ASTM E54.09 Homeland Security Applications; Response Robots Aerial Tests: Introduction, Recent Events, and Use Case Examples

Version 2022A

STARTS AT 10:00 AM EST WASHINGTON, DC TIME

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Intelligent Systems Division
National Institute of Standards and Technology
U.S. Department of Commerce

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Call To Order

Introduction

- Reminder that electronic recording of ASTM meetings is prohibited.
- Meeting will run in accordance with the ASTM Antitrust Statement.

Antitrust Statement (also in meeting minutes)

ASTM International is a not-for-profit organization and developer of voluntary consensus standards. ASTM's leadership in international standards development is driven by the contributions of its members: more than 30,000 technical experts and business professionals representing 135 countries.

The purpose of antitrust laws is to preserve economic competition in the marketplace by prohibiting, among other things, unreasonable restraints of trade. In ASTM activities, it is important to recognize that participants often represent competitive interests. Antitrust laws require that all competition be open and unrestricted.

It is ASTM's policy, and the policy of each of its committees and subcommittees, to conduct all business and activity in full compliance with international, federal and state antitrust and competition laws. The ASTM Board of Directors has adopted an antitrust policy which is found in Section 19 of ASTM Regulations Governing Technical Committees. All members need to be aware of and compliant with this policy. The Regulations are accessible on the ASTM website (http://www.astm.org/COMMIT/Regs.pdf) and copies of the antitrust policy are available at the registration desk. ***For a complete list of standards, see:*** *http://www.astm.org/COMMIT/SUBCOMMIT/E5409.htm*

Objective

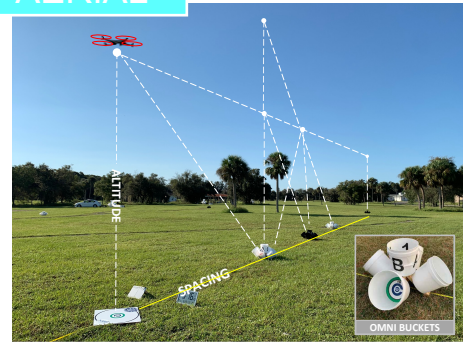
Introduction

Remotely operated robots, including ground, aerial, and aquatic systems, enable emergency responders to perform extremely hazardous tasks from safer stand-off distances.

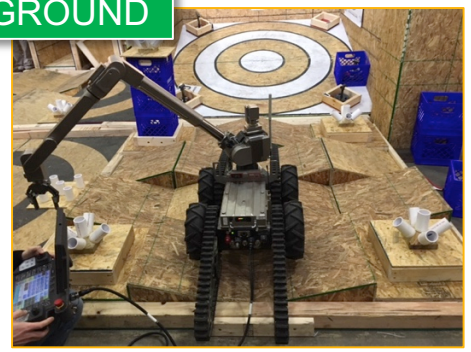
Standard test methods help researchers, manufacturers, and users objectively evaluate system capabilities to align with mission requirements.

We're developing the measurements and standards infrastructure necessary to *quantitatively evaluate and compare* robotic system capabilities and remote operator proficiency.

AERIAL



GROUND



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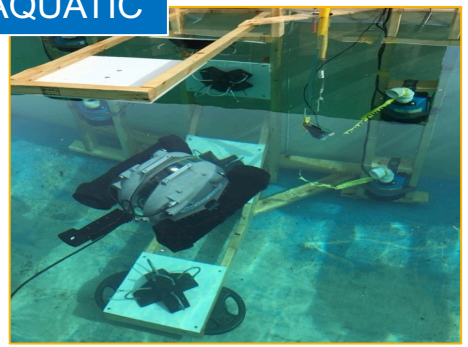
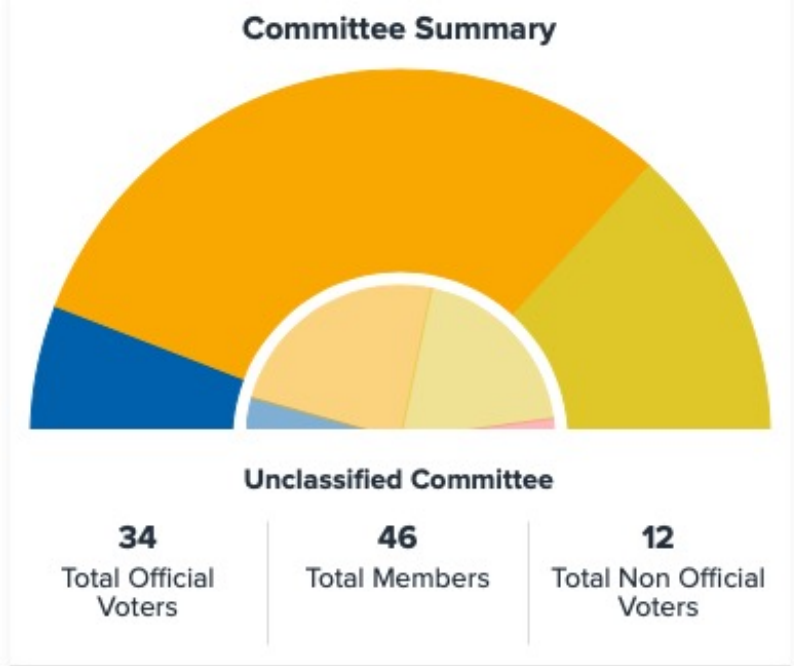


Committee

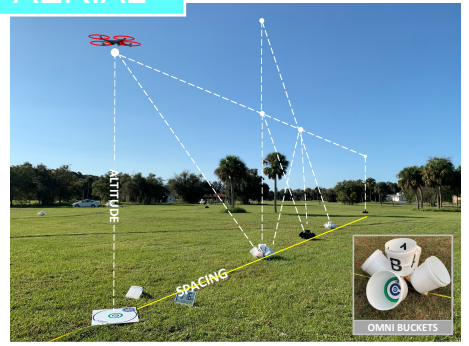
Introduction



46 MEMBERS

Classifications	Official	Non Official	Total
Producer	4	0	4
User	21	1	22
Consumer	0	0	0
General Interest	9	9	18
Unclassified	0	2	2

AERIAL



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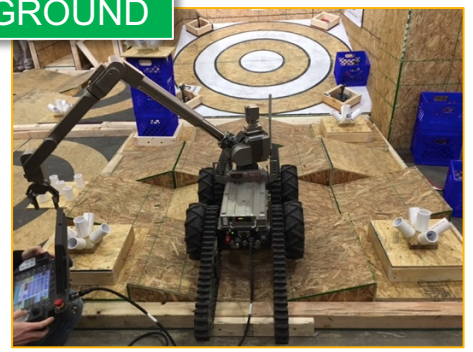

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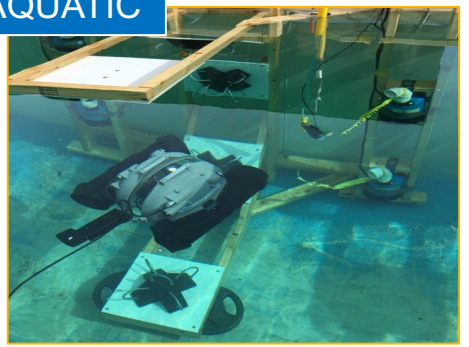
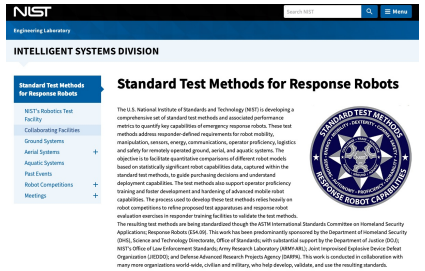


Previous Meeting Presentations

Introduction

RobotTestMethods.nist.gov



[ASTM E54.09 Aerial Test Methods Introduction (2021A)]

[ASTM E54.09 Aerial Test Methods Sensing and Radio Comms (2021A)]

[ASTM E54.09 Aerial Test Methods Use Case Examples (2021A)]

[ASTM E54.09 Aquatic Tests Introduction (v2021A)]

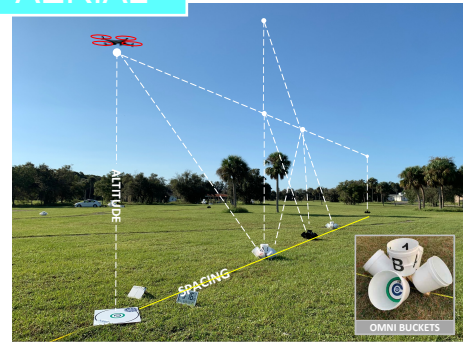
[ASTM E54.09 Ground Test Methods Introduction (2021A)]

[ASTM E54.09 Ground Test Methods Dexterity and Strength (2021A)]

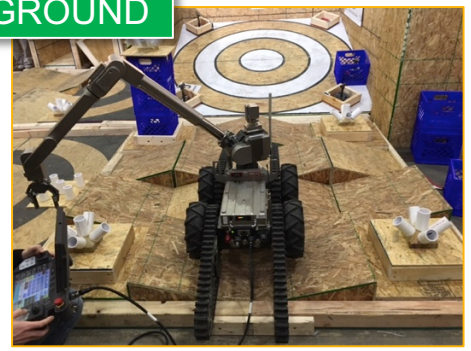
[ASTM E54.09 Ground Test Methods Maneuvering and Mobility (2021A)]

[ASTM E54.09 Ground Test Methods Sensors and Radio Comms (2021A)]

AERIAL



GROUND



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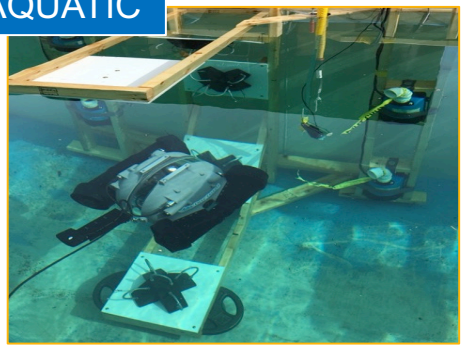


30+ Aerial Drone Tests

Sensing

- WK58677 Visual Image Acuity
- WK58925 Visual Color Acuity
- WK58926 Visual Dynamic Range
- WK58927 Audio Speech Acuity
- WK58928 Thermal Image Acuity
- WK58929 Thermal Dynamic Range
- WK58930 Latency of Video and Control
- WK#### Point and Zoom Cameras
- WK58938 Map Wide Areas

Energy/Power

- WK58939 Endurance Range/Duration
- WK58940 Endurance Perch Time

OPEN Test Lane and Related Scenarios

- WK58931 Position
- WK58935 Traverse
- WK58932 Orbit
- WK58933 Spiral
- WK58934 Recon

OBSTRUCTED Test Lane and Related Scenarios

- Perch Alignments
- Wall Alignments
- Ground Alignments
- Alley Alignments
- Post Alignments

CONFINED Test Lane and Related Scenarios

- Perch Alignments
- Wall Alignments
- Ground Alignments
- Alley Alignments
- Post Alignments

Radio Communications:

- WK58942 Line-of-Sight Range
- WK58941 Non-Line-of-Sight Range
- WK#### Attenuated Range

Safety/Others

- WK#### Impact Forces
- WK58943 Lights and Sounds
- WK#### Deliver Packages

Agenda for Today

Introduction

.

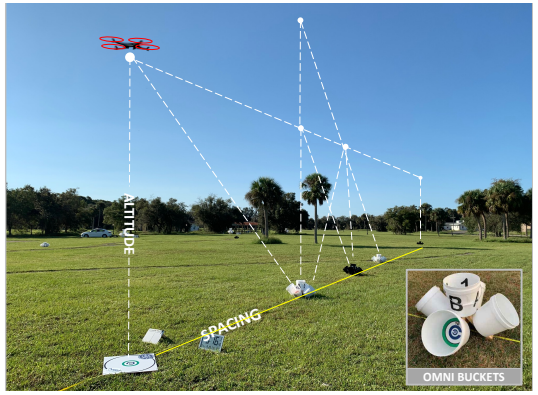
10:00 am EST Introduction, Recent Events, Use Case Examples

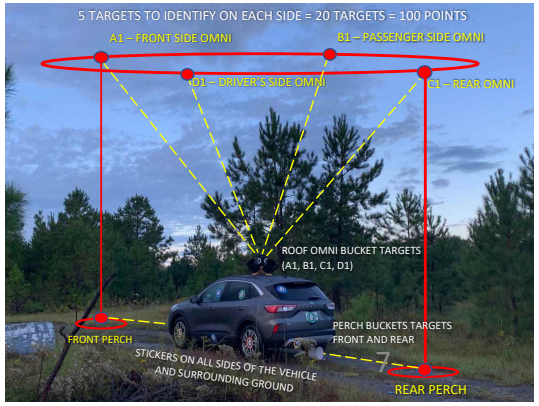
11:00 am EST Open Test Lane and Related Scenarios

12:00 pm EST Obstructed Test Lane and Related Scenarios

1:00 pm EST Sensor Test Lane, Radio Comms, Other Tests

2:00 pm EST Open Discussion





"Start Remote, Stay Remote?"

Safety | Capabilities | Proficiency

"Start Remote, Stay Remote?"

Safety | Capabilities | Proficiency

Mission Success = Robotic System Capabilities + Remote Operator Proficiency

Break Glass Tasks
(VERTICAL REPETITIONS)

Bore Holes Tasks
(VERTICAL REPETITIONS)

Conventional Systems

Break Glass Tasks
(3x3 REPETITIONS)

Emerging Technologies

Measuring Performance: Search/Identify Objects

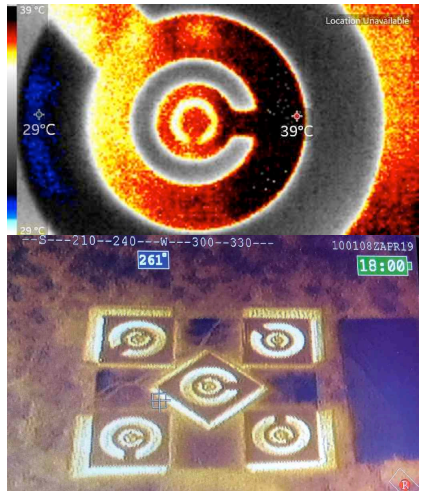
Safety | Capabilities | Proficiency

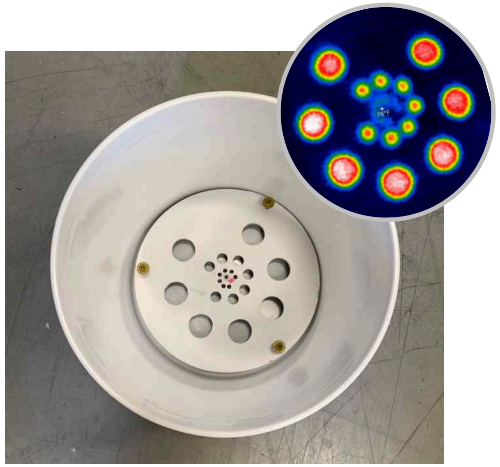
Measuring Performance: Search/Identify Objects

Safety | Capabilities | Proficiency

Measuring Performance: Search/Identify Objects

Safety | Capabilities | Proficiency





Measuring sUAS Performance: Close Proximity Inspection

Safety | Capabilities | Proficiency

Examples of Drones in the Class

Safety | Capabilities | Proficiency

Small Unmanned Aircraft Systems (sUAS)
Weigh Less Than 25 kg (55 lbs)









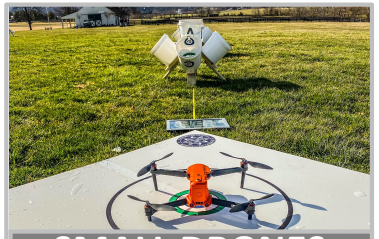


Initial focus is VTOL, but some tests apply to forward flying aircraft when scaled up to the appropriate orbit radius.

