

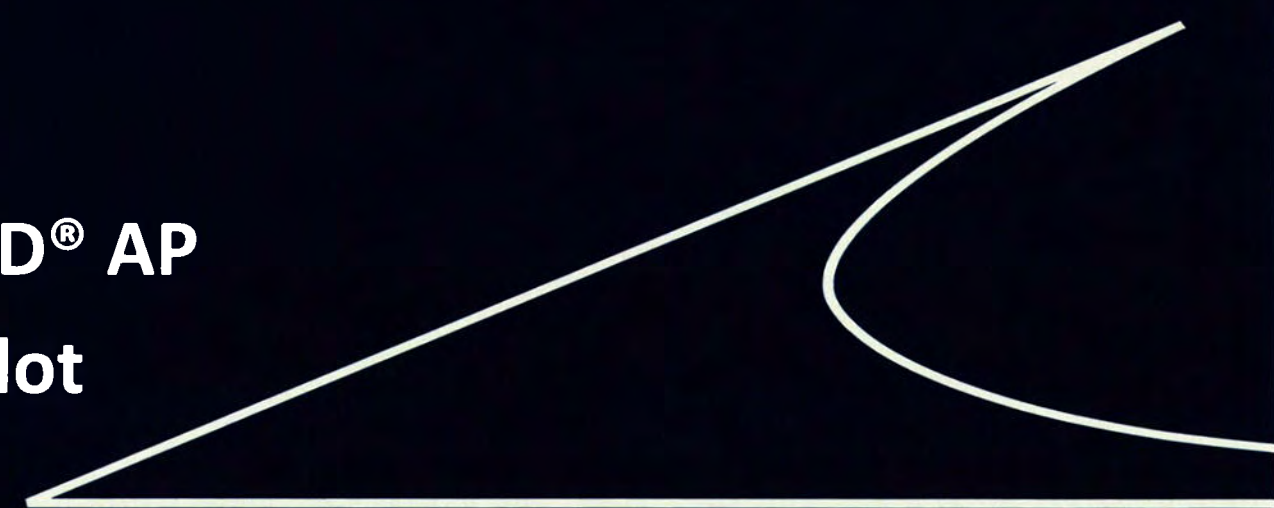
*CELEBRATING 55 YEARS*



# The Benefits of Drone Use in Evaluating the Building Enclosure

**SRAPPA 2020**

**Tony B. Robinson, BECxp, RRC, LEED® AP**  
**Associate and Certified Remote Pilot**



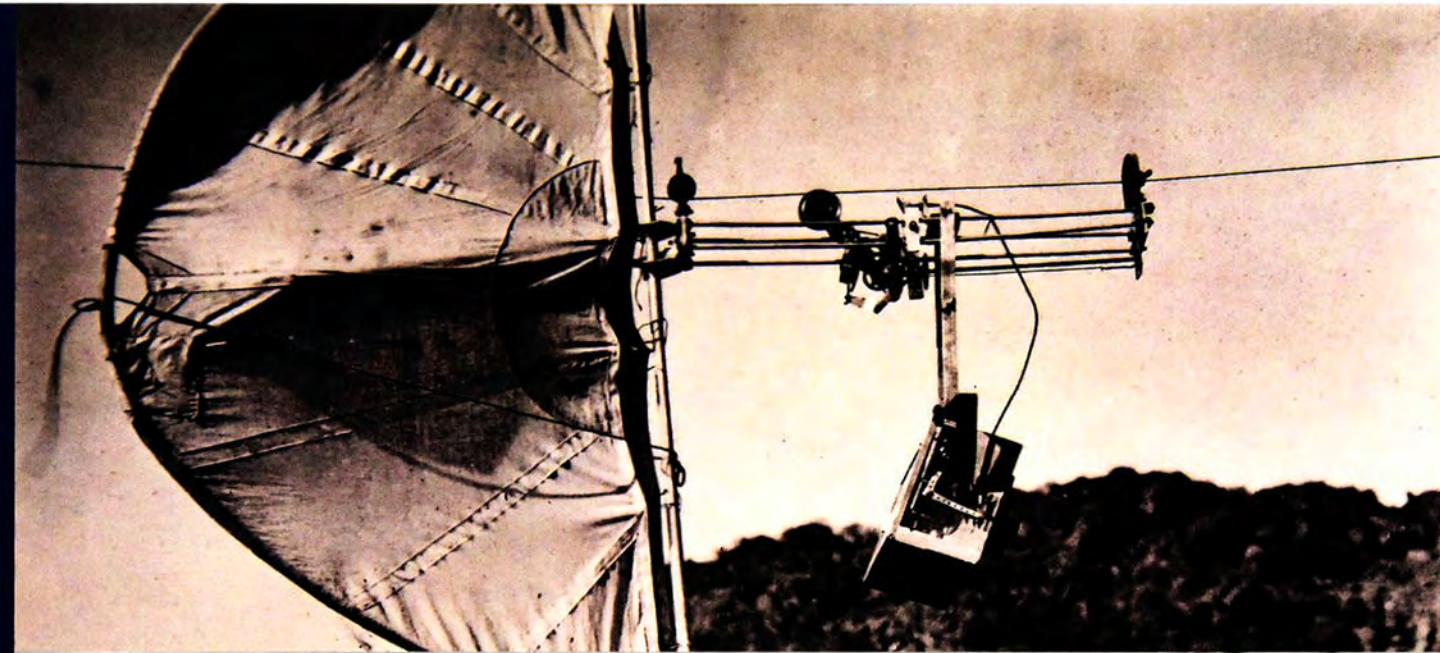
# Learning Objectives

- ▶ **Brief History Drones**
- ▶ **How Drones Work and their various components**
- ▶ **Review of FAA Regulations**
- ▶ **Evaluating the Building Enclosure**
- ▶ **Other Uses**



