALIGN TO BUCKET B – CAPTURE IMA	9B (Straight)	5 POINTS FOR ALIGNMENT				
4 ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	9B (Angled)	TR	L	BL	R	TL
5 CLIMB/SPIRAL LEFT AND ALIGN TO BUCKET C – CAPTURE IMAGE	9C (Straight)	5 POINTS FOR ALIGNMENT				
6 ALIGN TO ANGLED BUCKET C ACUITY – CAPTURE IMAGE	9C (Angled)	R	BL	T	TR	B
7 DESCEND/SPIRAL LEFT AND ALIGN TO BUCKET D – CAPTURE IMA	9D (Straight)	5 POINTS FOR ALIGNMENT				
8 ALIGN TO ANGLED BUCKET D ACUITY – CAPTURE IMAGE	9D (Angled)	BR	B	TL	B	TR
9 LAND CENTERED FOR LOW PERCH TARGET – CAPTURE IMAGE	6P LOW Perch	T	BL	R	BR	L
10 LAND CENTERED FOR HIGH PERCH TARGET – CAPTURE IMAGE	6A HIGH Perch	TR	B	TR	L	BR
REVERSE DIRECTION						
11 ALIGN TO BOPTTOM BUCKET D NEAR GUY-WIRE – CAPTURE IMA	9D (Straight)	5 POINTS FOR ALIGNMENT				
12 ALIGN TO ANGLED BUCKET D ACUITY – CAPTURE IMAGE	9D (Angled)	BR	B	TL	B	TR
13 CLIMB/SPIRAL RIGHT AND ALIGN TO BUCKET C – CAPTURE IMAG	9C (Straight)	5 POINTS FOR ALIGNMENT				
14 ALIGN TO ANGLED BUCKET C ACUITY – CAPTURE IMAGE	9C (Angled)	R	BL	T	TR	B
15 DESCEND/SPIRAL RIGHT AND ALIGN TO BUCKET B – CAPTURE IM	9B (Straight)	5 POINTS FOR ALIGNMENT				
16 ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	9B (Angled)	TR	L	BL	R	TL
17 CLIMB/SPIRAL RIGHT AND ALIGN TO BUCKET A – CAPTURE IMAG	9A (Straight)	5 POINTS FOR ALIGNMENT				
18 ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	9A (Angled)	T	BL	B	TR	L
19 LAND CENTERED FOR LOW PERCH TARGET – CAPTURE IMAGE	6P LOW Perch	T	BL	R	BR	L
20 LAND CENTERED FOR HIGH PERCH TARGET – CAPTURE IMAGE	6A HIGH Perch	TR	B	TR	L	BR
CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LANDING CENTERED FACING STANDS						
IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: APPARATUS GROUND BOUNDARY SAFETY						

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINIMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

Obstructed Lane: Post

MAN/PAY 9

Bucket #	Trial Notes
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

_____	_____	_____
PILOT NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
OTHER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
PROCTOR NAME	ORGANIZATION	SIGNATURE

Obstructed Lane: Avoid

MAN/PAY 10

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

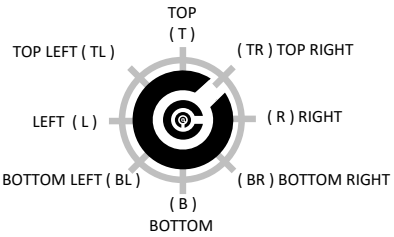
1 point per successfully aligned image
SCORE UP TO 20 POINTS

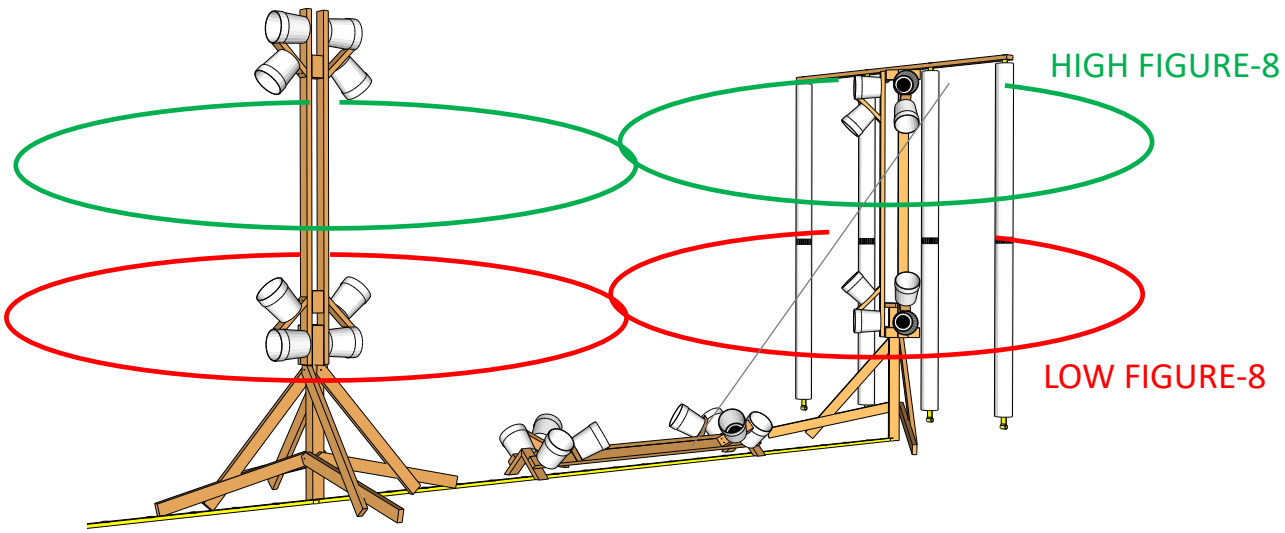
Payload Functionality (PAY)

ALIGN AND IDENTIFY TARGETS

Align with the 20 designated buckets long enough to capture a single image (FULL ZOOM) showing a continuous green ring AND the increasingly small Concentric C gap directions up to 5 deep.

1 point per correct gap shown in the image
SCORE UP TO 100 POINTS





Be sure to capture a clear image of the CLOCK JUST BEFORE OR AFTER LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Obstructed Lane: Avoid

MAN/PAY 10

Purpose

This test method evaluates maneuvering and payload functionality while avoiding multiple vertical and diagonal obstacles. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft performs figure-8 maneuvers around and between vertical and diagonal obstacles at known positions. Each lap starts and ends at the same dual bucket alignments, either high or low in front of the landing, to identify targets inside. The perpendicular buckets are identified first, then the associated angled buckets with visual acuity targets. The position at which both buckets are simultaneously aligned is 2 m (6ft) from the obstacle. The higher altitude figure-8 is roughly 3 m (10 ft) AGL. The lower altitude figure-8 is approximately 1.2 m (4 ft). The guy-wire is more involved in the lower altitude laps.

The aircraft must pause long enough aligned with each bucket to capture a single image showing the entire inscribed ring. The perpendicular bucket alignments are NO ZOOM images. The associated angled bucket alignments are FULL ZOOM images to identify the visual acuity targets. The aircraft then lands centered on the platform facing the stands with the chassis or ground contact within the 30cm (12in) radius circle to identify low and high perch targets at FULL ZOOM.