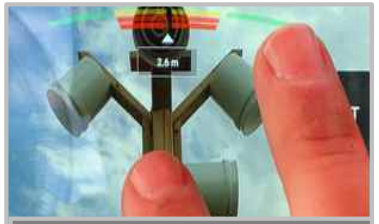
Open Test Lane

Aerial Tests

MEASURE & COMPARE


SMALL DRONES


LARGE DRONES

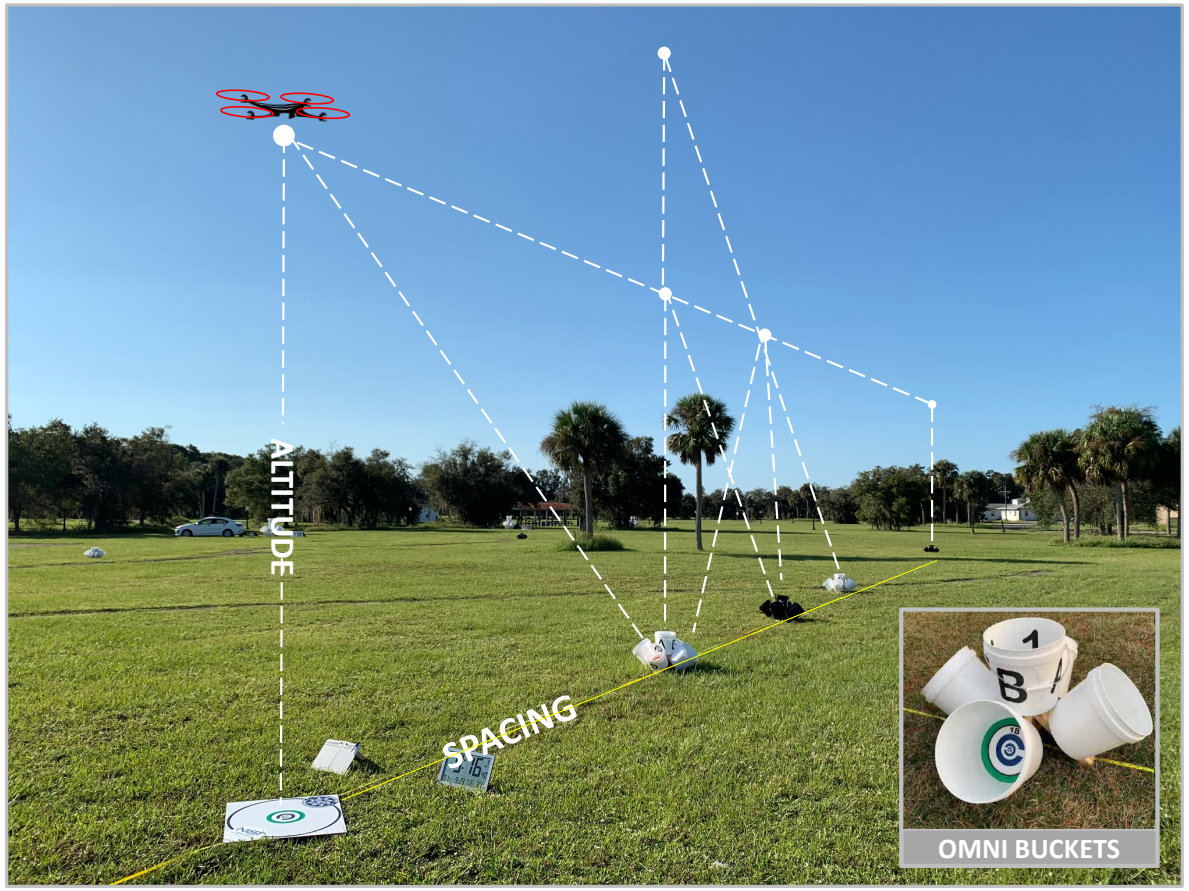

INTERFACES


PROCEDURES


SENSORS

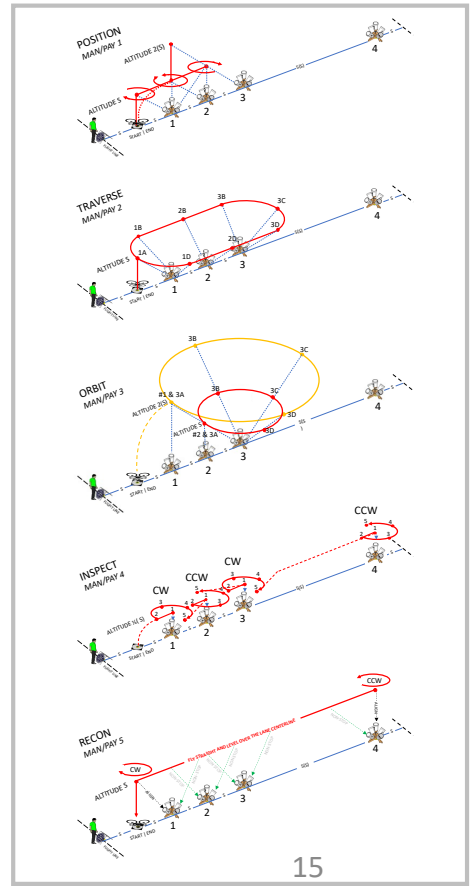

MANEUVERING

SCALABLE (ALTITUDE = SPACING)



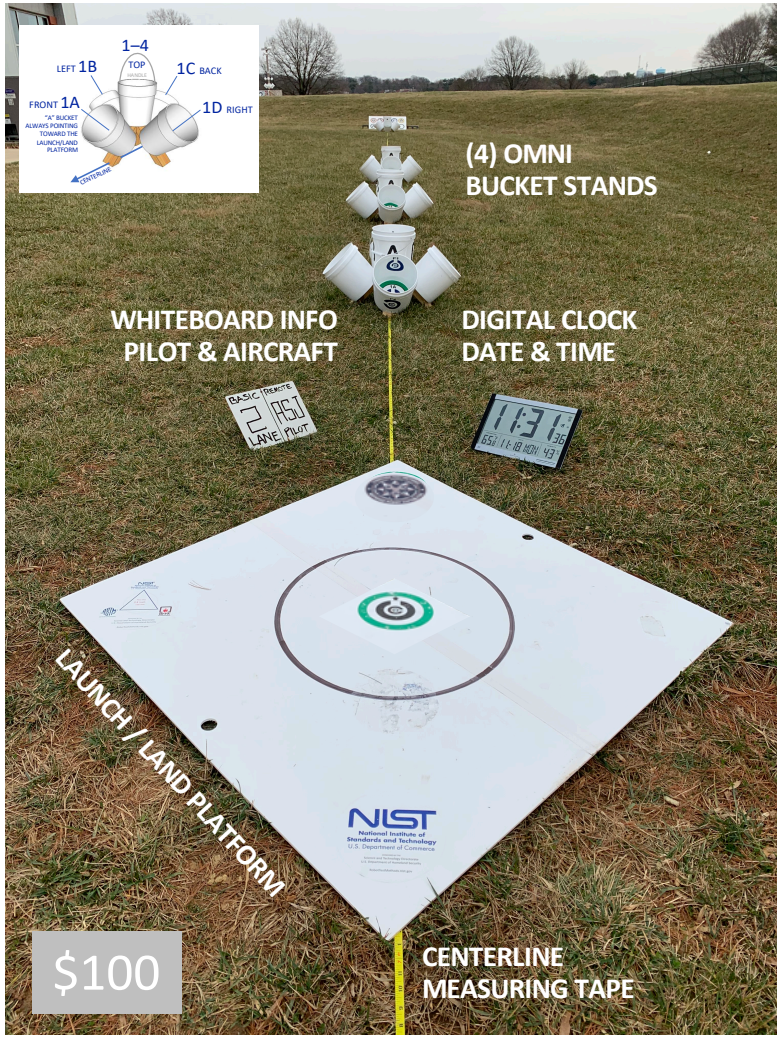
OMNI BUCKETS

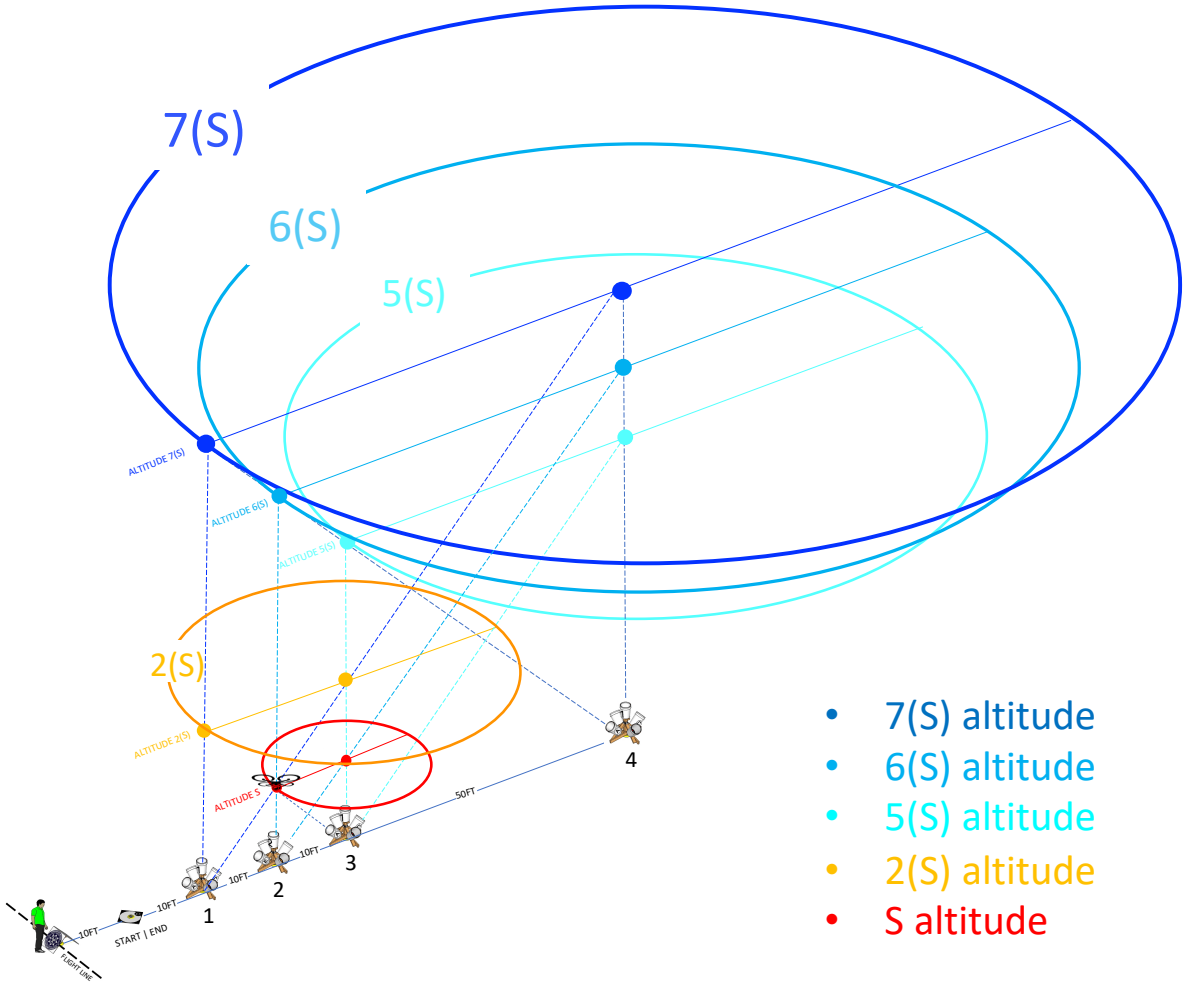
5 FLIGHT PATHS



Inexpensive and Easy to Fabricate

Aerial Tests





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

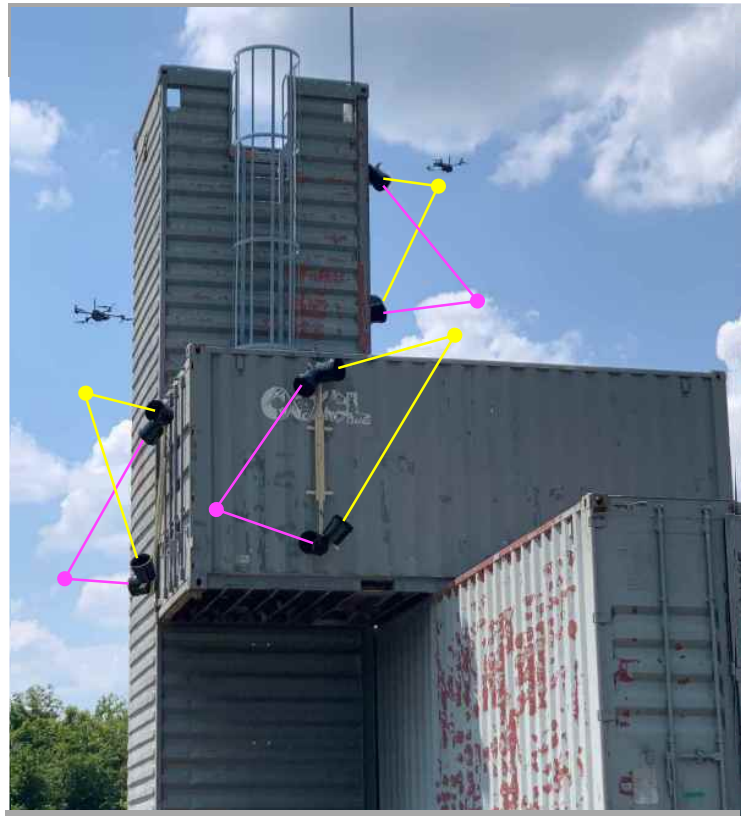
Obstructed Test Lane and Related Scenarios

Aerial Tests

VEHCLE INSPECTION

OBJECT INSPECTION

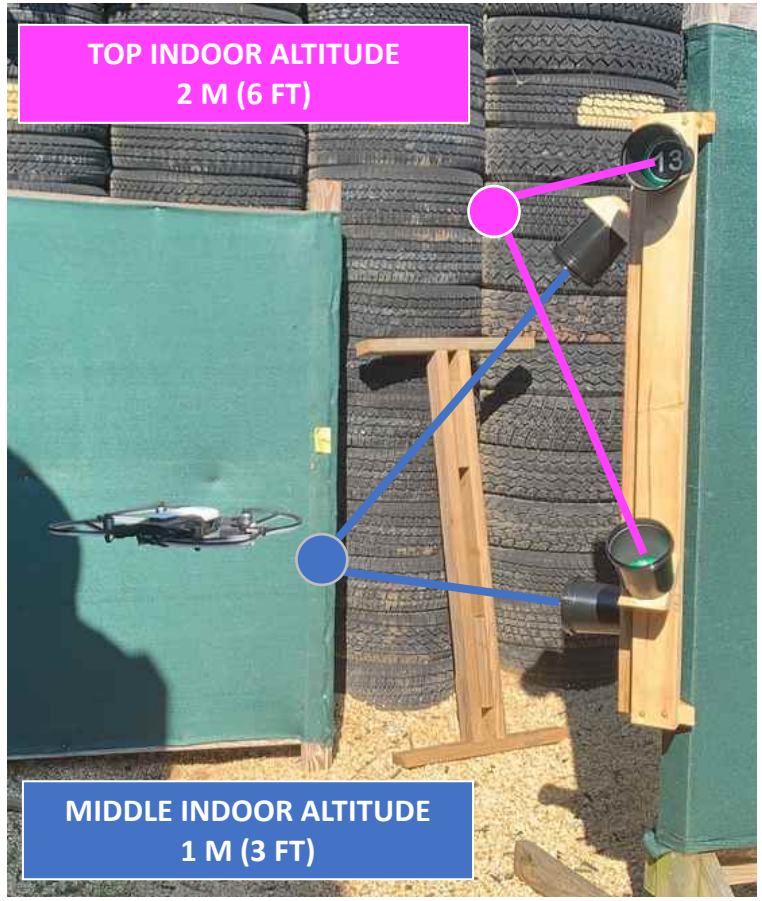
STRUCTURE INSPECTION

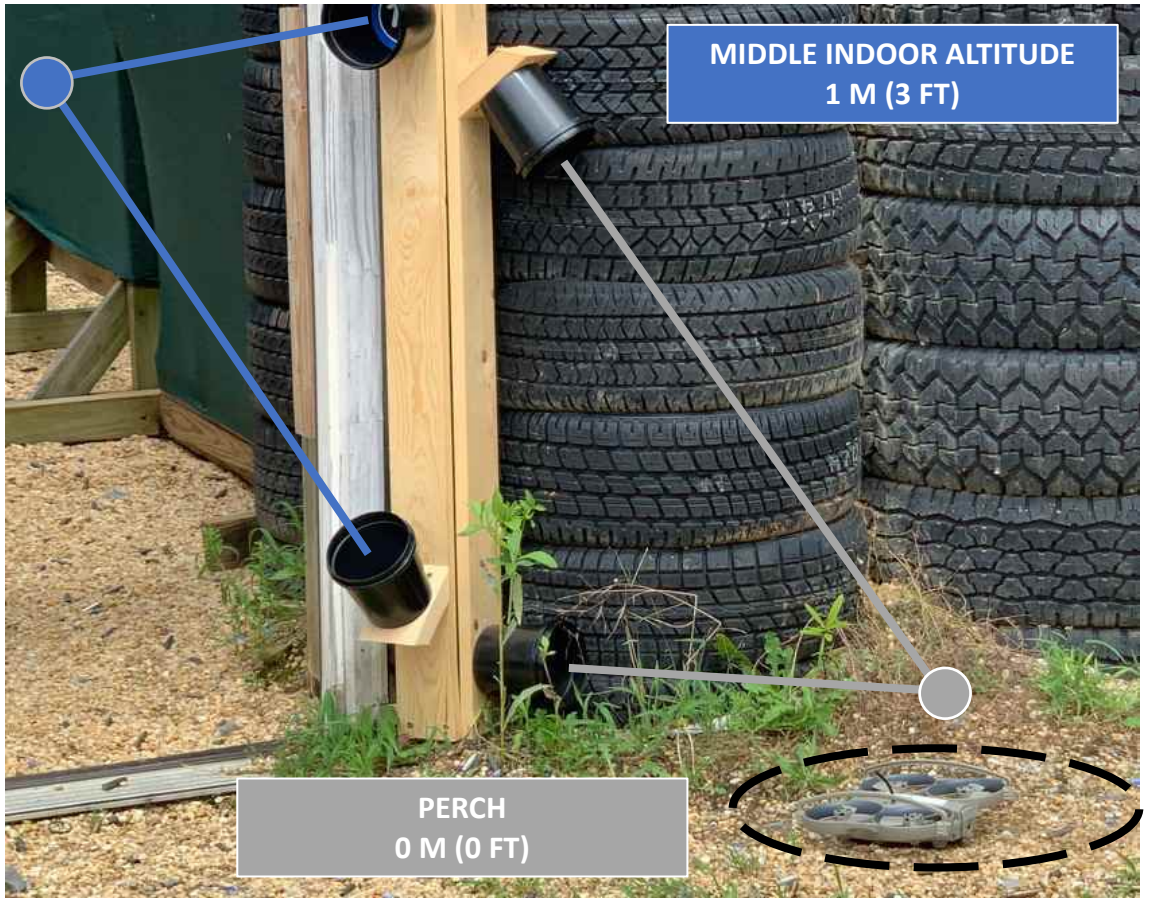


DUAL BUCKET ALIGNMENTS GUIDE PILOTS INTO SAFE POSITIONS WITHIN PROXIMITY TO OBJECTS

Confined Test Lane and Related Scenarios

Aerial Tests





Confined Test Lane and Related Scenarios

Aerial Tests

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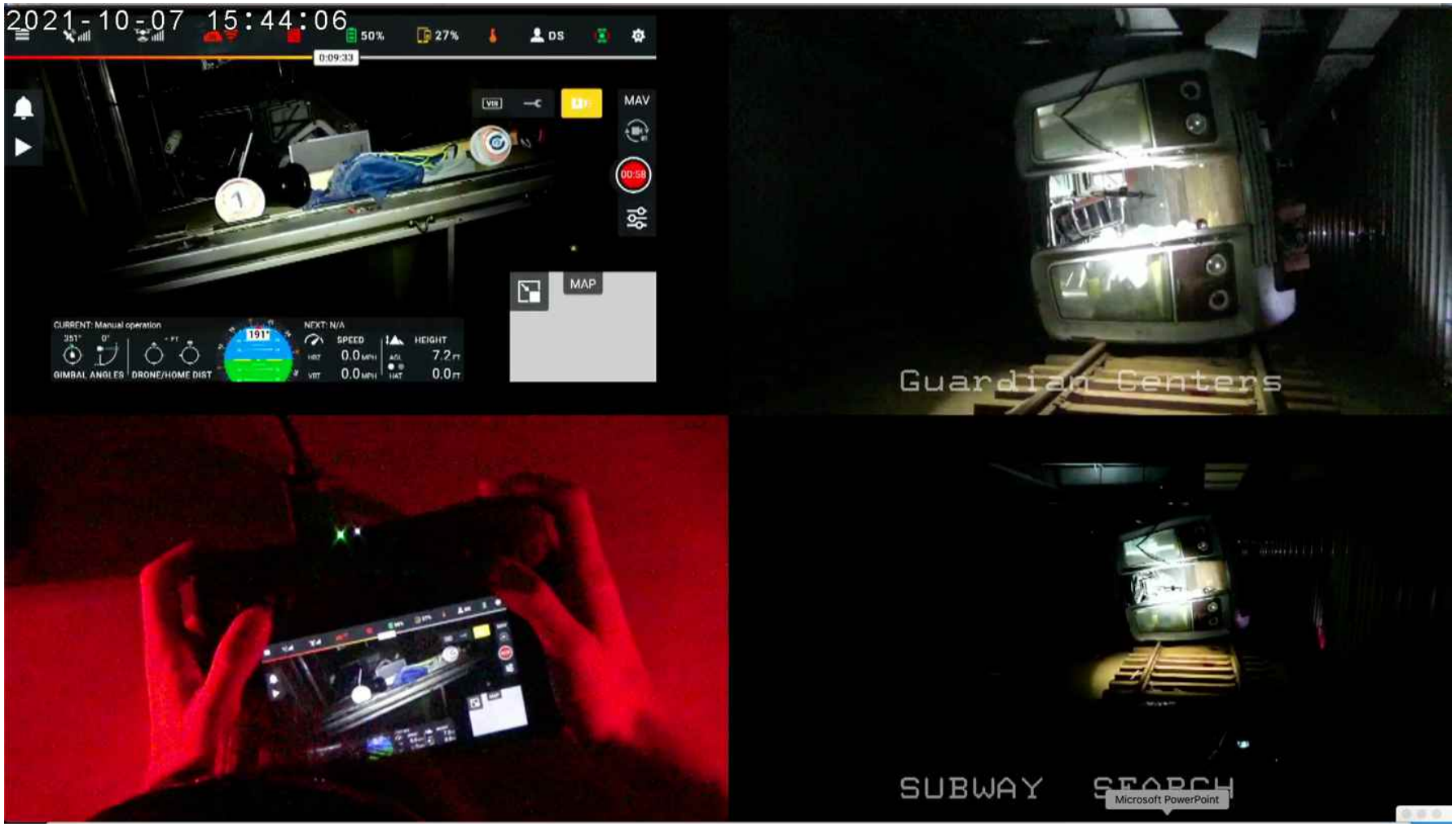
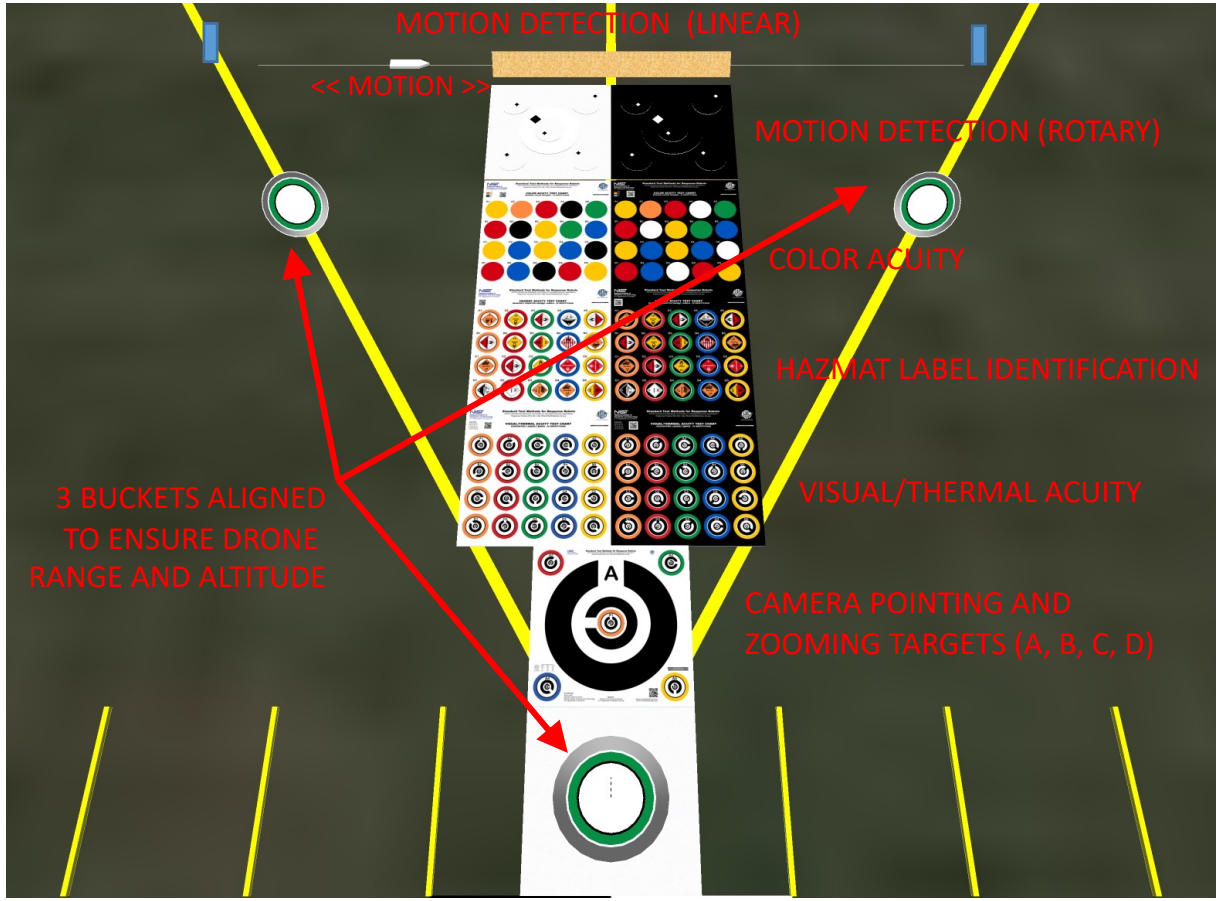


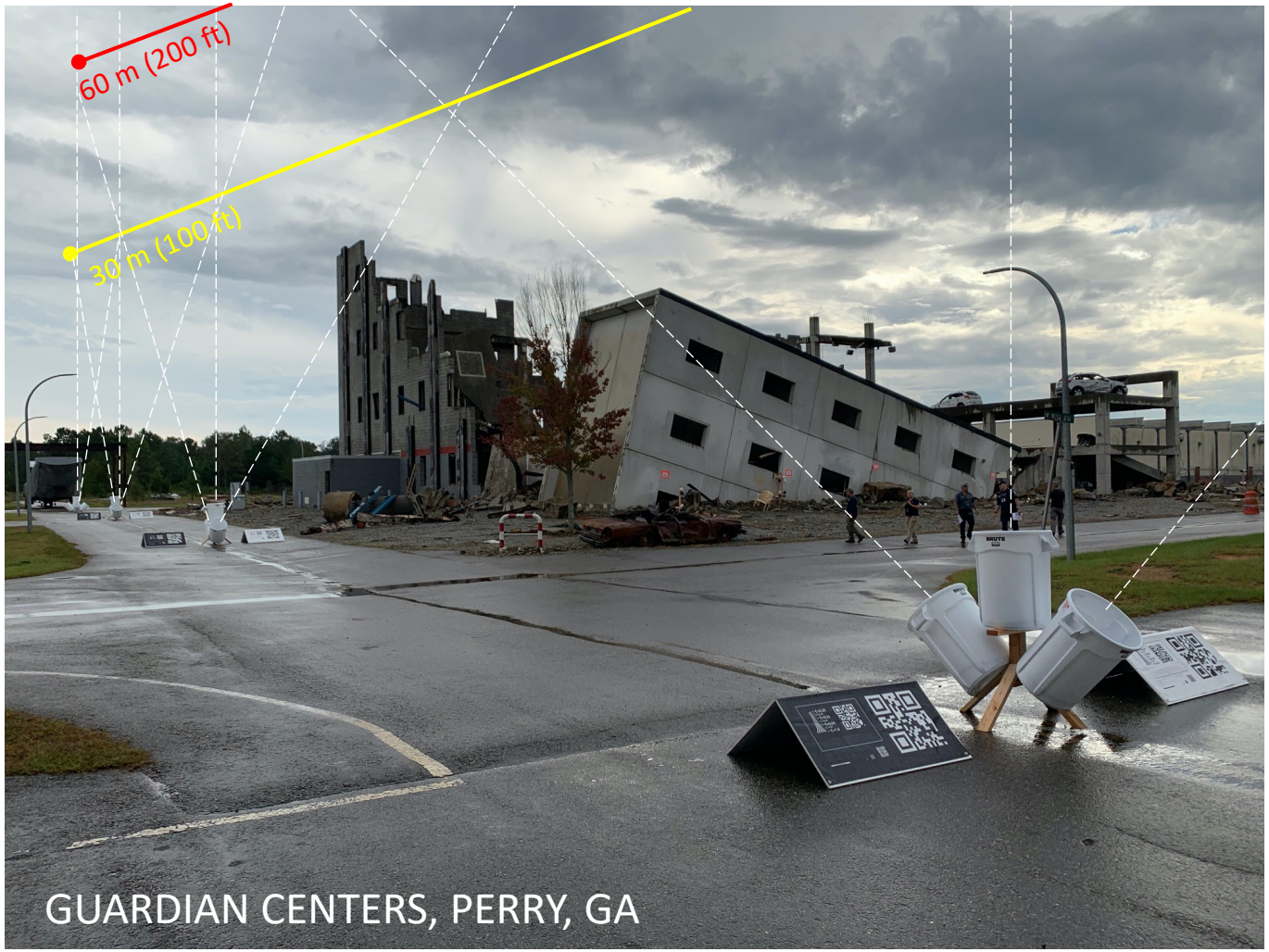
Sensor Test Lane

Aerial Tests



Sensor Test Lane

Aerial Tests



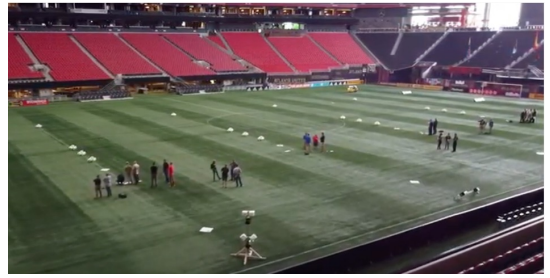
GUARDIAN CENTERS, PERRY, GA


ACUITY TARGETS FOR PILOT READING


QR CODES FOR SURVEY ACUITY

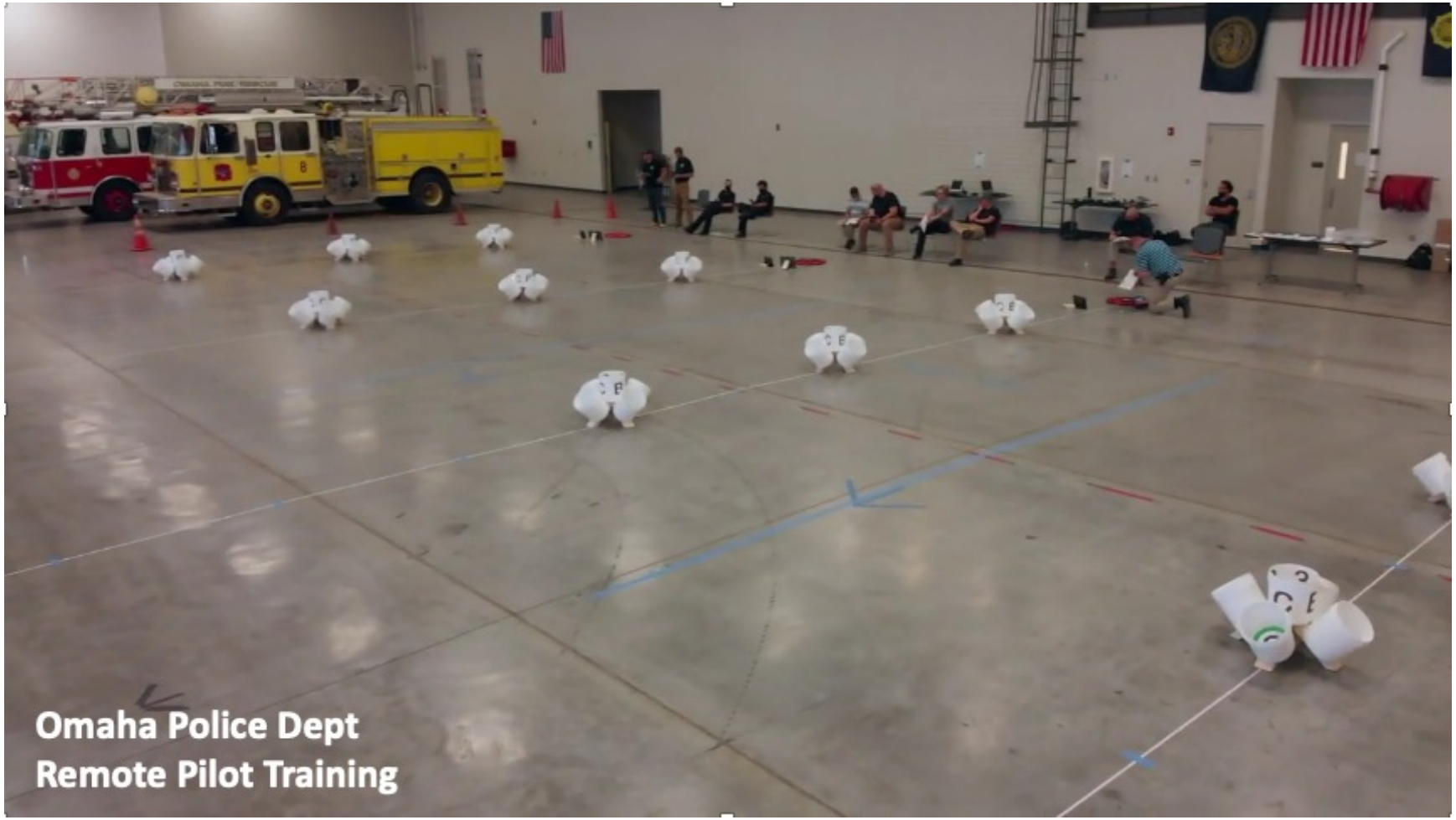
Enabling Credentialing of Remote Pilot Proficiency