A complete trial includes 5 figure-8 laps alternating between high and low altitudes to capture 20 images (4 dual bucket images per lap). Perpendicular buckets are scored 5 points for a successful alignment image and angled acuity buckets are scored up to 5 points for an aligned image showing each increasingly small Concentric C gap directions successfully identified. The maximum score for a trial is 100 points.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = number of successfully identified Concentric Cs (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

Reporting:

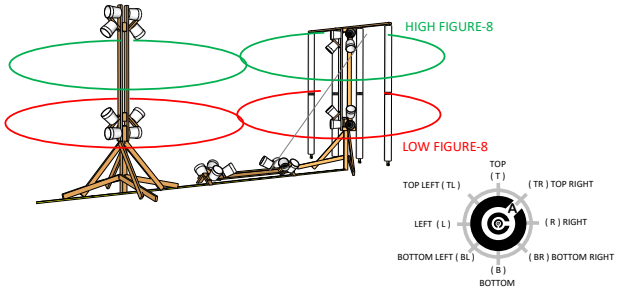
Fill in the form for complete trials using **22 Maneuvering images** captured (1 pre-launch clock + 20 alignments + 1 post-land clock), or **42 Payload Functionality images** captured (1 pre-launch clock + 20 alignments and 20 targets + 1 post-land clock).

Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

Obstructed Lane: Avoid

MAN/PAY 10



Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

BUCKET DIAM.	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
10 CM (4 IN)	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE SOME INTERFACE OPTIONAL V.O.	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	5 MIN	10 MIN	____ MIN
20 CM (8 IN)				____ MPH	____ MPH					
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)					(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

OBSTRUCTED LANE | AVOID		FORMS ANSWER KEY VERSION 2020B					
	CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LAUNCH	CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1	ALIGN TO TOP BUCKET A FACING LANDING – CAPTURE IMAGE	6A	5 POINTS FOR ALIGNMENT				
2	ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	6A (Angled)	TR	B	TR	L	BR
3	ALIGN TO TOP BUCKET A FACING LANDING – CAPTURE IMAGE	6A	5 POINTS FOR ALIGNMENT				
4	ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	6A (Angled)	TR	B	TR	L	BR
5	ALIGN TO BOTTOM BUCKET B FACING LANDING – CAPTURE IMAG	6B	5 POINTS FOR ALIGNMENT				
6	ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	6B (Angled)	R	TL	T	BL	B
7	ALIGN TO BOTTOM BUCKET B FACING LANDING – CAPTURE IMAG	6B	5 POINTS FOR ALIGNMENT				
8	ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	6B (Angled)	R	TL	T	BL	B
9	ALIGN TO TOP BUCKET A FACING LANDING – CAPTURE IMAGE	6A	5 POINTS FOR ALIGNMENT				
10	ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	6A (Angled)	TR	B	TR	L	BR
11	ALIGN TO TOP BUCKET A FACING LANDING – CAPTURE IMAGE	6A	5 POINTS FOR ALIGNMENT				
12	ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	6A (Angled)	TR	B	TR	L	BR
13	ALIGN TO BOTTOM BUCKET B FACING LANDING – CAPTURE IMAG	6B	5 POINTS FOR ALIGNMENT				
14	ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	6B (Angled)	R	TL	T	BL	B
15	ALIGN TO BOTTOM BUCKET B FACING LANDING – CAPTURE IMAG	6B	5 POINTS FOR ALIGNMENT				
16	ALIGN TO ANGLED BUCKET B ACUITY – CAPTURE IMAGE	6B (Angled)	R	TL	T	BL	B
17	ALIGN TO TOP BUCKET A FACING LANDING – CAPTURE IMAGE	6A	5 POINTS FOR ALIGNMENT				
18	ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	6A (Angled)	TR	B	TR	L	BR
19	ALIGN TO TOP BUCKET A FACING LANDING – CAPTURE IMAGE	6A	5 POINTS FOR ALIGNMENT				
20	ALIGN TO ANGLED BUCKET A ACUITY – CAPTURE IMAGE	6A (Angled)	TR	B	TR	L	BR
	CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LANDING CENTERED FACING STANDS						
	IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON:		APPARATUS	GROUND	BOUNDARY	SAFETY	

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINIMUM SCORE (CIRCLE ONE)

FAIL ____ PASS

Obstructed Lane: Avoid

MAN/PAY 10

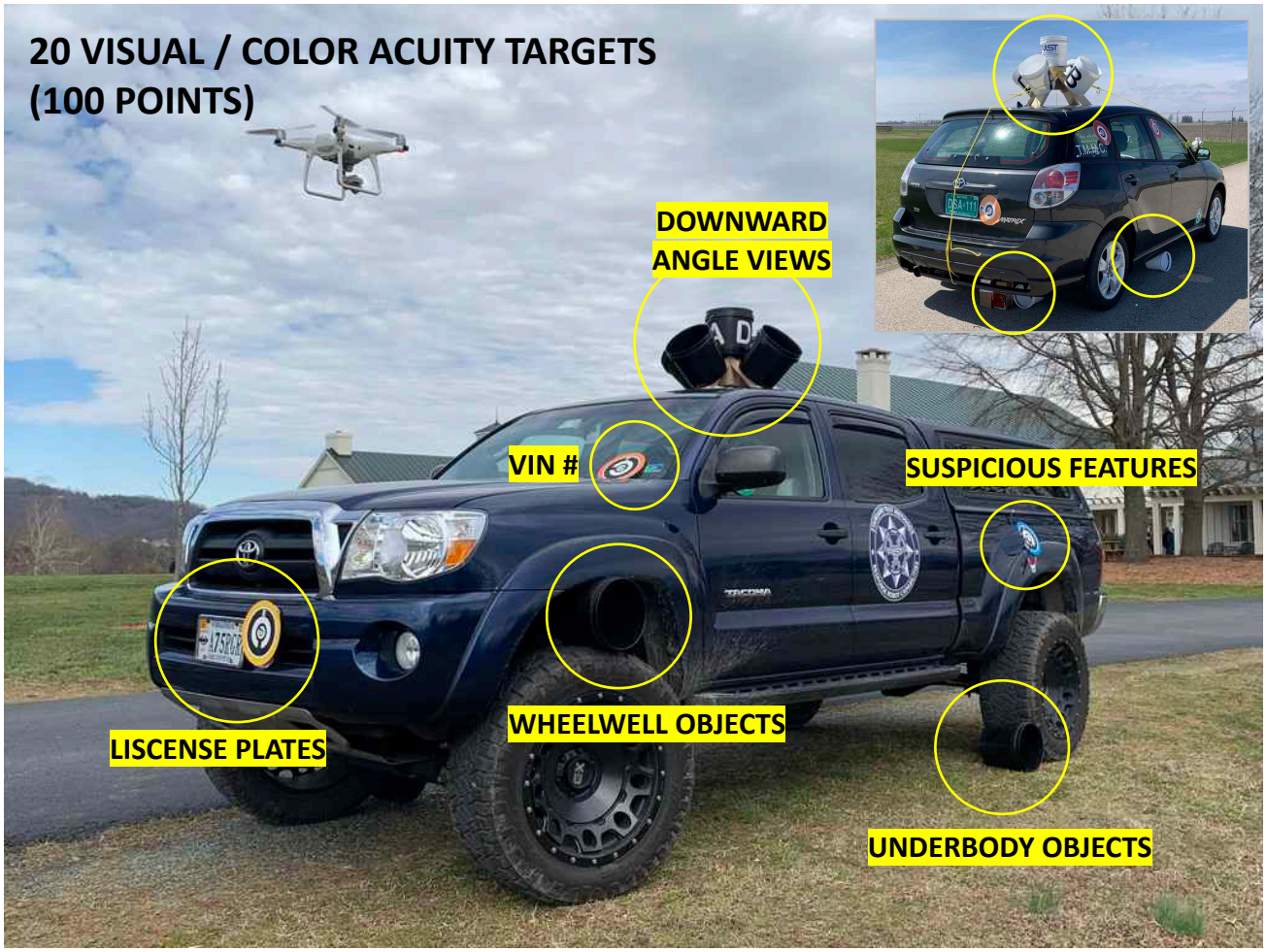
Bucket #	Trial Notes
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

_____	_____	_____
PILOT NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
OTHER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
PROCTOR NAME	ORGANIZATION	SIGNATURE

Vehicle Inspection

TRAINING SCENARIO



*If your training aircraft camera has a limited range of motion, align with as many buckets as possible.
Pilot proficiency should only be compared using similar systems.