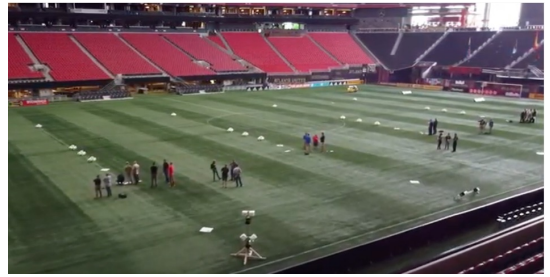
Aerial Tests



Enabling Credentialing of Remote Pilot Proficiency

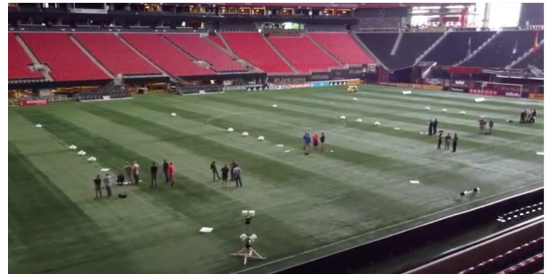
Aerial Tests





Enabling Credentialing of Remote Pilot Proficiency

Aerial Tests



Enabling Credentialing of Remote Pilot Proficiency

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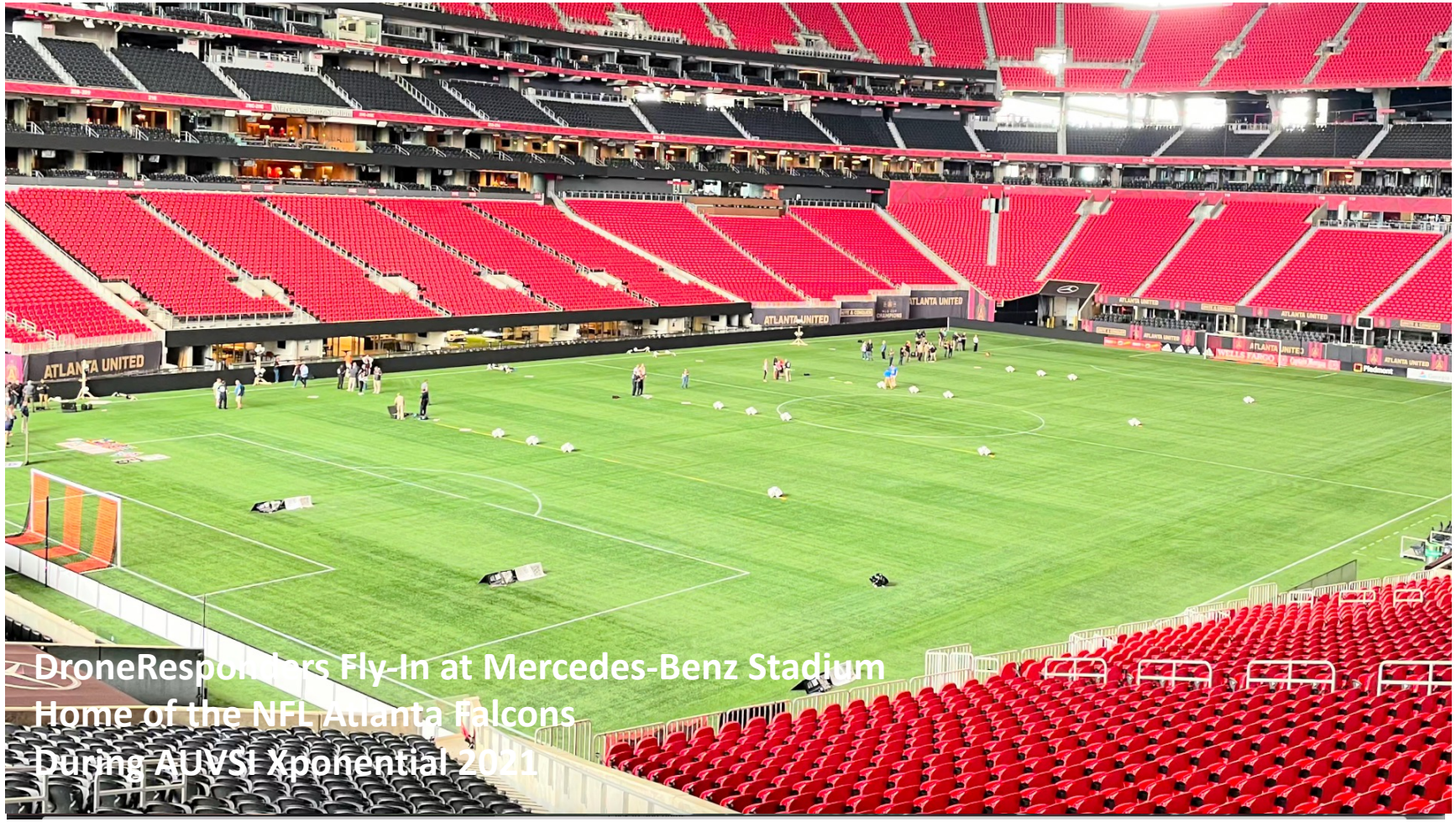
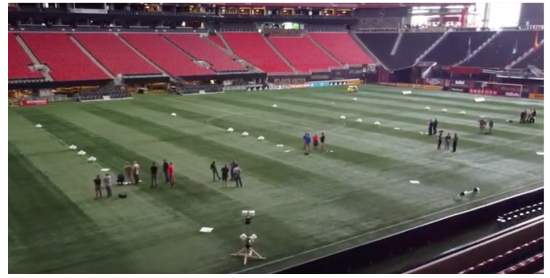
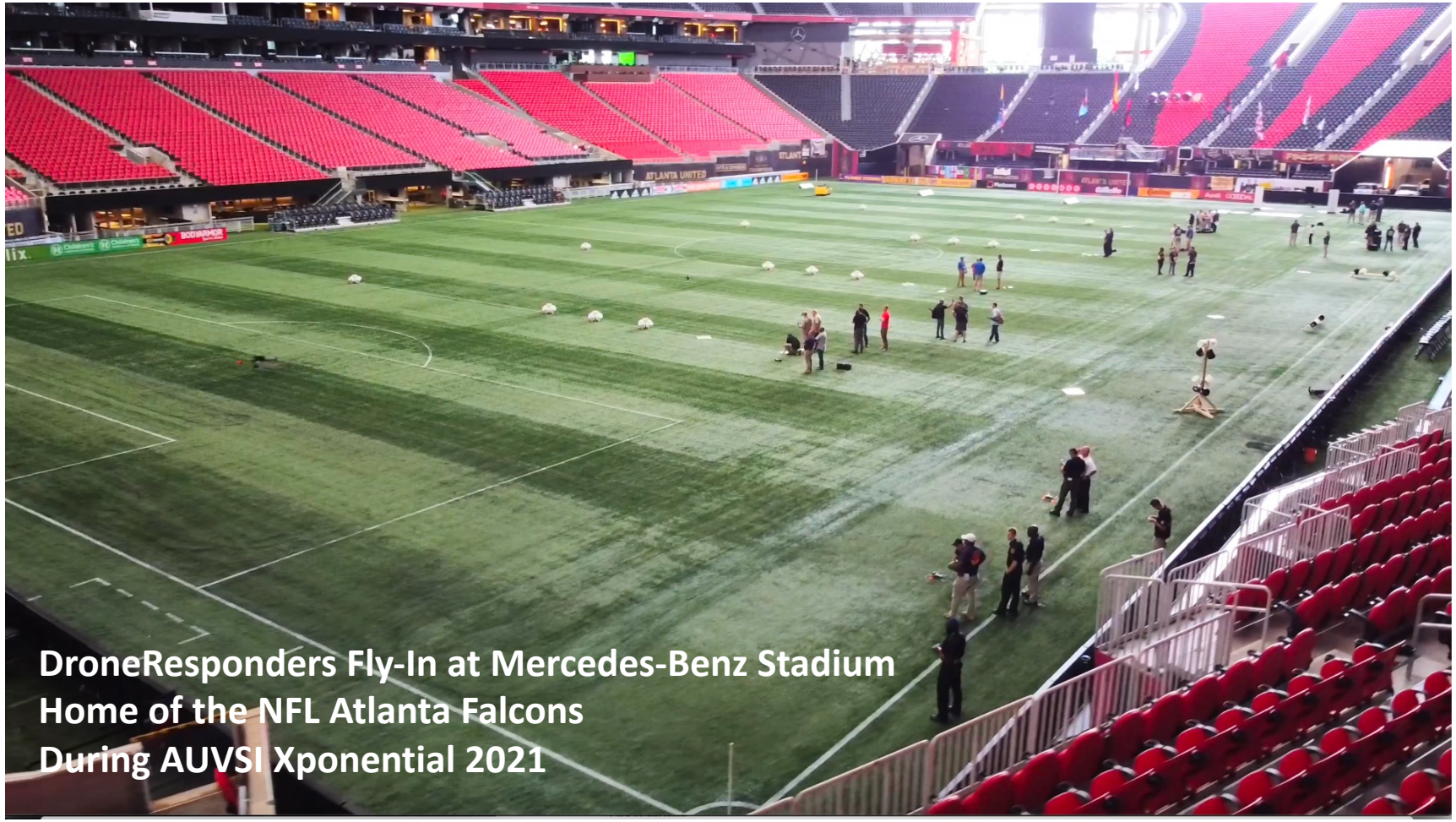


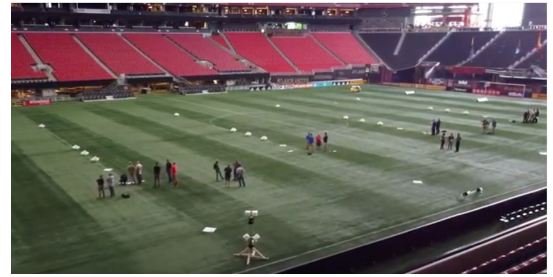
DroneResponders Fly-In at Mercedes-Benz Stadium
Home of the NFL Atlanta Falcons
During AUVSI Xponential 2021



Enabling Credentialing of Remote Pilot Proficiency

Aerial Tests





Enabling Credentialing of Remote Pilot Proficiency

Aerial Tests

DroneResponders Fly-In at Mercedes-Benz Stadium
NFL Atlanta Falcons
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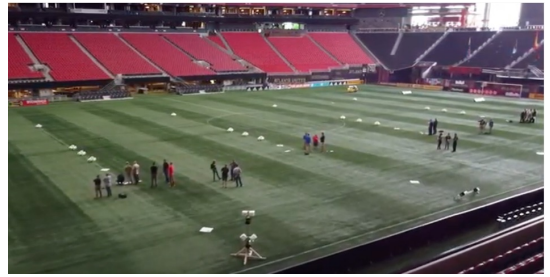


Quantifying Practical Skills Requirements

Focus Training and Evaluate Proficiency for Credentialing

"ASTM F38 Standard Guide for Training for Remote Pilot in Command of UAS Endorsement"

<u>Qualitative Task Performance Levels:</u>

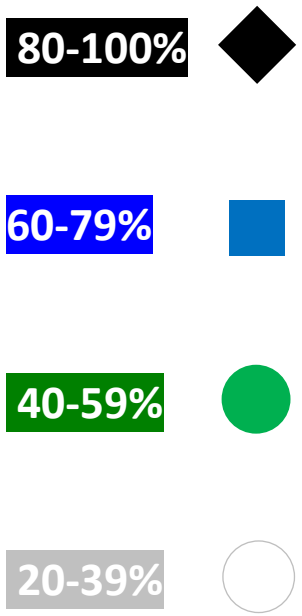
4) PROFICIENT
- Can do the complete task quickly and accurately.
- Can tell or show others how to do the task.

3) COMPETENT
- Can do all parts of the task.
- Needs only a spot check of completed work.

2) PARTIALLY PROFICIENT
- Can do most parts of the task.
- Needs only help on hardest parts.

1) LIMITED
- Can do simple parts of task.
- Needs to be told or shown how to do most of task.

<u>Quantitative Measures</u>
Example Thresholds



<u>Thresholds Set By Any Organization</u>
Based on Airspace, Mission, Environment

Organization "A" Pass/Fail
Maybe populated, obstructed area, windy, night, etc.

Organization "B" Pass/Fail
Maybe populated, open area, windy, daytime, etc.

Organization "C" Pass/Fail
Maybe rural, open area, calm, daytime, etc.

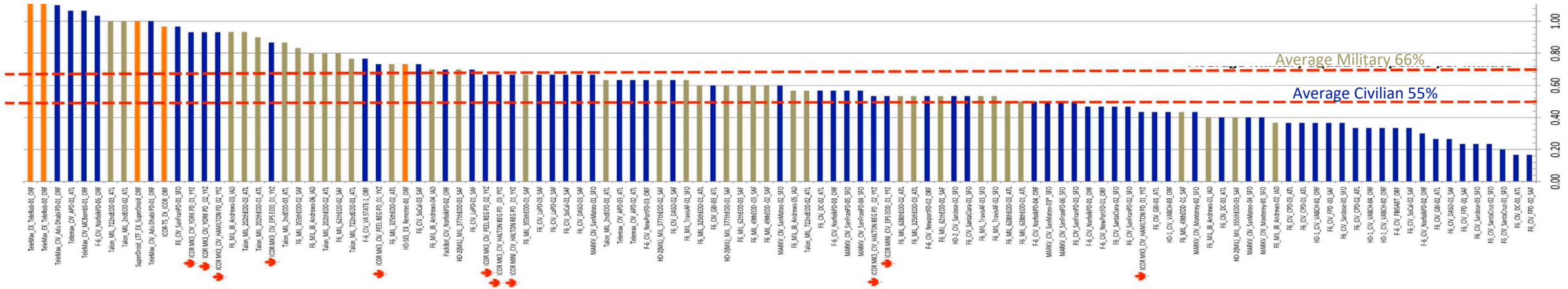
Set Your Minimum Thresholds for Pass/Fail

Focus Training and Evaluate Proficiency for Credentialing

- Organizations can set their own threshold for pass/fail in these tests based on their tolerance for reliability and/or efficiency. Complete trials are assumed.

- Measure everybody repeatedly over time and graph the results to help people understand their strengths and weaknesses. Then set minimum thresholds relative to the average or “expert” scores. Or adopt other organization’s thresholds as a central credentialing reference.

- At deployment time, each organization needs to consider their airspace restrictions, environmental variables, and mission complexity (night ops, BVLOS, etc.) to select a pilot and aircraft that’s likely to succeed.



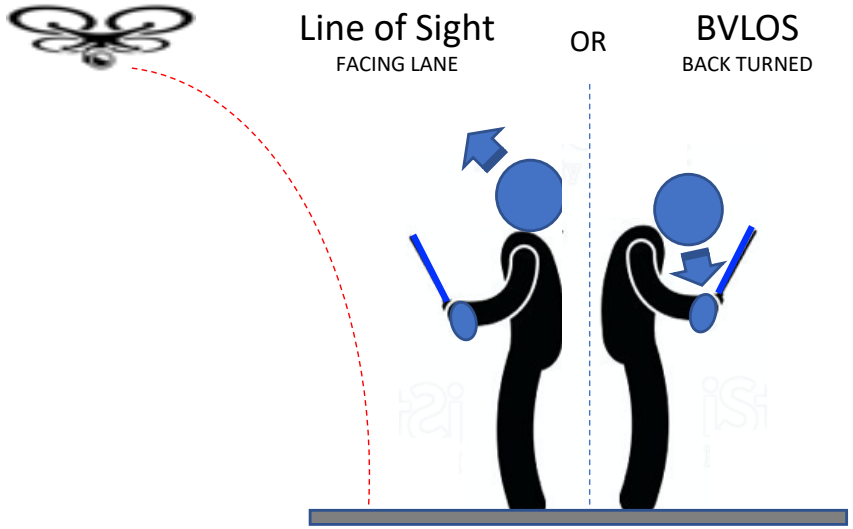
Example proficiency data shown from bomb squads in ground robot tests

Select Trial Settings for Different Flight Credentials

Aerial Tests

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

S:



THE PILOT'S BACK TURNED TO THE LANE FORCES RELIANCE ON THE INTERFACE (VISUAL OBSERVER REQUIRED)

ILLUMINATED BUCKETS PROVIDE POSITIONING AIDS LIKE STRUCTURE WINDOWS OR STREET LIGHTS

Example Use Cases

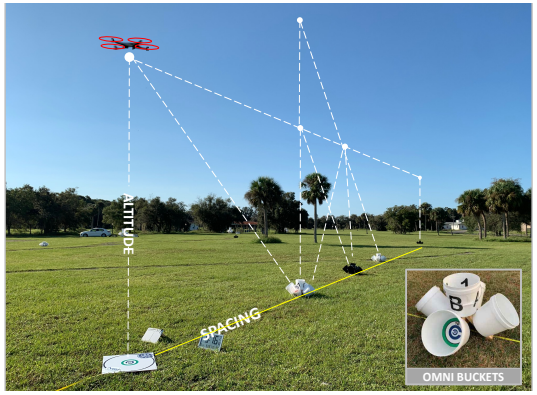
- **DHS/DOJ $35M small drone procurement** uses our aerial tests to evaluate drones for emergency response operations, fire/arson investigation, and other applications. We conducted a series of drone evaluations at the Montgomery County Police Training Facility, MD.

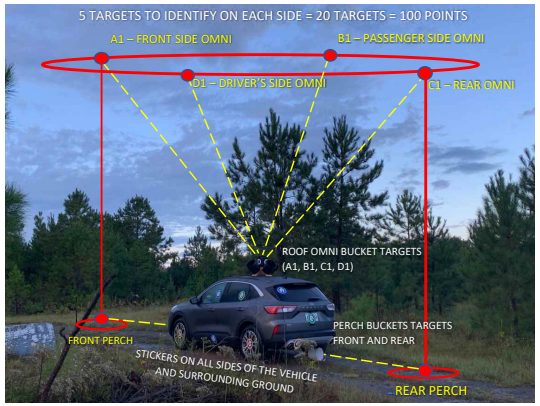
- **FEMA's Civil Air Patrol (U.S. Air Force Auxiliary)** uses our tests to train and credential more than 1200 pilots across 52 air wings nationwide through FAA webinars and then APSA Proctor courses.

- **Airborne Public Safety Association (APSA)** hosts a nationwide series of "train the trainer" courses (3 day, 24-hour) using our Open Test Lane for credentialing. More than ***250 certified Proctors*** to date.

- **Border Patrol** uses our tests to support innovation by evaluating drones available on the market and distributed training across more than 1000 remote pilots.

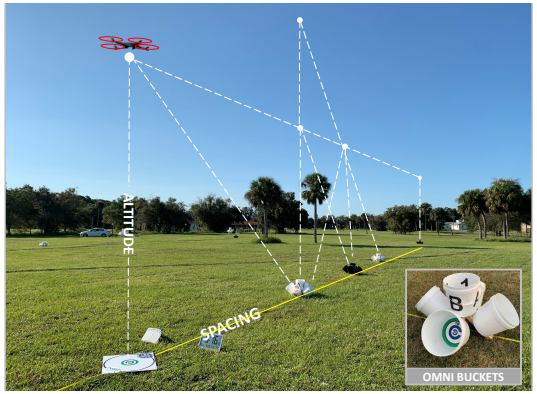
- **U.S. Secret Service** uses our tests to evaluate tethered drone capabilities and conduct training.

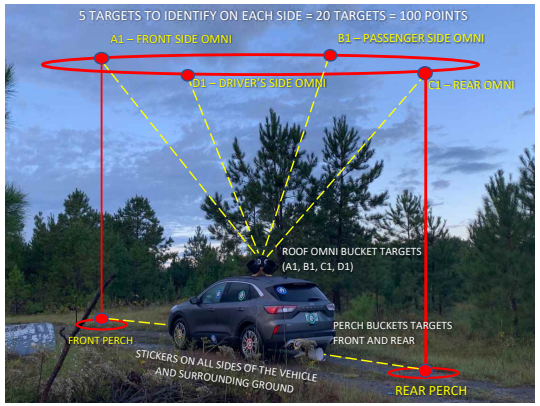




Example Use Cases

- Drone Responders Public Safety UAS Alliance
- FAA Safety Training online course for the Open Test Lane and related scenarios.
- Law Enforcement Drone Association (LEDA)
- Embry-Riddle Worldwide University
- Public Safety Aviation Accreditation Commission (PSAAC) credentialing
- DOJ Federal Bureau of Investigation (FBI)
- DOJ U.S. Marshals Service
- Texas Department of Public Safety statewide credentialing
- Colorado Department of Public Safety statewide credentialing
- Transport Canada (their FAA) considering nationwide credentialing of responders
- Several simulation environments for test lanes and scenarios.
- Dozens of state and local fire and police departments, international too!



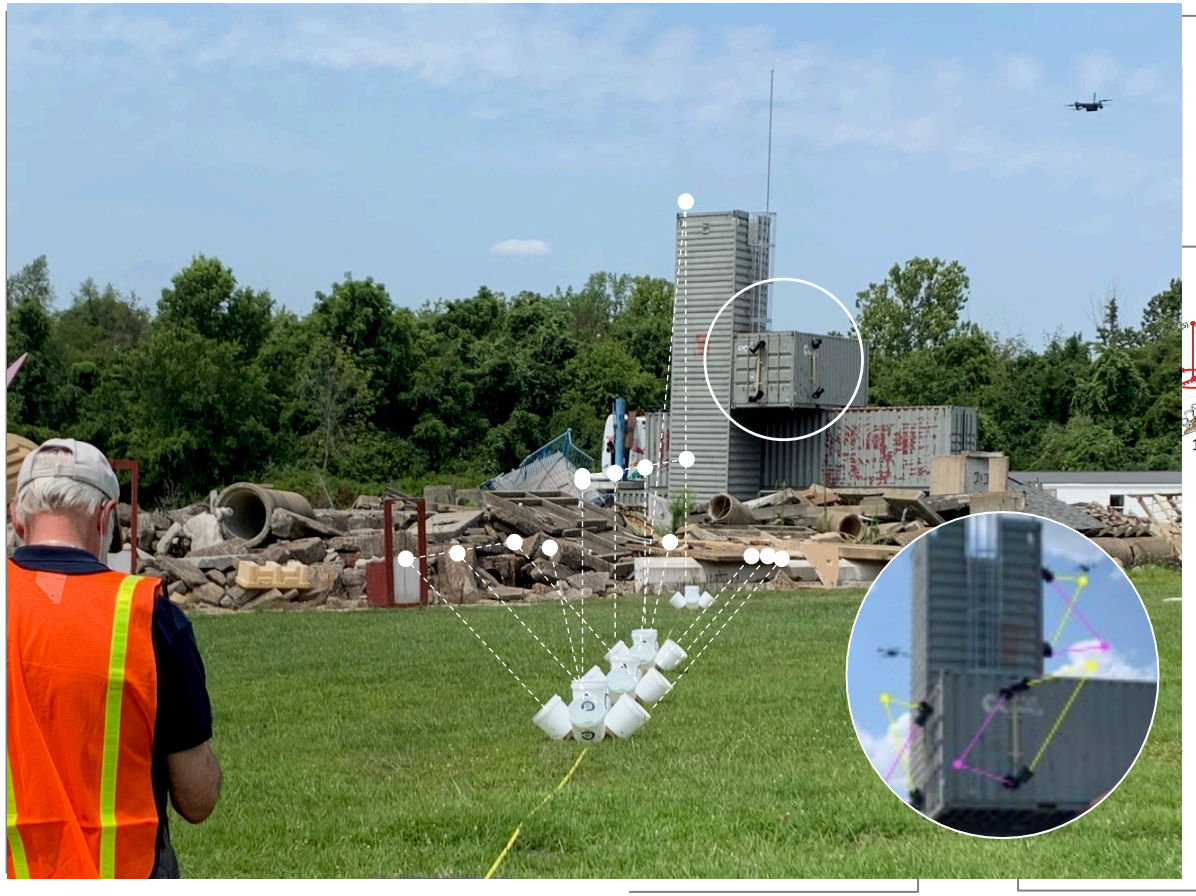


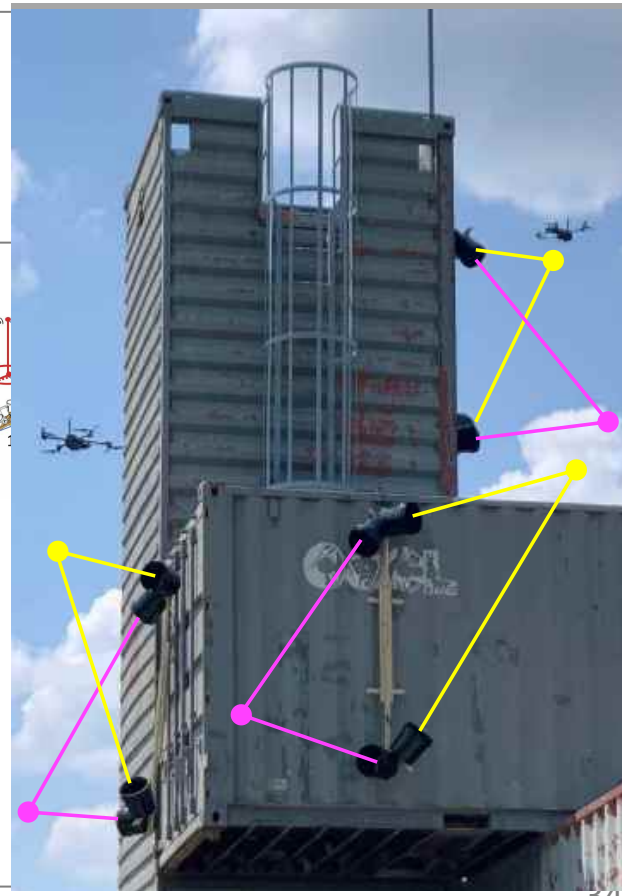
Recent Events and Use Cases

Civil Air Patrol Training and Credentialing

Aerial Tests

60,000 Subscribers – 2,036 sUAS – 1200 pilots – 52 Wings – CAPF 70-5U pilot certification

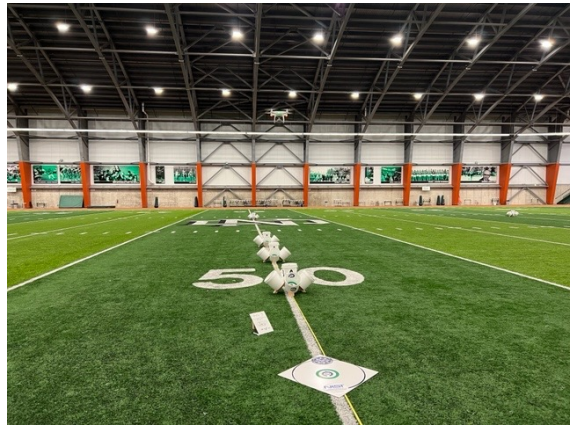




Airborne Public Safety Association (APSA) Train the Trainer Courses

Use Case Examples

- 250+ proctors certified to conduct Basic Proficiency Evaluations for Remote Pilots in the Open Test Lanes and scenarios
- 10 courses monthly distributed regionally.
- Roughly half the Civil Air Patrol wings credentialed.
- New advanced course starting to use the Open and Obstructed Test Lanes and Scenarios starting Feb. 2022.
  - Alameda County (Dublin), CA | February 18-20, 2022
  - Burnet, TX | March 30-April 1, 2022
  - Creve Coeur, MO | October 7-9, 2022
  - Niceville, FL | October 27-29, 2022

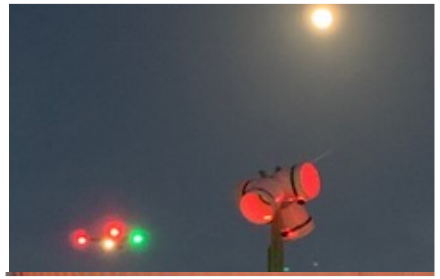


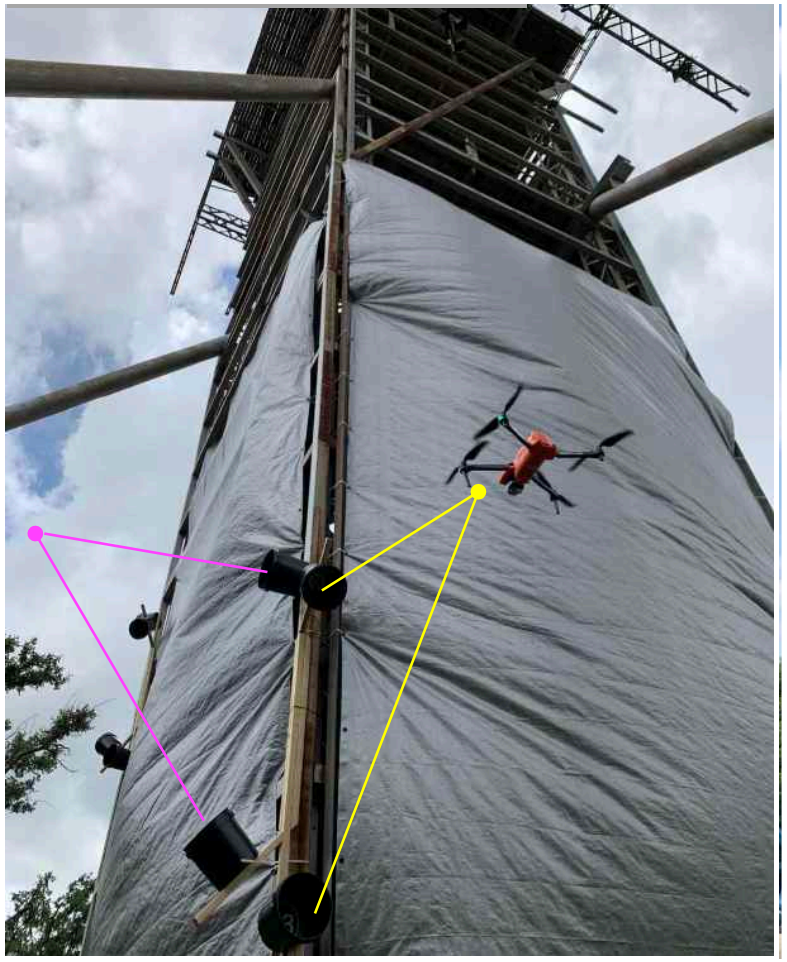
Texas Public Safety Robotics Summit 2021/2022

Use Case Examples

https://www.txpsrobots.com

MARCH 28-30, 2022 Reveille Peak Ranch, Burnet, TX





Unmanned Tactical Applications Conference (TAC), Guardian Centers, GA

See report at RobotTestMethods.nist.gov

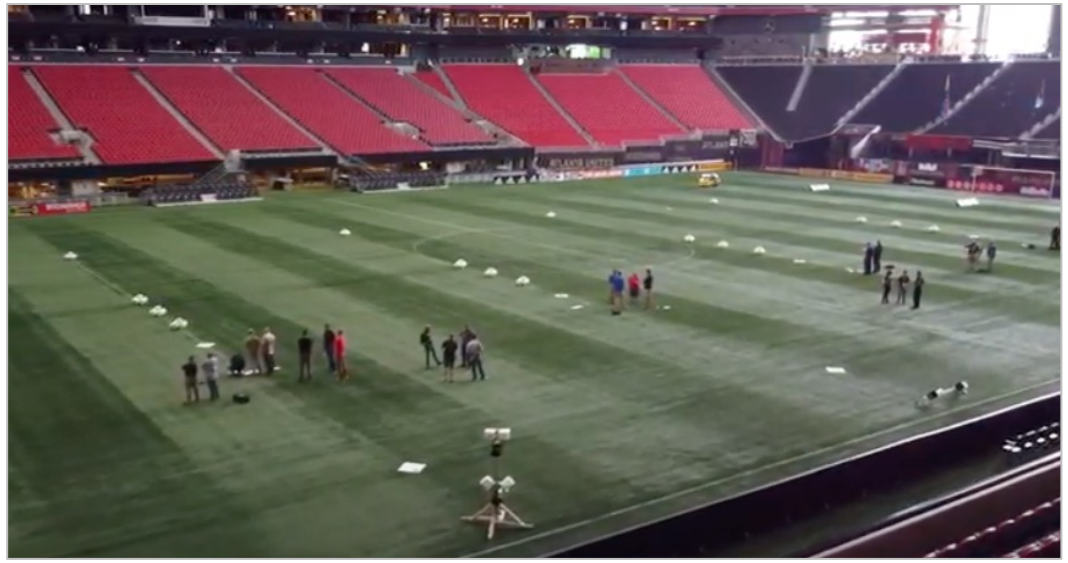
Use Case Examples

Drone Responders Fly-In at NFL Atlanta Falcons Stadium, GA

Use Case Examples

140 regional responders and others during AUVSI Xponential 2021.

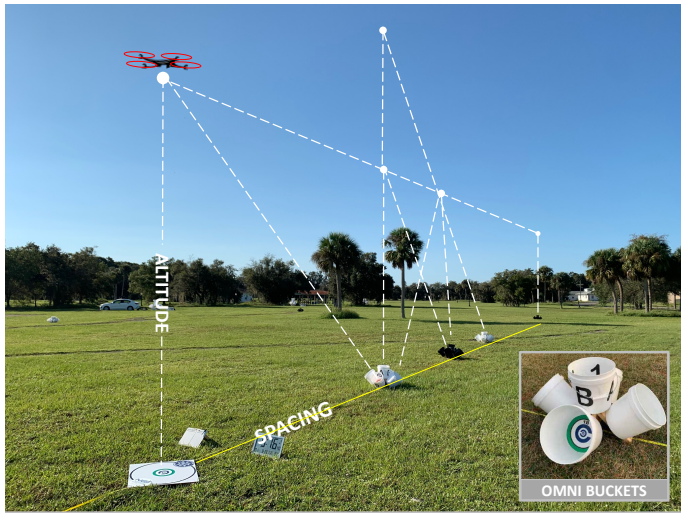
All apparatuses distributed to the responders after the event



DHS S&T Drone Evaluation, Ft. Meyers, FL

Use Case Examples

- Conducted by Dagar Technologies for DHS S&T.
- 40+ Regional responders participated
- Captured baseline proficiency with their existing aircraft.
- Then used NEW aircraft in the same tests.
  - Open Test Lanes and Scenarios
  - Obstructed Test Lanes and Scenarios
  - Sensor Test Lane
- Night operations too.



FAA Safety Team Online Course

Use Case Examples

FAAST Course Pointer

NIST sUAS Tests: Measuring Capabilities and Remote Pilot Proficiency

Topic: Self-Evaluation, Measuring Proficiency

FAAsafety.gov
Course Code: ALC-716

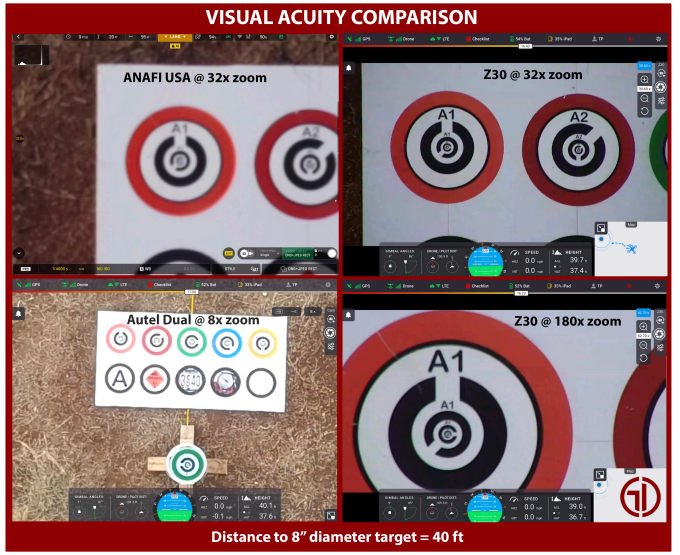
INTRODUCTION

This course is an Introduction to the Standard Test Methods for Small Unmanned Aircraft Systems (sUAS). The U.S. National Institute of Standards and Technology (NIST) is leading an international effort to develop dozens of standard test methods for small unmanned aircraft systems. These tests can be used to quantitatively evaluate and compare various system capabilities and remote pilot proficiency no matter where or when the testing occurs. These tests are inexpensive, easy to fabricate, and simple to conduct so organizations use them worldwide to guide procurements, focus training, and measure proficiency for credentialing.