Vehicle Inspection

TRAINING SCENARIO

Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LOCATION	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE WITH SOME INTERFACE	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	10 MIN	20 MIN	____ MIN
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)			____ MPH	____ MPH	(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

SCENARIO | VEHICLE INSPECTION		FORMS ANSWER KEY VERSION 2020B					
	CAPTURE IMAGE OF CLOCK – LAUNCH FROM PLATFORM	CIRCLE WHEN ALIGNED	CIRCLE RING GAP DIRECTION WHEN CORRECT				
0	ROOF OMNI STAND – INSIDE TOP BUCKET NUMBER Identify Acuity or Disk Insert to Determine if Inspection is Needed	#	#____				
1	FRONT – ROOFTOP ANGLED **BUCKET A**	A1	T	BL	R	BR	L
2	FRONT – EXTERIOR FEATURE (**LICENSE PLATE**)	A2	TR	B	TR	L	BR
3	FRONT – EXTERIOR FEATURE (**VIN #**)	A3	R	TL	T	BL	B
4	FRONT – INTERIOR FEATURE (**DRIVER HEADREST**)	A4	BR	R	TL	L	BR
5	FRONT – INTERIOR FEATURE (**PASSENGER HEADREST**)	A5	B	TL	R	BL	T
6	PASSENGER – ROOFTOP ANGLED **BUCKET B**	B1	BL	T	BR	R	TL
7	PASSENGER – EXTERIOR FEATURE (**LIGHTED**)	B2	L	BR	T	TL	R
8	PASSENGER – UNDERBODY BUCKET (**SHADOW**)	B3	TL	R	TR	L	BR
9	PASSENGER – INTERIOR FEATURE (**PASSENGER SEAT**)	B4	T	BL	R	TL	B
10	PASSENGER – INTERIOR FEATURE (**CONSOLE, FLOOR, OR REAR**)	B5	TR	B	TL	B	BL
11	REAR – ROOFTOP ANGLED **BUCKET C**	C1	R	TL	B	BL	R
12	REAR – EXTERIOR FEATURE (**LICENSE PLATE**)	C2	BR	T	TL	R	BL
13	REAR – UNDERBODY BUCKET (**SHADOW**)	C3	B	TR	R	BL	T
14	REAR – INTERIOR FEATURE (**REARWARD VIEWABLE**)	C4	BL	R	BL	T	BR
15	REAR – INTERIOR FEATURE (**REARWARD VIEWABLE**)	C5	L	TL	R	BR	T
16	DRIVER – ROOFTOP ANGLED **BUCKET D**	D1	TL	B	TR	R	BR
17	DRIVER – EXTERIOR FEATURE (**LIGHTED**)	D2	T	BL	B	TR	L
18	DRIVER – UNDERBODY BUCKET (**SHADOW**)	D3	TR	L	BL	R	TL
19	DRIVER – INTERIOR FEATURE (**DRIVER SEAT**)	D4	R	BL	T	TR	B
20	DRIVER – INTERIOR FEATURE (**CONSOLE, FLOOR, OR REAR**)	D5	BR	B	TL	B	TR

LAND ON PLATFORM – CAPTURE IMAGE OF CLOCK -- END OF TRIAL

IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: | APPARATUS | GROUND | BOUNDARY | SAFETY |