Texas Dept. of Public Safety Statewide Credentialing

Use Case Examples

Pilots: 100+
Aircraft: 100+
Annual Flights: 10,000+
Main focus: Crash/crime scene reconstruction



News from Texas Legislature

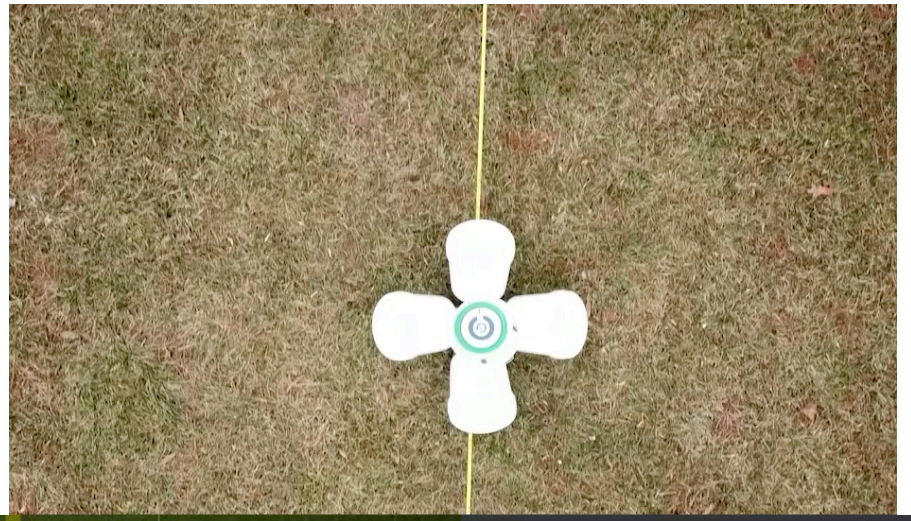
- Training
- Software
- Adoption of NIST tests

Reveille Peak Ranch Test Facility and Statewide Use Cases by Local Organizations (next pages)

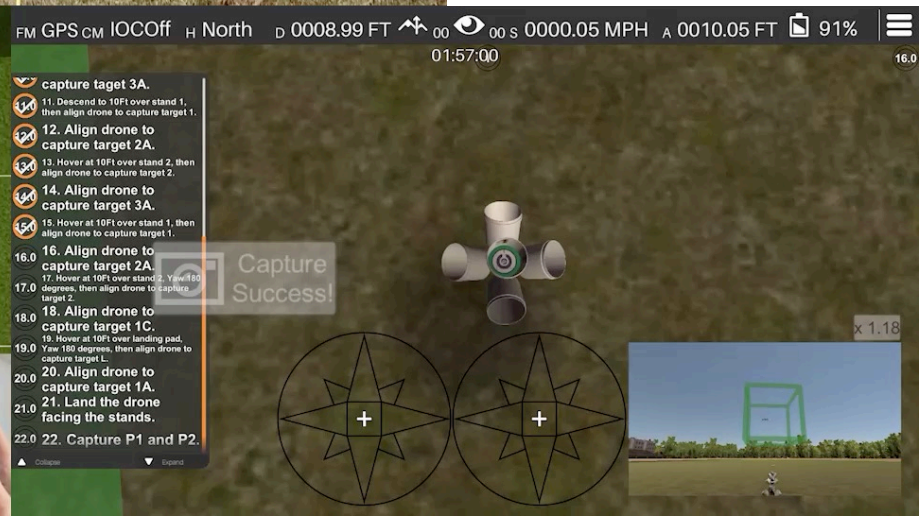
Simulated Flight Environments

Use Case Examples

DJI Drone Simulator
Demo Version



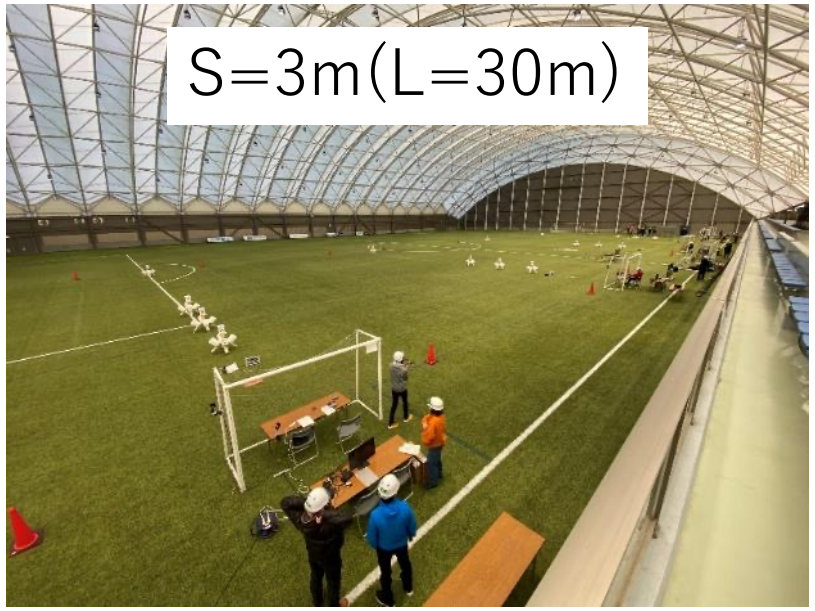
Zephyr Drone Simulator
Little Arms Studio & Clemson Univ.

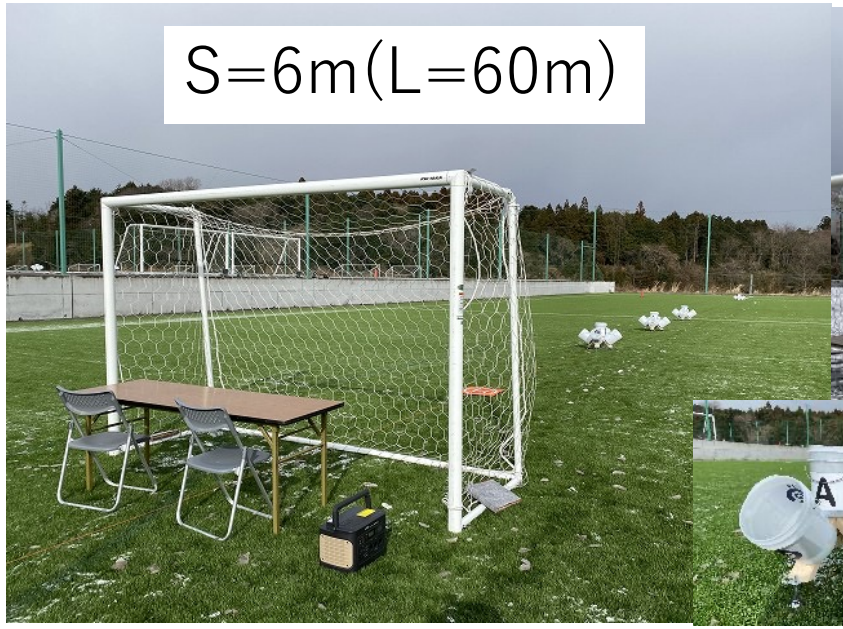


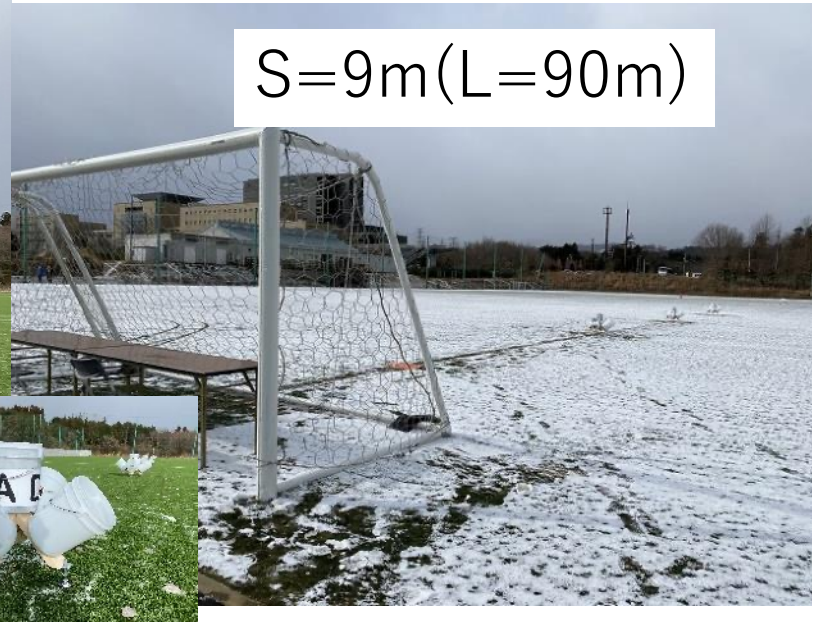
Japanese Validation Exercises

Use Case Examples

Tetsuya Kimura(IRS/Nagaoka University of Tech.)
Hiroki Igarashi(AIST)





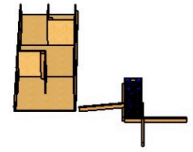


Canadian CETA and CERRA Training/Credentialing

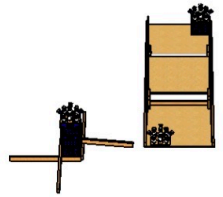
Use Case Examples

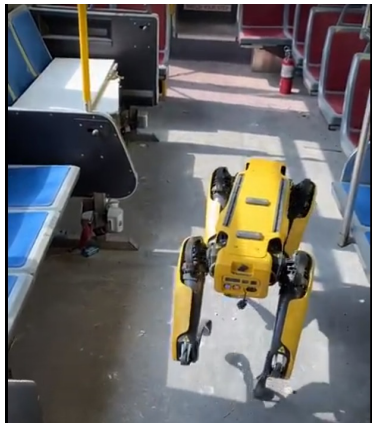
Lead Agencies;
CETA- Canadian Explosives Technicians Association
CERRA- Canadian Emergency Responders Robotics Association

Primary Locations:
Pearson International Airport (Toronto Canada)
Grimsby Regional Training Centre (Grimsby, Ontario , Canada)



CETA
CETA is the national association for police/military/government agencies tasked with response to explosives , chemical, biological, and radiological incidents in Canada. Current projects include EOD Standard training methods for both robots and bomb techs deployed in bomb suits.





CERRA
Spring 2020 established with focus on the public safety deployment of ground, air, water based robotics. Membership is open to any current or former public safety member or agency or any supporting government agency with an interest in response robots.

OLDER EVENTS

Validation Exercises

Committee Update

Color Key: Ground Aerial Aquatic Multiple Standards

- 2021.10 Unmanned Tactical Applications Conference, Guardian Center, Georgia (3 days)
- 2021.10 Law Enforcement Drone Association Conference, Bend, Oregon (3 days)
- 2021.09 DHS sUAS Assessment, Ft. Meyers, FL (5 days)
- 2021.08 FAA Safety Team Online Course (1 hour, quiz, certificate)
- 2021.08 AUVSI Xponential with DroneResponders Fly-In at Merceded Benz Stadium (3 days)
- 2021.08 Civil Air Patrol Advanced Training, Ft. Atterbury, Indiana (3 days)
- 2021.08 Eastern Regional Robot Rodeo, NAVEODTECHDIV, Indianhead, MD (3 days)
- 2021.06 RoboCupRescue Robot Competition – Remote Video Trials (months)

2021.06 ASTM E54.09 Response Robots Meeting, Online Only

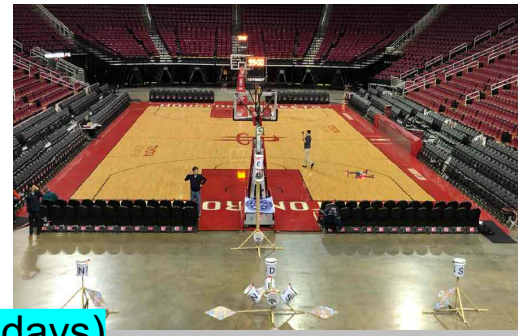
Validation Exercises

Committee Update

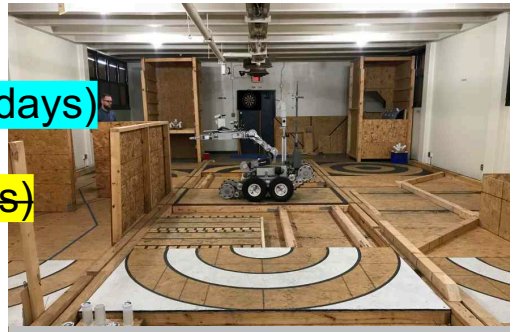
Color Key: Ground Aerial Aquatic Multiple Standards

- 2020.08 DHS/DOJ sUAS Procurement Testing ($35M), Montgomery County Police Facility, MD (1 days)
- 2020.10 Air Force Large Ground Robot Procurement ($70M), Tyndall AFB, FL (Weeks)
- 2020.08 DHS/DOJ sUAS Procurement Testing ($35M), Montgomery County Police Facility, MD (5 days)
- ~~2020.09 Canadian Fire Training Facility Opening Exercise, Toronto Airport, Ontario, Canada (4 days)~~
- ~~2020.08 World Robot Summit Disaster Response Championship, Fukushima, Japan (4 days)~~
- ~~2020.06 RoboCupRescue International Championship, Bordeaux, France (5 days)~~
- ~~2020.05 AUVSI Exponential Conference (netted aviary), Boston, MA (3 days)~~
- ~~2020.04 Fire Dept. International Conference (FDIC) Hands-On Training, Indianapolis, IN (3 days)~~
- ~~2020.03 UTAC UAS Conference, Guardian Center, Perry, GA (4 days)~~
- 2020.03 Public Safety UAS Conference Validation Exercise, Crozet, VA (5 days)

2020.02 ASTM E54.09 Response Robots Meeting, Atlanta, GA (3 days)



2019 Host: Houston Fire Dept



2018 Host: San Diego Fire Dept

2017 Host: Canadian CETA

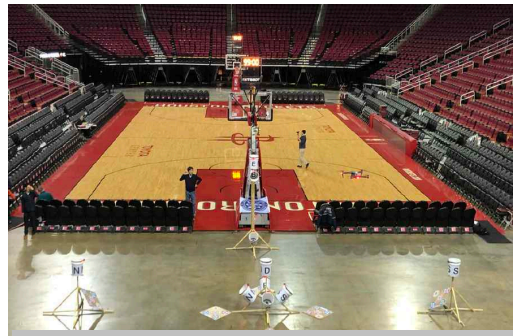
Validation Exercises

Committee Update

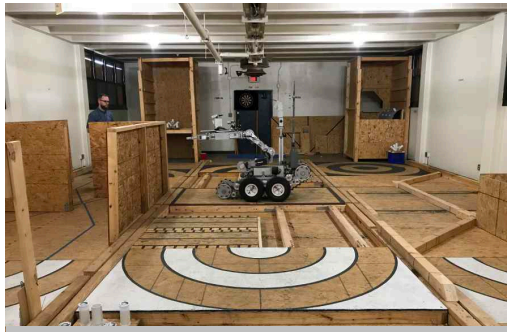
Color Key: Ground Aerial Aquatic Multiple Standards

- 2020.01 Ohio Fire Training Facility Opening, Ohio (2 days)
- 2020.01 FDIC Fire/Rescue East, Daytona, FL (2 days)
- 2020.01 Los Angeles Fire Dept. Training, Los Angeles, CA (3 days)
- 2019.12 FAA Requirements Workshop for Fire Depts and Emergency Services, NIST (1 day)
- 2019.11 Atlantic Future Forum, UK HMS Queen Elizabeth, Annapolis, MD (2 days)
- 2019.11 DHS Familiarization Exercise, Army Camp Shelby, MS (5 days)
- 2019.10 World Robot Summit, Fukushima, Japan (5 days)
- 2019.09 NATO Aerial and Ground Exercise, Base Borden, Ontario, Canada (3 days)
- 2019.07 Aerial Validation Exercise at NIST (3 days)
- 2019.06 RoboCupRescue International Championship, Sydney, Australia (5 days)

2019.06 ASTM E54.09 Response Robots Meeting and Exercise, Denver, CO (5 days)



2019 Host: Houston Fire Dept



2018 Host: San Diego Fire Dept

2017 Host: Canadian CETA

Validation Exercises

Use Case Examples

Color Key: Ground Aerial Aquatic Multiple Standards

- 2020.08 DHS/DOJ sUAS Procurement Testing ($35M), Montgomery County Police Facility, MD (1 days)
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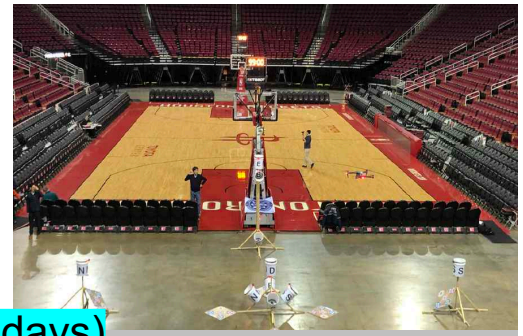
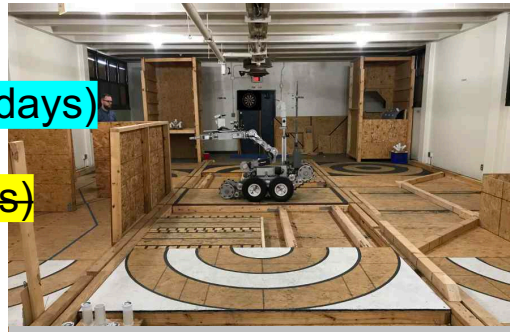