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

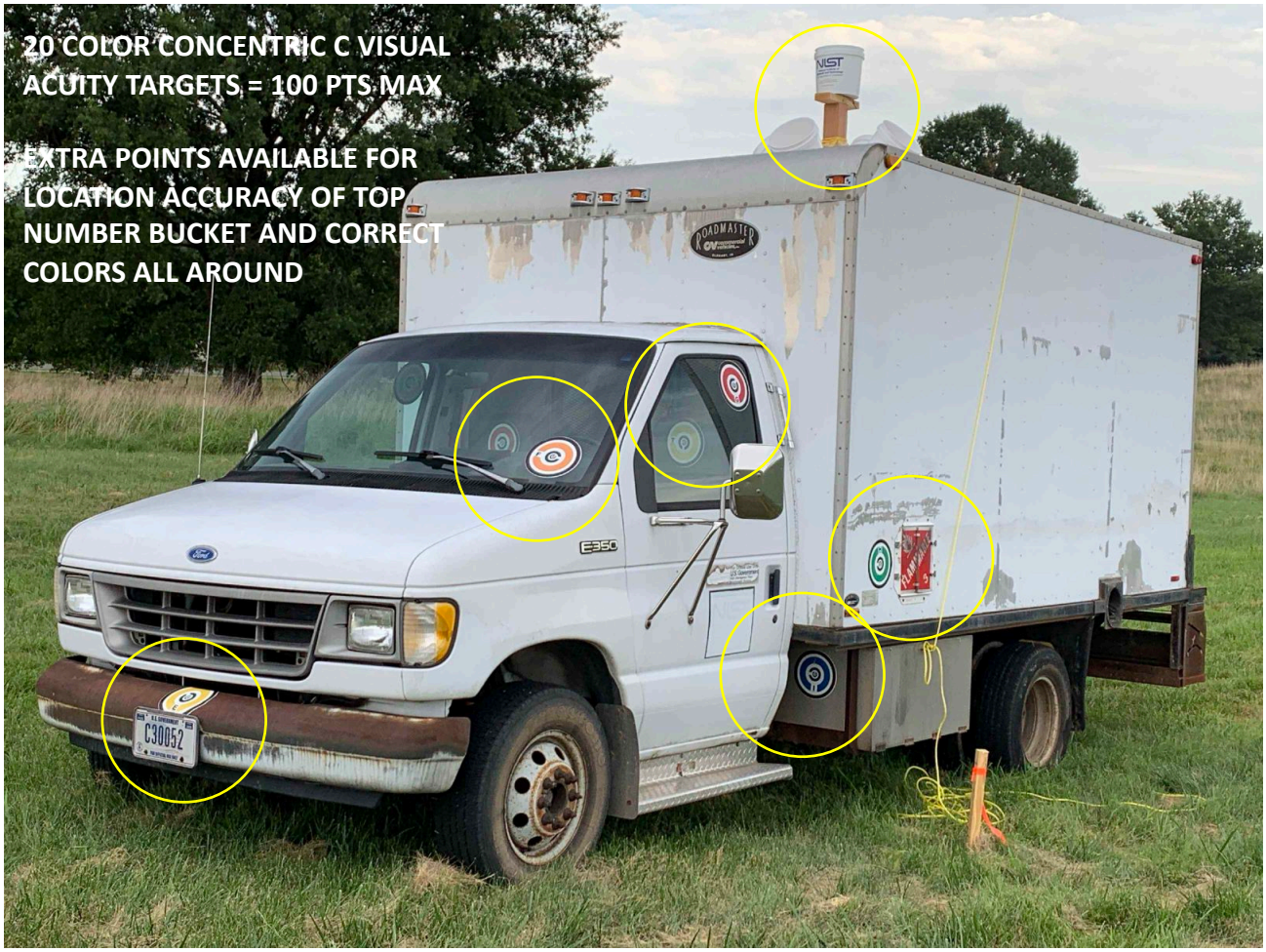
CORRECT GAPS / MINUTES

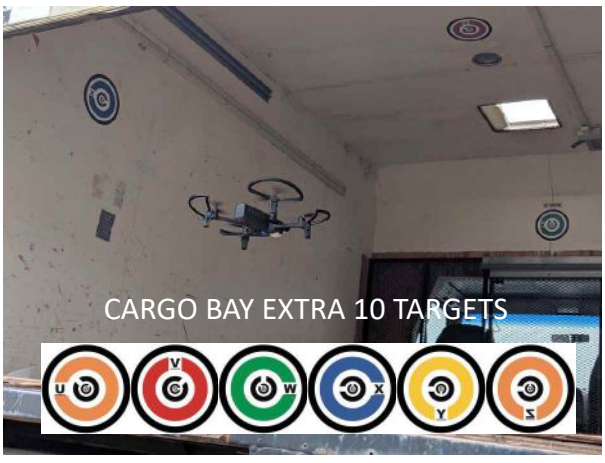
WRITE MINUMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

Box Truck Inspection

TRAINING SCENARIO





*If your training aircraft camera has a limited range of motion, align with as many buckets as possible.
Pilot proficiency should only be compared using similar systems.

Box Truck Inspection

TRAINING SCENARIO

Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LOCATION	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE WITH SOME INTERFACE	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	10 MIN	20 MIN	____ MIN
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)			____ MPH	____ MPH	(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

SCENARIO | VEHICLE INSPECTION

FORMS ANSWER KEY VERSION 2020B

	CAPTURE IMAGE OF CLOCK – LAUNCH FROM PLATFORM	CIRCLE WHEN ALIGNED		CIRCLE RING GAP DIRECTION WHEN CORRECT				
0	ROOF OMNI STAND – INSIDE TOP BUCKET NUMBER Identify Acuity or Disk Insert to Determine if Inspection is Needed	#	#____					
1	FRONT – ROOFTOP ANGLED **BUCKET A**		A1	T	BL	R	BR	L
2	FRONT – EXTERIOR FEATURE (**LICENSE PLATE**)		A2	TR	B	TR	L	BR
3	FRONT – EXTERIOR FEATURE (**VIN #**)		A3	R	TL	T	BL	B
4	FRONT – INTERIOR FEATURE (**DRIVER HEADREST**)		A4	BR	R	TL	L	BR
5	FRONT – INTERIOR FEATURE (**PASSENGER HEADREST**)		A5	B	TL	R	BL	T
6	PASSENGER – ROOFTOP ANGLED **BUCKET B**		B1	BL	T	BR	R	TL
7	PASSENGER – EXTERIOR FEATURE (**LIGHTED**)		B2	L	BR	T	TL	R
8	PASSENGER – UNDERBODY BUCKET (**SHADOW**)		B3	TL	R	TR	L	BR
9	PASSENGER – INTERIOR FEATURE (**PASSENGER SEAT**)		B4	T	BL	R	TL	B
10	PASSENGER – INTERIOR FEATURE (**CONSOLE, FLOOR, OR REAR**)		B5	TR	B	TL	B	BL
11	REAR – ROOFTOP ANGLED **BUCKET C**		C1	R	TL	B	BL	R
12	REAR – EXTERIOR FEATURE (**LICENSE PLATE**)		C2	BR	T	TL	R	BL
13	REAR – UNDERBODY BUCKET (**SHADOW**)		C3	B	TR	R	BL	T
14	REAR – INTERIOR FEATURE (**REARWARD VIEWABLE**)		C4	BL	R	BL	T	BR
15	REAR – INTERIOR FEATURE (**REARWARD VIEWABLE**)		C5	L	TL	R	BR	T
16	DRIVER – ROOFTOP ANGLED **BUCKET D**		D1	TL	B	TR	R	BR
17	DRIVER – EXTERIOR FEATURE (**LIGHTED**)		D2	T	BL	B	TR	L
18	DRIVER – UNDERBODY BUCKET (**SHADOW**)		D3	TR	L	BL	R	TL
19	DRIVER – INTERIOR FEATURE (**DRIVER SEAT**)		D4	R	BL	T	TR	B
20	DRIVER – INTERIOR FEATURE (**CONSOLE, FLOOR, OR REAR**)		D5	BR	B	TL	B	TR

LAND ON PLATFORM – CAPTURE IMAGE OF CLOCK -- END OF TRIAL

IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: | APPARATUS | GROUND | BOUNDARY | SAFETY |