2019 Host: Houston Fire Dept



2018 Host: San Diego Fire Dept

2017 Host: Canadian CETA

Validation Exercises

Use Case Examples

Color Key: Ground Aerial Aquatic Multiple Standards

2020.02 ASTM E54.09 Response Robots Meeting and Exercise, Atlanta, CO (3 days)

- 2020.01 Ohio Fire Training Facility Opening, Ohio (2 days)
- 2020.01 FDIC Fire/Rescue East, Daytona, FL (2 days)
- 2020.01 Los Angeles Fire Dept. Training, Los Angeles, CA (3 days)
- 2019.12 FAA Requirements Workshop for Fire Depts and Emergency Services, NIST (1 day)
- 2019.11 Atlantic Future Forum, UK HMS Queen Elizabeth, Annapolis, MD (2 days)
- 2019.11 DHS Familiarization Exercise, Army Camp Shelby, MS (5 days)
- 2019.10 World Robot Summit, Fukushima, Japan (5 days)
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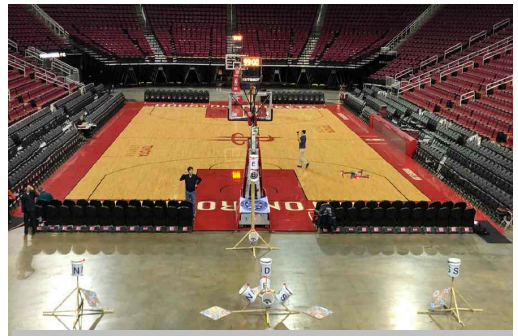
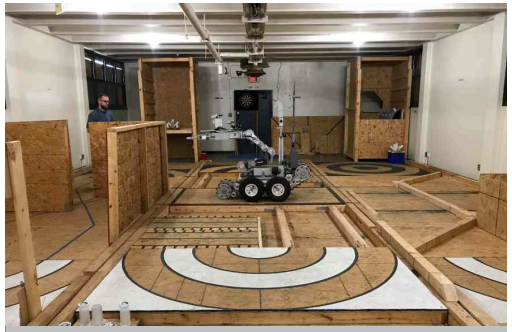


2019 Host: Houston Fire Dept



2018 Host: San Diego Fire Dept

2017 Host: Canadian CETA

Validation Exercises

Use Case Examples

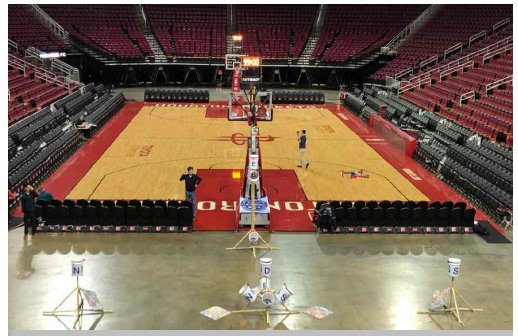
Color Key: Ground Aerial Aquatic Multiple Standards

2019.06 ASTM E54.09 Response Robots Meeting and Exercise, Denver, CO (5 days)

- 2019.05 Western Regional Robot Rodeo, Sandia/Kirtland, Albuquerque, NM (5 days)
- 2019.05 Canadian Police College Training Exercise, London, ON Canada (7 days)
- 2019.04 Thermite RS2 firefighting robot capabilities evaluation (1 day)
- 2019.04 Army Tank Automotive Research and Development facility fabrication (remote)
- 2019.04 Fire Dept Training Conference (FDIC), Indianapolis, IN (3 days)
- 2019.04 Guardian Center Training, Perry, GA (2 days remote)
- 2019.04 Reveille Ranch Calibration, Texas Dept of Public Safety, Burnet, TX (2 days)
- 2019.04 InstantEye UAS capabilities evaluation, NIST (3 days)

2019.03 ASTM F38 standard balloted referencing 6 of our aerial test methods

- 2019.03 Navy Explosive Ordinance Disposal Tech Division facility fabrication (remote)
- 2019.03 Virginia UAS Summit on Public Safety, Crozet, VA (3 days)



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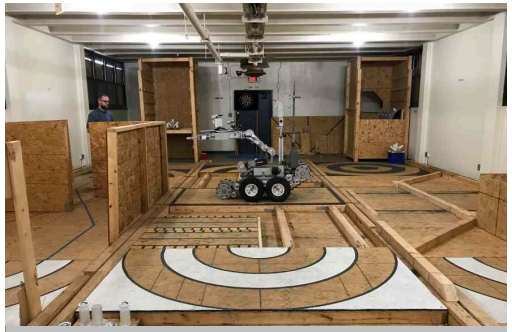


2018 Host: San Diego Fire Dept

2017 Host: Canadian CETA

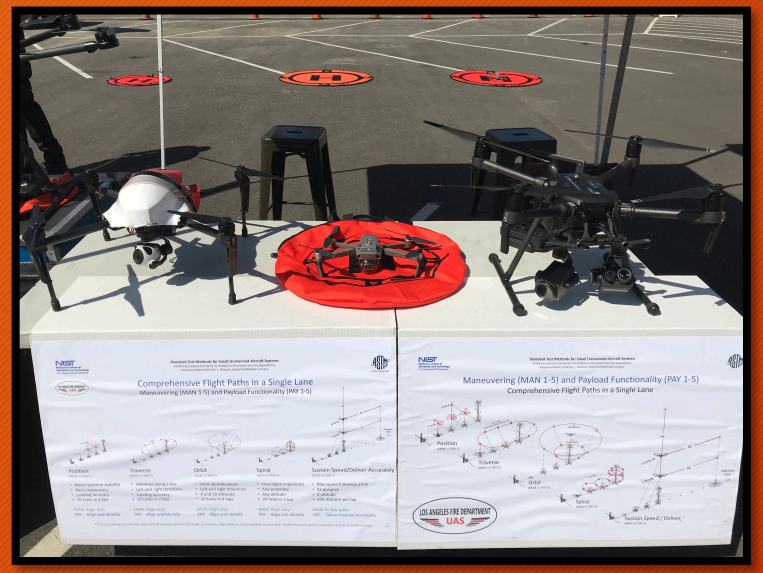
California: Los Angeles CITY Fire Dept.

Use Case Examples

Los Angeles *CITY* Fire Department Unmanned Aerial System (UAS) Program

- UAS Program approved by LA City Council, 2017
- Established to fight fires, improve efficiency of training, respond to high risk incidents
- Developed UAS applications for:
  - Brush Area Hazards inspections
  - Brush Fire Mapping
  - Thermal Hotspot Identification - assisting firefighters to identify and extinguish active fires
  - HAZMAT, Urban Search and Rescue, and Swift Water Operations
  - Situational Awareness - video-streaming to Emergency Operations Center for large scale events

Public Safety UAS Standardization with NIST Aerial Test Methods



HOW LAFD uses NIST Aerial Test Methods:

- Basic Evaluation Standards to objectively certify LAFD Basic Remote Pilots
  - Recognized by FAA and NFPA as recommended evaluation tool
- Scalable to evaluate advanced procedures and application
- Practical to evaluate equipment and perform Functional Check Flights (FCF)


LOS ANGELES FIRE DEPARTMENT
FOUNDED 1886
LOS ANGELES FIRE DEPARTMENT
UAS

Japan: International Rescue System Institute

Use Case Examples

ASTM E54.09

Status report on sUAV-STM evaluation excersize in Japan

4th Feb. 2021

Purpose of this paper

To share the results of sUAV-STM evaluation exercose in Japan (Nagaoka, Niigata) held on 25th-26th Jan. 2021

Summary

Purpose : **To identify the issues on the application of NIST sUAV-STM in Japan**

Date : **Jan. 25 - 26th 2021**

Location : **Nagaoka / Niigata, Japan**

Participants : **Pilot 11 , Proctor 6**

Tasks : **Basic / Position & Traverse** (MAN only, 2-Lap each)

Lane : **4 lanes** (simultaneous flight)

For the COVID-19 countermeasure;

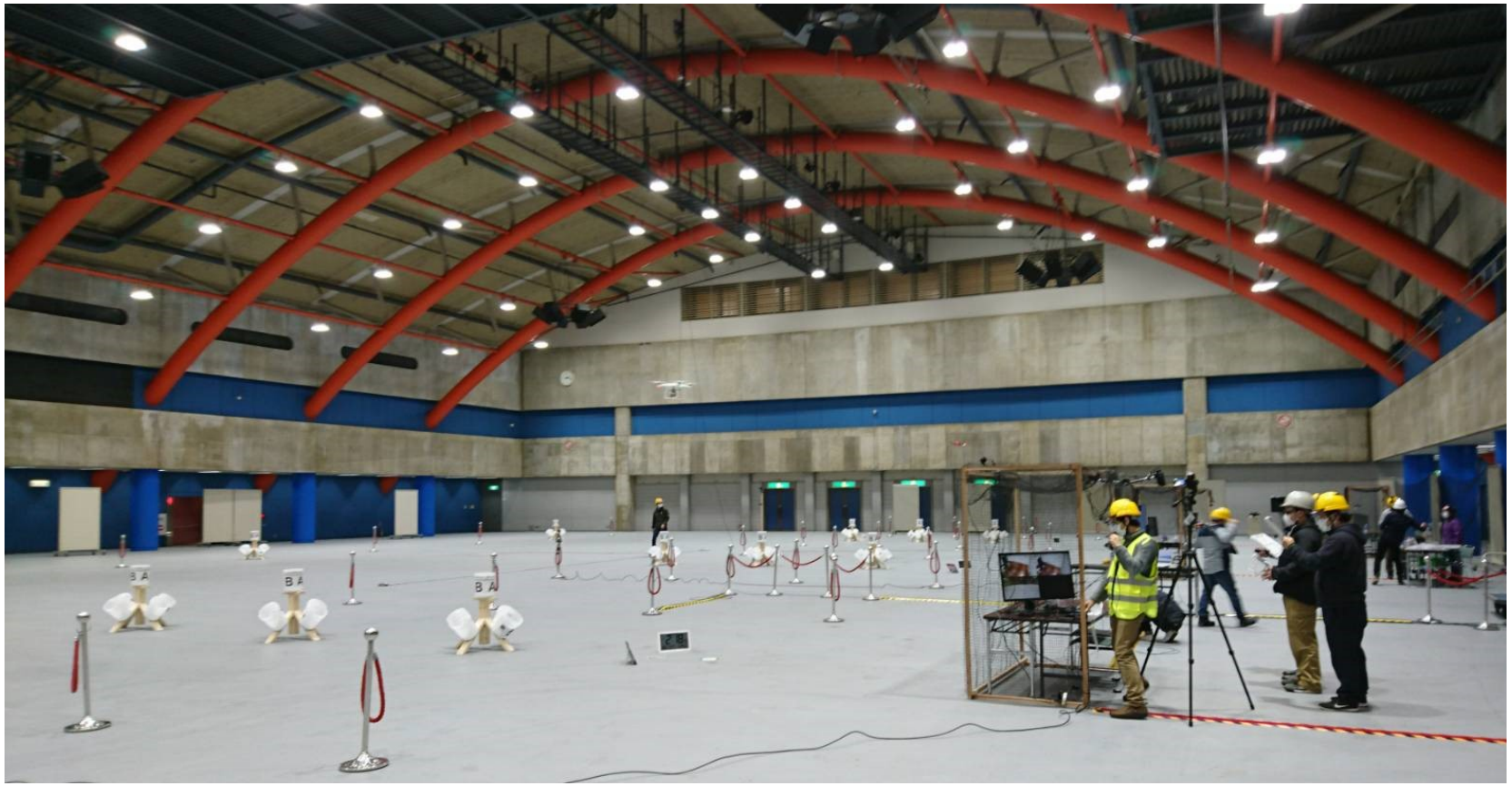
Reduced number of the on-site Participants by,

- ✓ YouTube Live distribution
- ✓ Independent 3-event repeated for 3 groups

	Day 1	Day2
9:30 -	Preparation	Group **B** (4 lanes) - Briefing - Exercise (1 hr.) - Flight - Debriefing
13:30 – -16:30	Group **A** (3 lanes) - Briefing - Exercise(1 hr.) - Flight - Debriefing	Group **C** (4 lanes) - Briefing - Exercise(1 hr.) - Flight - Debriefing
-19:00		Cleanup

Summary

■ **Open spaces for 4 lanes**



Total 11 pilots flew the sUAV without GPS on 4 lanes in 2 days.

Summary

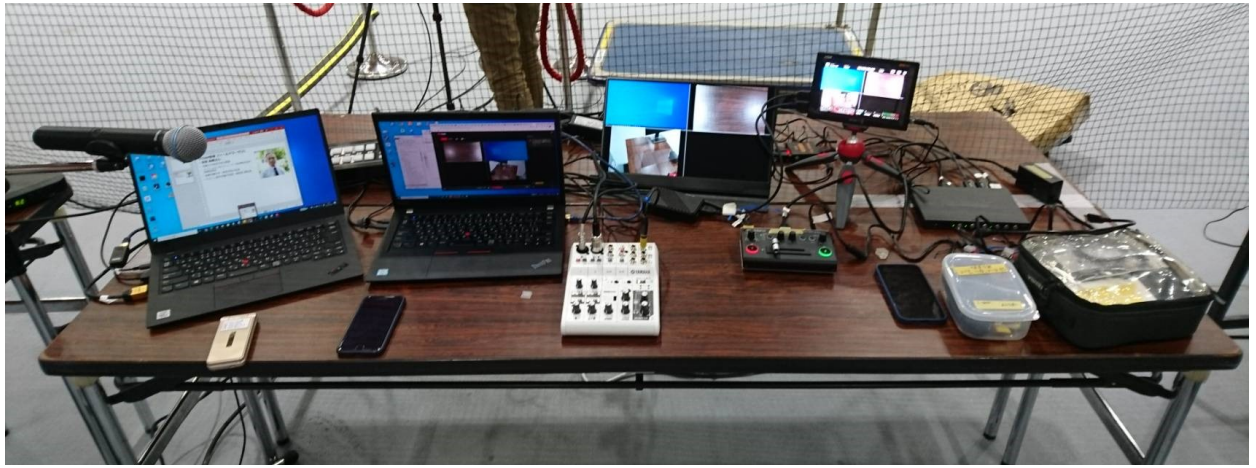
■ Safe Flight Booth

Left : Pilot with camera on his helmet for video distribution by YouTube.

Right : Visual Observer watching the large monitor to keep the Social Distance with the pilot

Summary

■ Cameras and Video distribution system

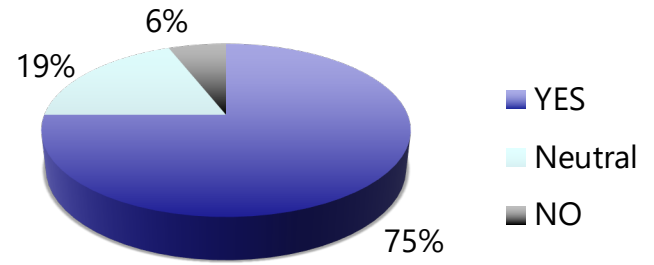


Results and analysis

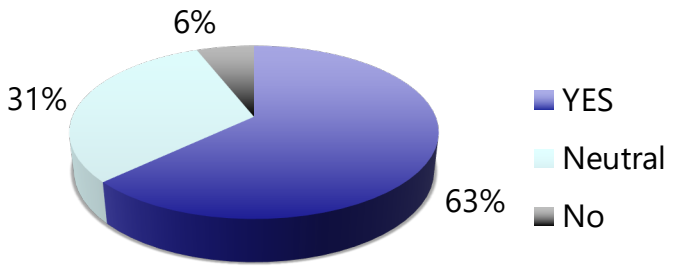
■ Major Results

Overall, the participants' comments are positive for applying the NIST sUAV-STM into Japan.

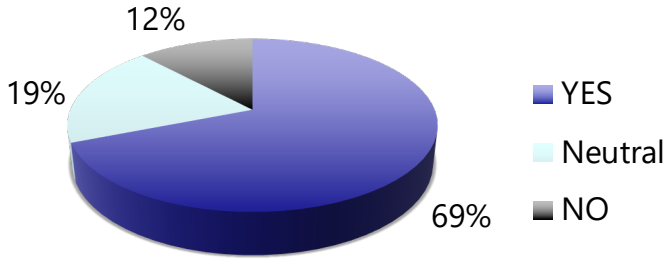
Q Is the sUAV-STM easy to understand ?



Q Is the sUAV-STM effective method for evaluating the PERFORMANCE OF sUAV?



Q Is the sUAV-STM effective method for evaluating the PERFORMANCE OF PILOTs?



Issues and analysis

■ Results

Major comments

The targets shown on the Monitor are too small to judge the alignment.
Larger monitors have advantages for getting better scores, which is not fair.

expected

actual

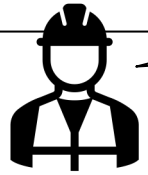
The size of monitor and/or the size of the targets shown on the monitor should be checked in advance.