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

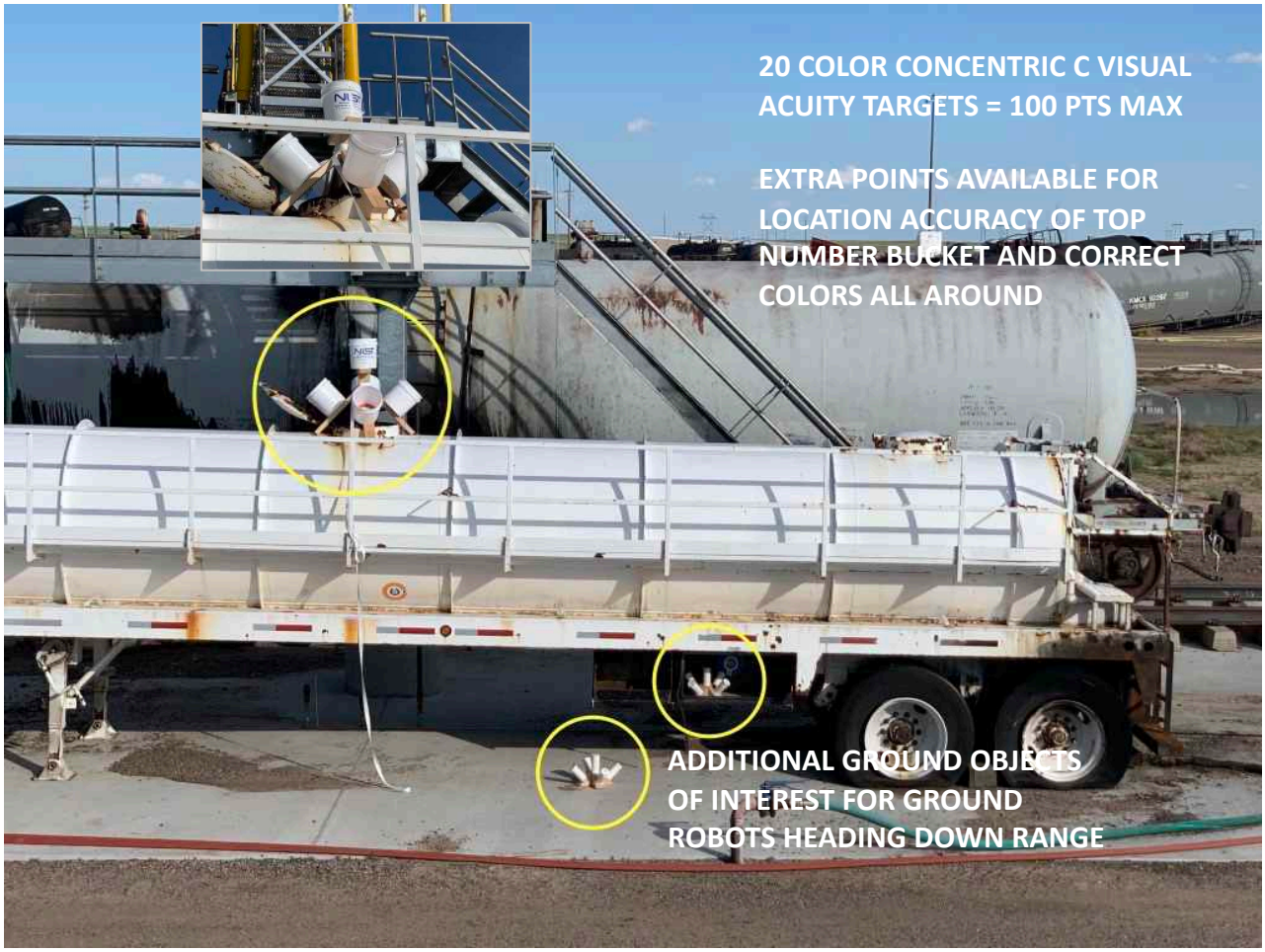
CORRECT GAPS / MINUTES

WRITE MINUMUM SCORE
(CIRCLE ONE)

FAIL ___ PASS

Fuel Truck Inspection

TRAINING SCENARIO



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Pilot proficiency should only be compared using similar systems.

Fuel Truck Inspection

TRAINING SCENARIO

Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LOCATION	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE WITH SOME INTERFACE	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	10 MIN	20 MIN	____ MIN
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)			____ MPH	____ MPH	(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

SCENARIO | VEHICLE INSPECTION		FORMS ANSWER KEY VERSION 2020B					
CAPTURE IMAGE OF CLOCK – LAUNCH FROM PLATFORM		CIRCLE WHEN ALIGNED	CIRCLE RING GAP DIRECTION WHEN CORRECT				
0	ROOF OMNI STAND – INSIDE TOP BUCKET NUMBER Identify Acuity or Disk Insert to Determine if Inspection is Needed	# #____					
1	FRONT – ROOFTOP ANGLED **BUCKET A**	A1	T	BL	R	BR	L
2	FRONT – EXTERIOR FEATURE (**LICENSE PLATE**)	A2	TR	B	TR	L	BR
3	FRONT – EXTERIOR FEATURE (**VIN #**)	A3	R	TL	T	BL	B
4	FRONT – INTERIOR FEATURE (**DRIVER HEADREST**)	A4	BR	R	TL	L	BR
5	FRONT – INTERIOR FEATURE (**PASSENGER HEADREST**)	A5	B	TL	R	BL	T
6	PASSENGER – ROOFTOP ANGLED **BUCKET B**	B1	BL	T	BR	R	TL
7	PASSENGER – EXTERIOR FEATURE (**LIGHTED**)	B2	L	BR	T	TL	R
8	PASSENGER – UNDERBODY BUCKET (**SHADOW**)	B3	TL	R	TR	L	BR
9	PASSENGER – INTERIOR FEATURE (**PASSENGER SEAT**)	B4	T	BL	R	TL	B
10	PASSENGER – INTERIOR FEATURE (**CONSOLE, FLOOR, OR REAR**)	B5	TR	B	TL	B	BL
11	REAR – ROOFTOP ANGLED **BUCKET C**	C1	R	TL	B	BL	R
12	REAR – EXTERIOR FEATURE (**LICENSE PLATE**)	C2	BR	T	TL	R	BL
13	REAR – UNDERBODY BUCKET (**SHADOW**)	C3	B	TR	R	BL	T
14	REAR – INTERIOR FEATURE (**REARWARD VIEWABLE**)	C4	BL	R	BL	T	BR
15	REAR – INTERIOR FEATURE (**REARWARD VIEWABLE**)	C5	L	TL	R	BR	T
16	DRIVER – ROOFTOP ANGLED **BUCKET D**	D1	TL	B	TR	R	BR
17	DRIVER – EXTERIOR FEATURE (**LIGHTED**)	D2	T	BL	B	TR	L
18	DRIVER – UNDERBODY BUCKET (**SHADOW**)	D3	TR	L	BL	R	TL
19	DRIVER – INTERIOR FEATURE (**DRIVER SEAT**)	D4	R	BL	T	TR	B
20	DRIVER – INTERIOR FEATURE (**CONSOLE, FLOOR, OR REAR**)	D5	BR	B	TL	B	TR
LAND ON PLATFORM – CAPTURE IMAGE OF CLOCK -- END OF TRIAL							
IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: | APPARATUS | GROUND | BOUNDARY | SAFETY |							

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINUMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

Wide Area Search

TRAINING SCENARIO

All Basic Lane Buckets
https://drive.google.com/open?id=1NOrHY3UH98fUeXKyffnQwt6-h5ewoeqU

Letters - INSERT DISCS FOR MAN
https://drive.google.com/open?id=1FoQvoKkOu5iUC4bJJNM7TailCWWs-C3_

Concentric Cs Black - SENSOR PANELS
https://drive.google.com/open?id=1YxY1_26dn1KB0FHfleU4Xna_gxHzw98L

Concentric Cs Color - SCENARIOS
https://drive.google.com/open?id=198sR8TzRB4TKtvZvHcAuXRWdgS35Thzj

Misc Hazmats, Directions, Plates, Images
https://drive.google.com/open?id=1nuHyZS9ARZ6KkF_vJZKbhO6qwEo4UlkM

Xtra Bucket Stands for Scenarios
https://drive.google.com/open?id=1RklQazk4r8ZyUPJxidjlNpVyF-ZNRCrn

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible.
Pilot proficiency should only be compared using similar systems.

Wide Area Search

TRAINING SCENARIO

Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LOCATION	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE WITH SOME INTERFACE	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	10 MIN	20 MIN	____ MIN
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)			____ MPH	____ MPH	(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

SCENARIO | WIDE AREA SEARCH		FORMS ANSWER KEY VERSION 2020B					
CAPTURE IMAGE OF CLOCK – LAUNCH FROM PLATFORM		CIRCLE WHEN ALIGNED	CIRCLE RING GAP DIRECTION WHEN CORRECT				
1	***WRITE STAND LOCATION, IDENTIFY TOP –> A –> LEFTWARD***	1	T	BL	R	BR	L
2	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	1A	TR	B	TR	L	BR
3	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	1B	R	TL	T	BL	B
4	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	1C	BR	R	TL	L	BR
5	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	1D	B	TL	R	BL	T
6	***WRITE STAND LOCATION, IDENTIFY TOP –> A –> RIGHTWARD***	2	BL	T	BR	R	TL
7	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	2A	L	BR	T	TL	R
8	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	2D	TR	B	TL	B	BL
9	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	2C	T	BL	R	TL	B
10	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	2B	TL	R	TR	L	BR
11	***WRITE STAND LOCATION, IDENTIFY TOP –> A –> LEFTWARD***	3	R	TL	B	BL	R
12	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	3A	BR	T	TL	R	BL
13	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	3B	B	TR	R	BL	T
14	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	3C	BL	R	BL	T	BR
15	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	3D	L	TL	R	BR	T
16	***WRITE STAND LOCATION, IDENTIFY TOP –> A –> RIGHTWARD***	4	TL	B	TR	R	BR
17	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	4A	T	BL	B	TR	L
18	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	4D	BR	B	TL	B	TR
19	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	4C	R	BL	T	TR	B
20	*WRITE INSERTED OBJECT DESCRIPTION (IF ANY)*	4B	TR	L	BL	R	TL

LAND ON PLATFORM – CAPTURE IMAGE OF CLOCK -- END OF TRIAL

IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: | APPARATUS | GROUND | BOUNDARY | SAFETY |

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINUMUM SCORE (CIRCLE ONE)

FAIL ____ PASS

TRAINING SCENARIO

Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

BUCKET DIAM.	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
10 CM (4 IN)	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE WITH SOME INTERFACE	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	10 MIN	20 MIN	____ MIN
20 CM (8 IN)				____ MPH	____ MPH					
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)					(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

OBSTRUCTED LANE | SCENARIO 1-10		FORMS ANSWER KEY VERSION 2020B					
	CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LAUNCH	CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1		1 (Straight)	5 POINTS FOR ALIGNMENT				
2		1 (Angled)	T	BL	R	BR	L
3		2 (Straight)	5 POINTS FOR ALIGNMENT				
4		2 (Angled)	TR	B	TR	L	BR
5		3 (Straight)	5 POINTS FOR ALIGNMENT				
6		3 (Angled)	R	TL	T	BL	B
7		4 (Straight)	5 POINTS FOR ALIGNMENT				
8		4 (Angled)	BR	R	TL	L	BR
9		5 (Straight)	5 POINTS FOR ALIGNMENT				
10		5 (Angled)	B	TL	R	BL	T
11		6 (Straight)	5 POINTS FOR ALIGNMENT				
12		6 (Angled)	BL	TL	BR	R	TL
13		7 (Straight)	5 POINTS FOR ALIGNMENT				
14		7 (Angled)	L	BR	T	TL	R
15		8 (Straight)	5 POINTS FOR ALIGNMENT				
16		8 (Angled)	TL	R	TR	L	BR
17		9 (Straight)	5 POINTS FOR ALIGNMENT				
18		9 (Angled)	T	BL	R	TL	B
19		10 (Straight)	5 POINTS FOR ALIGNMENT				
20		10 (Angled)	TR	B	TL	B	BL
CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LANDING CENTERED FACING STANDS							
IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: APPARATUS GROUND BOUNDARY SAFETY							

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINIMUM SCORE (CIRCLE ONE)

FAIL ___ PASS

TRAINING SCENARIO

Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

BUCKET DIAM.	LIGHTING			WIND		PILOT VIEW		TIME LIMIT		
10 CM (4 IN)	DAYLIGHT 1000+ LUX	LIGHTED 300+ LUX	DARK < 1 LUX	AVERAGE	GUSTS	EYES ON FACING LANE WITH SOME INTERFACE	BVLOS BACK TO LANE INTERFACE ONLY WITH V.O.	10 MIN	20 MIN	____ MIN
20 CM (8 IN)				____ MPH	____ MPH					
(CIRCLE ONE OR FILL IN)	(CIRCLE ONE)					(CIRCLE ONE)		(CIRCLE ONE OR FILL IN)		

OBSTRUCTED LANE | SCENARIO 11-20 — FORMS ANSWER KEY VERSION 2020B

	CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LAUNCH	CIRCLE WHEN ALIGNED	CIRCLE GAP DIRECTION WHEN CORRECT				
1		11 (Straight)	5 POINTS FOR ALIGNMENT				
2		11 (Angled)	R	TL	B	BL	R
3		12 (Straight)	5 POINTS FOR ALIGNMENT				
4		12 (Angled)	BR	T	TL	R	BL
5		13 (Straight)	5 POINTS FOR ALIGNMENT				
6		13 (Angled)	B	TR	R	BL	T
7		14 (Straight)	5 POINTS FOR ALIGNMENT				
8		14 (Angled)	BL	R	BL	T	BR
9		15 (Straight)	5 POINTS FOR ALIGNMENT				
10		15 (Angled)	L	TL	R	BR	T
11		16 (Straight)	5 POINTS FOR ALIGNMENT				
12		16 (Angled)	TL	B	TR	R	BL
13		17 (Straight)	5 POINTS FOR ALIGNMENT				
14		17 (Angled)	T	BL	B	TR	L
15		18 (Straight)	5 POINTS FOR ALIGNMENT				
16		18 (Angled)	TR	L	BL	TL	R
17		19 (Straight)	5 POINTS FOR ALIGNMENT				
18		19 (Angled)	R	BL	T	TR	B
19		20 (Straight)	5 POINTS FOR ALIGNMENT				
20		20 (Angled)	BR	B	TL	B	TR

CAPTURE IMAGE OF CLOCK BEFORE OR AFTER LANDING CENTERED FACING STANDS

IF A FAULT OCCURS, STRIKE THROUGH THE ENTIRE TRIAL AND CIRCLE THE REASON: APPARATUS GROUND BOUNDARY SAFETY

SOURCE

PILOT (CIRCLE ONE) IMAGES

MAN SCORE (MAX=20)

CORRECT ALIGNMENTS OF 20

RELIABILITY (%)

CORRECT ALIGNMENTS / ATTEMPTED X100

EFFICIENCY (RATE)

CORRECT ALIGNMENTS / MINUTES

PAY SCORE (MAX=100)

CORRECT GAPS

AVERAGE ACUITY (GAPS)

CORRECT GAPS / CORRECT ALIGNMENTS

EFFICIENCY (RATE)

CORRECT GAPS / MINUTES

WRITE MINIMUM SCORE (CIRCLE ONE)

FAIL ____ PASS

OTHER TESTS

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency should only be compared using similar systems.

Endurance (ENERGY)

Basic Maneuvering

FLY 5X FAST TO A STABLE HOVER

Fly at maximum sustained speed on a line both horizontally and vertically. Align to see the entire inscribed ring inside the buckets.

1point per bucket alignment

NOT QUITE ALIGNED

Procedure: Complete 5 laps with 20 flight paths total (2 horizontal and 2 vertical flight paths per lap). Start at X altitude centered over Bucket 3. Maneuver along the designated horizontal and vertical flight paths at the maximum sustained speed possible. Align with each designated bucket to see the entire inscribed ring. Stopping is allowed. A single screenshot of each bucket alignment can be captured for verification if necessary. Continue until the trial is complete or the timer expires.

Form Fill-in: Circle the **bucket number** (shown in green) for each successfully aligned bucket, or strike through if missed. Circle a **FAULT** (shown in red) and strike through the entire lap if there is any contact with an apparatus or the ground, or if the drone leaves the lane for any reason.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible.
Pilot proficiency should only be compared using similar systems.

Deliver

Purpose

Procedure:
Complete 5 payload deliveries downrange to Bucket Stand #4 either by dropping from altitude 2(S) or placing on the ground around it.