Issues and analysis

■ Results

Major comments

It is important to record the detail of the sUAV specifications & pilots' experiences, since those "conditions" drives the results of "man-machine integrated performance.



Following information should be recorded on the evaluation form.

[Pilot info]
- Flight hours
- Type of sUAV business (surveyor etc.)
- BVLOS flight experiences
- Major operation is Auto or Manual
- STM experiences
- normally 1 person flight (both of maneuvering and camera operations) or 2-person operation (Camera operation is done by another person)

[sUAV info]
- Visual sensor On / Off (P-mode flight or A-mode flight etc.)
- with or without Camera Zoom
- Size of Monitor
- Size of Target view (Green Circle) shown on the monitor
- Velocity of Camera Tilt control
- Is the sUAV pilot's familiar vehicle or the one flew for the first time today.

Issues and analysis

■ Discussions

One of the major debriefing discussion is the “allowable navigation by proctor for the pilot during flight.”

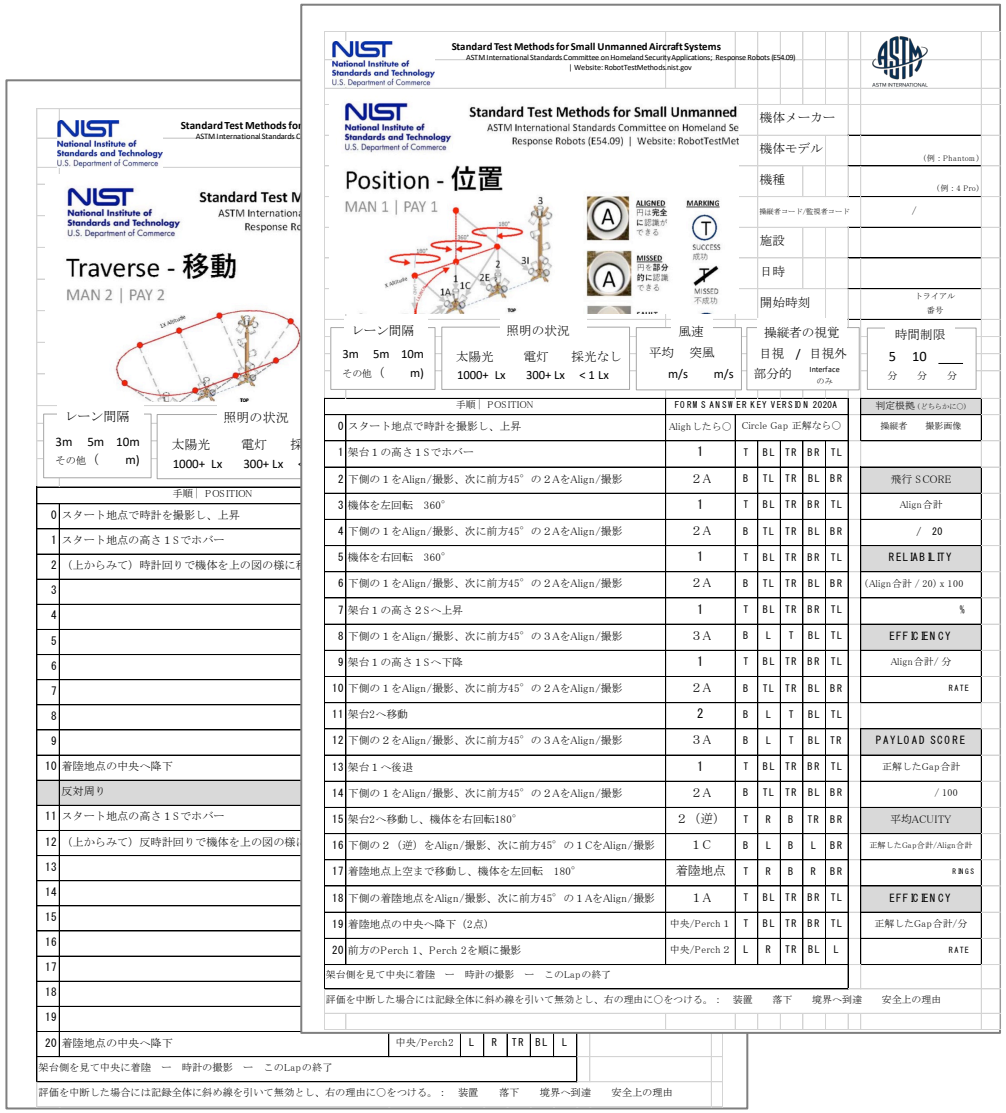
During our event, we allowed the proctors to give some “words of guide” such as “ next, go to 2, forward ” “next, camera tilt down for 2A” to the pilot. Some proctors gave the pilots a “ navigation for smooth flight and camera shooting” which may lead better score. On the other hand, some proctors might give some “waiting-time to the pilot” during recording on the form, which makes the pilots’ score worse.

These navigations should be standardized and proctors should be trained .

Issues and analysis

■ Other topics

For the better
understanding
of NIST Score Form,
Japanese-version was used
for participants temporarily.



Standard Test Methods for Small Unmanned Aircraft Systems
ASTM International Standards Committee on Homeland Security Applications; Response Robots (E54.09)
| Website: RobotTestMethods.nist.gov

Standard Test Methods for Small Unmanned
ASTM International Standards Committee on Homeland Se
Response Robots (E54.09) | Website: RobotTestMet

Position - 位置
MAN 1 | PAY 1

Traverse - 移動
MAN 2 | PAY 2

機体メーカー	
機体モデル	（例：Phantom）
機種	（例：4 Pro）
操縦者コード/監視者コード	/
施設	
日時	
開始時刻	トライアル番号

レーン間隔: 3m 5m 10m / その他（ m）
照明の状況: 太陽光 1000+ Lx / 電灯 300+ Lx / 採光なし < 1 Lx
風速: 平均 m/s / 突風 m/s
操縦者の視覚: 目視 / 目視外 部分的 Interface のみ
時間制限: 5 分 10 分 ___ 分

	手順｜POSITION	FORM S ANSWER KEY VERSION 2020A Aligh したら○	Circle Gap 正解なら○				
0	スタート地点で時計を撮影し、上昇						
1	架台１の高さ１Ｓでホバー	1	T	BL	TR	BR	TL
2	下側の１をAlign/撮影、次に前方45° の２AをAlign/撮影	２A	B	TL	TR	BL	BR
3	機体を左回転 360°	1	T	BL	TR	BR	TL
4	下側の１をAlign/撮影、次に前方45° の２AをAlign/撮影	２A	B	TL	TR	BL	BR
5	機体を右回転 360°	1	T	BL	TR	BR	TL
6	下側の１をAlign/撮影、次に前方45° の２AをAlign/撮影	２A	B	TL	TR	BL	BR
7	架台１の高さ２Ｓへ上昇	1	T	BL	TR	BR	TL
8	下側の１をAlign/撮影、次に前方45° の３AをAlign/撮影	３A	B	L	T	BL	TL
9	架台１の高さ１Ｓへ下降	1	T	BL	TR	BR	TL
10	下側の１をAlign/撮影、次に前方45° の２AをAlign/撮影	２A	B	TL	TR	BL	BR
11	架台2へ移動	2	B	L	T	BL	TL
12	下側の２をAlign/撮影、次に前方45° の３AをAlign/撮影	３A	B	L	T	BL	TR
13	架台１へ後進	1	T	BL	TR	BR	TL
14	下側の１をAlign/撮影、次に前方45° の２AをAlign/撮影	２A	B	TL	TR	BL	BR
15	架台2へ移動し、機体を右回転180°	２（逆）	T	R	B	TR	BR
16	下側の２（逆）をAlign/撮影、次に前方45° の１CをAlign/撮影	１C	B	L	B	L	BR
17	着陸地点上空まで移動し、機体を左回転 180°	着陸地点	T	R	B	R	BR
18	下側の着陸地点をAlign/撮影、次に前方45° の１AをAlign/撮影	１A	T	BL	TR	BR	TL
19	着陸地点の中央へ降下（2点）	中央/Perch 1	T	BL	TR	BR	TL
20	前方のPerch 1、Perch 2を順に撮影	中央/Perch 2	L	R	TR	BL	L

架台側を見て中央に着陸 ― 時計の撮影 ― このLapの終了

評価を中断した場合には記録全体に斜め線を引いて無効とし、右の理由に○をつける。： 装置 落下 境界へ到達 安全上の理由

判定根拠（どちらかに○） 操縦者 撮影画像

飛行 SCORE
Align 合計
/ 20
RELIABILITY
(Align 合計 / 20) x 100
%
EFFICIENCY
Align 合計/ 分
RATE
PAYLOAD SCORE
正解したGap 合計
/ 100
平均ACUITY
正解したGap合計/Align 合計
RINGS
EFFICIENCY
正解したGap 合計/分
RATE

Future Plan

■ Further study and trial for sUAV-STM in Japan

We are going to further study the appropriate application of NIST sUAV-STM method in Japan including following discussions,

✓ Proctor and visual observer training program

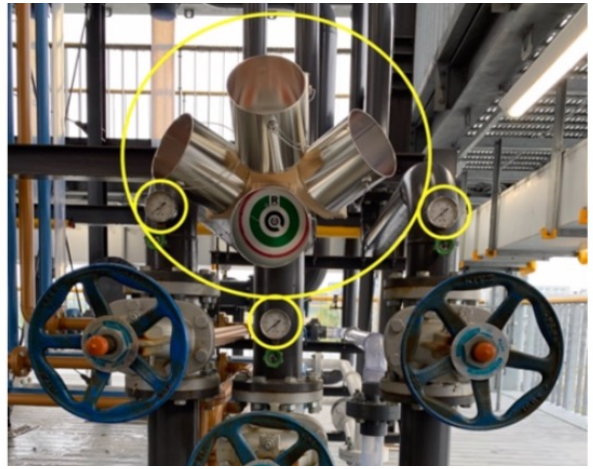
World Robot Summit (2018-2020)

Use Case Examples

Standard Disaster Robotics Category, Fukushima Robot Test Field, Fukushima, Japan





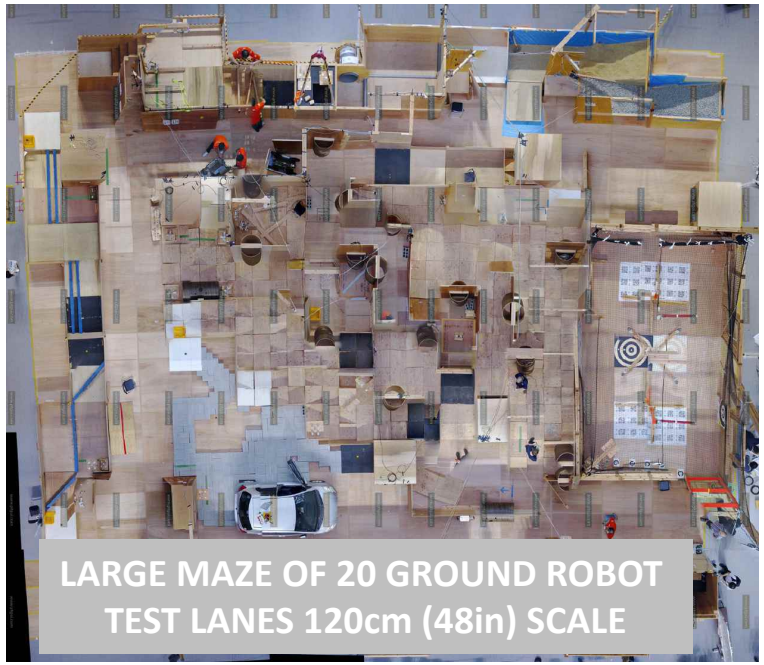



RoboCupRescue Robot League (2000-present)

Use Case Examples

- We conduct annual international robotics research competitions, sometimes two a year.
- The RoboCupRescue Championships (shown below) use 20 ground robot tests set up in a large maze so they can be conducted individually as preliminaries then a comprehensive search mission for finals.
- These competition focus on autonomous behaviors vs. remote teleoperation using all three sizes of robot test lanes. Typically more than 30 teams participate.
- Most teams fabricate the test methods at their facilities to refine designs and practice.


NAGOYA, JAPAN


LARGE MAZE OF 20 GROUND ROBOT TEST LANES 120cm (48in) SCALE

RoboCupRescue Championships

2020 Bordeux, France
2019 Sydney, Australia
2018 Montreal, Canada
2017 Nagoya, Japan
2016 Leipzig, Germany
2015 Hefei, China
2014 Joao Pessoa, Brazil
2013 Eindhoven, Netherlanc
2012 Mexico City, Mexico
2011 Istanbul, Turkey
2010 Singapore, Singapore
2009 Graz, Austria
2008 Suzhou, China
2007 Atlanta, USA
2006 Bremen, Germany
2005 Osaka, Japan
2004 Lisbon, Portugal
2003 Padua, Italy
2002 Fukuoka, Japan
2001 Seattle, USA
2000 AAAI Conf, Austin, TX

Nebraska: Omaha Police Dept.

Use Case Examples

Texas Dept. of Public Safety and Reveille Peak Ranch Test Facility

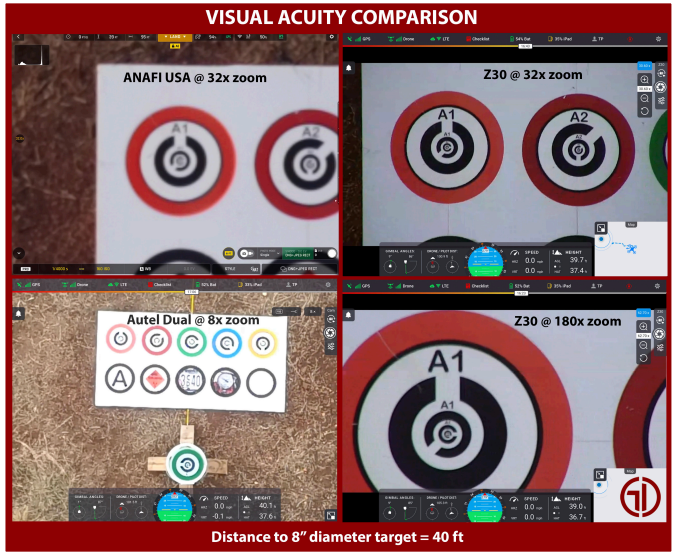
Use Case Examples

Texas Dept. of Public Safety Stats:

Pilots: 100+
Aircraft: 100+
Annual Flights: 10,000+
Main focus: Crash/crime scene reconstruction

News from Texas Legislature

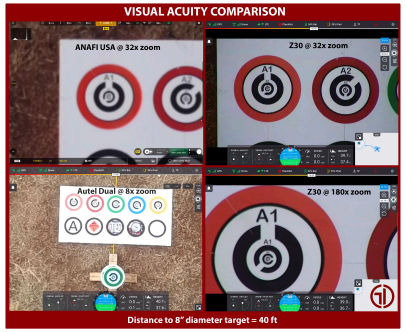
- Training
- Software
- Adoption of NIST tests



Reveille Peak Ranch Test Facility and Statewide Use Cases by Local Organizations (next pages)

Texas Dept. of Public Safety and Reveille Peak Ranch Test Facility

Use Case Examples



Texas Dept. of Public Safety and Reveille Peak Ranch Test Facility

Use Case Examples

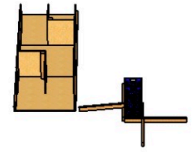
- North Texas Public Safety Unmanned Response Team (PSURT) PSURT Dallas/ Ft. Worth
- Camp Mabry in Austin Texas Granite Defense & Technologies hosted four of the 5 BLUE DIU approved drones for the Texas Air National Guard.
- Harris County (Houston area) Fire Marshal's Office
- Reveille Peak Ranch test facility evaluation
- Texas Department of Emergency Management (TEDM) pursuant to Texas HB2340

Canadian CETA and CERRA Training/Credentialing

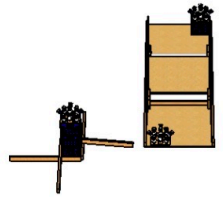
Use Case Examples

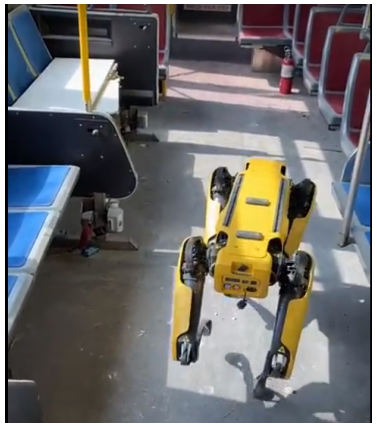
Lead Agencies;
CETA- Canadian Explosives Technicians Association
CERRA- Canadian Emergency Responders Robotics Association

Primary Locations:
Pearson International Airport (Toronto Canada)
Grimsby Regional Training Centre (Grimsby, Ontario , Canada)



CETA
CETA is the national association for police/military/government agencies tasked with response to explosives , chemical, biological, and radiological incidents in Canada. Current projects include EOD Standard training methods for both robots and bomb techs deployed in bomb suits.





CERRA
Spring 2020 established with focus on the public safety deployment of ground, air, water based robotics. Membership is open to any current or former public safety member or agency or any supporting government agency with an interest in response robots.

Drone Responders Now Auditing for ASTM International Compliance

Use Case Examples

XXXXXXXXXXXXXXXXXXX

Safety | Capabilities | Proficiency

SLIDE TEMPLATE