Start at the Launch Platform with the payload attached. Launch and fly to a stable hover at altitude 2(S) centered over Bucket 3 and Bucket 1 simultaneously. Maneuver along the designated flight path until over the drop zone. Place or drop the payload as close to the center of the drop zone as possible and pause the timer. A single screenshot of the stable hover bucket alignments and/or over the drop zone can be captured for verification if necessary, including the final location of the payload on the ground within the marked concentric circle targets. Continue until the trial is complete or the timer expires.

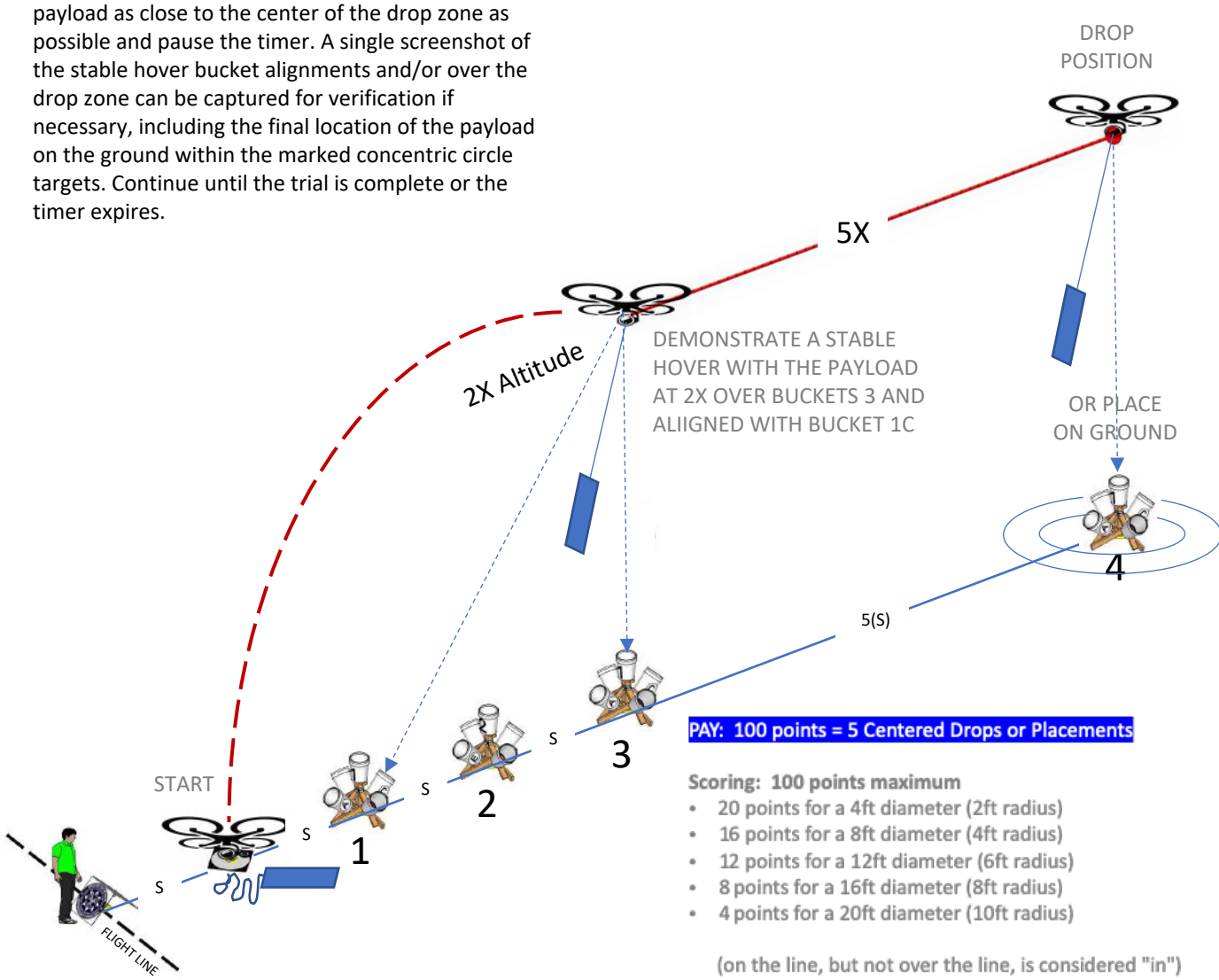
Payload Functionality

PLACE OR DROP PAYLOAD ACCURATELY


ALIGNED

Hover stably with the payload, fly the designated 5X path, and PLACE or DROP the payload as close to the center of the drop zone as possible.

4-20 points for proximity to center



PAY: 100 points = 5 Centered Drops or Placements

Scoring: 100 points maximum

- 20 points for a 4ft diameter (2ft radius)
- 16 points for a 8ft diameter (4ft radius)
- 12 points for a 12ft diameter (6ft radius)
- 8 points for a 16ft diameter (8ft radius)
- 4 points for a 20ft diameter (10ft radius)

(on the line, but not over the line, is considered "in")

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Deliver Payload

Basic Maneuvering (MAN)

ALIGN WITH BUCKETS

Align with the 20 designated buckets long enough to capture a single image (NO ZOOM) showing a continuous green ring inside each bucket. The numbers and letters are bucket identifiers.

1 point per successfully aligned image
SCORE UP TO 20 POINTS

Payload Functionality (PAY)

PLACE OR DROP PAYLOAD ACCURATELY

Hover stably with the payload, fly straight and level over the lane centerline to the far end and back, then PLACE or DROP the payload as close to center of the Launch/Land Platform as possible.

4-20 points for proximity to center
SCORE UP TO 100 POINTS

OPTIONAL PAYLOAD:
PVC PIPE/CAPS
FILLED WITH
FASTENERS
TO 1/2 AND FULL
AIRCRACT CAPACITY
(TAPE COLOR CODE)

PAY: 100 points = 5 Centered Drops or Placements

Scoring: 100 points maximum

- 20 points for a 4ft diameter (2ft radius)
- 16 points for a 8ft diameter (4ft radius)
- 12 points for a 12ft diameter (6ft radius)
- 8 points for a 16ft diameter (8ft radius)
- 4 points for a 20ft diameter (10ft radius)

Be sure to capture a clear image of the CLOCK JUST BEFORE OR AFTER LAUNCH and LANDING to document the date, start time, and elapsed time of the trial.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Deliver Payload

Purpose

This test method evaluates the accuracy of payload deliveries either by placing or dropping a weighted package in a designated drop zone. It can be used to evaluate system capabilities, as a repeatable training task, or as an evaluation of remote pilot proficiency.

Summary of Test

The pilot operates within line of sight of the lane and the aircraft or with their back turned to the lane to represent flying beyond visual line of sight (BVLOS) with a visual observer (VO) to ensure safety.

The aircraft launches with the payload attached to the aircraft and verifies it can maintain a stable hover at the designated altitude by aligning with the omni bucket stands. The aircraft flies down range straight and level to the far end of the lane and aligns over the bucket stand 8(S) down range. Then flies back up range to a stable hover over the drop zone using the bucket stands to verify the hover position and altitude prior to dropping or placing the payload as close to the center of the Launch/Land Platform as possible. The resulting radius of the settled payload from the center of the Launch/Land Platform is the measure of success.

Procedure

- Start on the Launch Platform facing down-range with the payload attached (capture a clock image).
- Launch to a stable hover directly over the Launch/Land Platform at the designated altitude.
- Align with the Launch/Land platform directly below to verify position (capture an alignment image).
- Align with the “A” bucket on the appropriate omni bucket stand to verify altitude (capture an alignment image).
- Fly down-range straight and level over the lane centerline to a stable hover directly over bucket stand #4 and align with the top bucket (capture an alignment image).
- Rotate 180 degrees and align again with the top bucket inverted (capture an alignment image).
- Fly up-range straight and level along the lane centerline. Use the angled “C” buckets as moving alignments to verify you remain over the centerline with the drag effects of the payload.
- Establish a stable hover over the Launch/Land Platform and rotate 180 degrees.
- Align with the “A” bucket on the appropriate bucket stand (capture an alignment image).
- Align downward over center of the Launch/Land Platform (capture an alignment image).
- Drop or place the payload as close to the center of the Launch/Land Platform as possible.
- Hover at any altitude necessary to capture an image of the resulting payload location relative to the center of the Launch/Land platform.
- Land the aircraft in view of the clock (capture of clock image).
- Measure the settled payload radius from center of Launch/Land Platform.

Metrics (in order of priority)

1. *Completeness* = the number of target identifications performed
2. *Points (Overall Acuity)* = drop/place distances from center (Assuming a *Complete* trial)
3. *Reliability* = (points / attempts) x 100 = ____ %. (Assuming a *Complete* trial)
4. *Efficiency* = points / elapsed time = ____ points/minute (Assuming a *Complete* and *Reliable* trial)

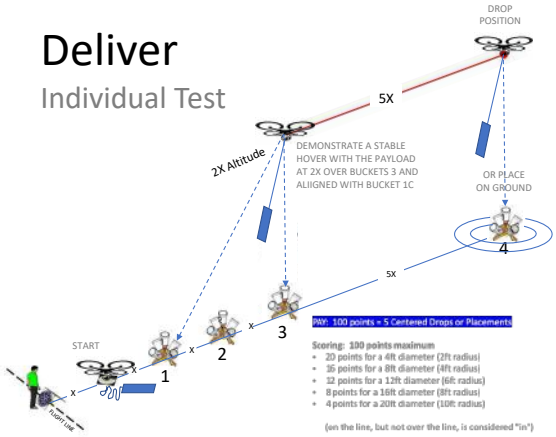
Form Fill-In:

- Circle the IDENTIFIER (shown in green) for successfully aligned targets, or strike through it if missed.
- Circle the GAP DIRECTION (shown in blue) for correctly identified gaps, or strike through it if missed.
- Circle the FAULT (shown in red) if there is any contact with the apparatus, ground, or safety enclosure. Or if the aircraft leaves the lane for any reason. Faults force an end of trial for safety concerns.

*If your training aircraft camera has a limited range of motion, align with as many buckets as possible. Pilot proficiency is only compared using similar systems.

Deliver

Individual Test



Robot Make: _____

Robot Model: _____

Robot Config: _____

Pilot Code : _____ VO Code: _____

Facility : _____

YYYY-MM-DD : _____

Time (2400): _____ Lane #: _____

LANE SPACING S	LIGHTING	WIND	PILOT VIEW	TIME LIMIT
10 FT 20 FT 30 FT _____ FT (CIRCLE ONE OR FILL IN)	DAYLIGHT 1000+ LUX LIGHTED 300+ LUX DARK < 1 LUX (CIRCLE ONE)	AVERAGE _____ MPH GUSTS _____ MPH	EYES ON FACING LANE WITH SOME INTERFACE BVLOS BACK TO LANE INTERFACE ONLY WITH V.O. (CIRCLE ONE)	5 MIN 10 MIN ____ MIN (CIRCLE ONE OR FILL IN)

PROCEDURE | **DELIVER PAYLOAD (PLACE OR DROP)**		CIRCLE ONE PER OCCURANCE:	FAULT	FAULT	FAULT		
ATTACH PAYLOAD AT LAUNCH/LAND PLATFORM		CIRCLE WHEN ALIGNED	CIRCLE POINTS FOR PLACE/DROP CIRCLE DIAMETER				
1	START TIMER AT LAUNCH FROM PLATFORM	3					
2	FLY TO 2X | ALIGN WITH BUCKETS 3 AND 1C	1C					
3	FLY 5X DOWN RANGE | ALIGN WITH BUCKET 4	4	4 ft	8 ft	12 ft	16 ft	20 ft
4	PLACE OR DROP PAYLOAD AND PAUSE TIMER	PLACE or DROP	20 pts	16 pts	12 pts	8 pts	4 pts
5	START TIMER AT LAUNCH FROM PLATFORM	3					
6	FLY TO 2X | ALIGN WITH BUCKETS 3 AND 1C	1C					
7	FLY 5X DOWN RANGE | ALIGN WITH BUCKET 4	4	4 ft	8 ft	12 ft	16 ft	20 ft
8	PLACE OR DROP PAYLOAD AND PAUSE TIMER	PLACE or DROP	20 pts	16 pts	12 pts	8 pts	4 pts
9	START TIMER AT LAUNCH FROM PLATFORM	3					
10	FLY TO 2X | ALIGN WITH BUCKETS 3 AND 1C	1C					
11	FLY 5X DOWN RANGE | ALIGN WITH BUCKET 4	4	4 ft	8 ft	12 ft	16 ft	20 ft
12	PLACE OR DROP PAYLOAD AND PAUSE TIMER	PLACE or DROP	20 pts	16 pts	12 pts	8 pts	4 pts
13	START TIMER AT LAUNCH FROM PLATFORM	3					
14	FLY TO 2X | ALIGN WITH BUCKETS 3 AND 1C	1C					
15	FLY 5X DOWN RANGE | ALIGN WITH BUCKET 4	4	4 ft	8 ft	12 ft	16 ft	20 ft
16	PLACE OR DROP PAYLOAD AND PAUSE TIMER	PLACE or DROP	20 pts	16 pts	12 pts	8 pts	4 pts
17	START TIMER AT LAUNCH FROM PLATFORM	3					
18	FLY TO 2X | ALIGN WITH BUCKETS 3 AND 1C	1C					
19	FLY 5X DOWN RANGE | ALIGN WITH BUCKET 4	4	4 ft	8 ft	12 ft	16 ft	20 ft
20	PLACE OR DROP PAYLOAD AND PAUSE TIMER	PLACE or DROP	20 pts	16 pts	12 pts	8 pts	4 pts
END OF TRIAL - STOP THE TIMER							

RESULTS

PILOT (CIRCLE ONE) VIDEO

PAY 5 SCORE

TOTAL POINTS

of 100

AVERAGE DIAMETER

TOTAL DIAMETERS / PAYLOADS

FT

AVERAGE SPEED

(PAYLOADS x 5X) / MINUTES

FT/MIN

MAX DISTANCE (25X)

IF X = 10 FT, DISTANCE = 250 FT

IF X = 20 FT, DISTANCE = 500 FT

IF X = 30 FT, DISTANCE = 750 FT

IF X = __ FT, DISTANCE = ____ FT

Deliver

Individual Test

Bucket #	Trial Notes
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SIGNATURES “ATTESTING” THE SCORES ARE CORRECT

_____	_____	_____
PILOT NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
VISUAL OBSERVER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
OTHER NAME	ORGANIZATION	SIGNATURE
_____	_____	_____
PROCTOR NAME	ORGANIZATION	SIGNATURE