# History

- ▶ One of the first recorded uses was by Austrians in July 1849
- ▶ 1898 Spanish – American War when the U.S. military fitted a camera to a kite, producing one of the first aerial reconnaissance photographs





# History

- ▶ The term “drone” originated from the British produced unmanned radio-controlled aircraft in 1935 that were used as anti-aircraft practice targets
- ▶ A Lightning Bug Drone was used during the Vietnam war, it was one of the first drones used for surveillance by the USAF





# History

- ▶ Whatever the size of the drone, they all perform the same functions:
  - ▶ Providing intelligence, surveillance, reconnaissance (ISR) via photographs and/or videos



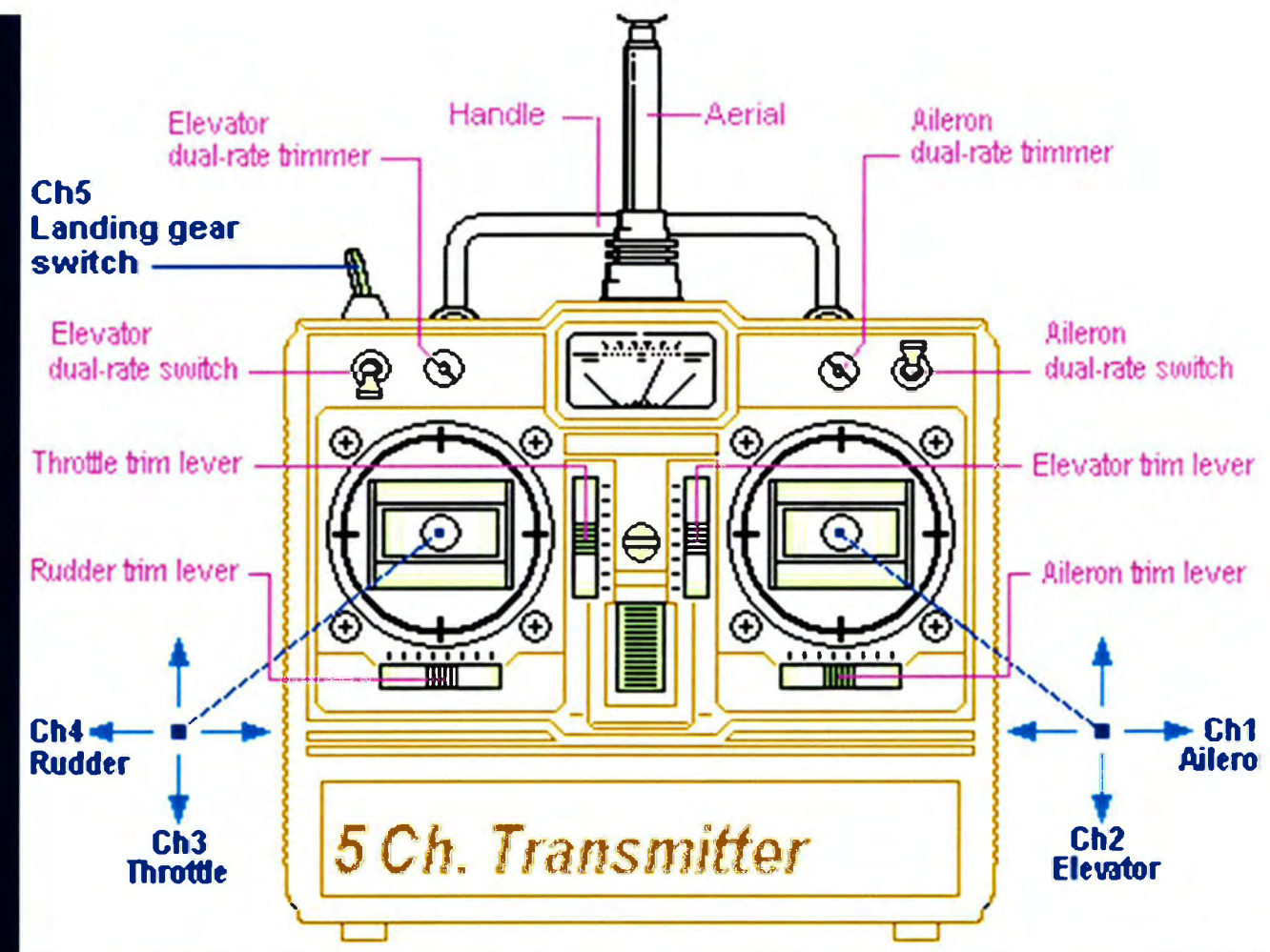


# How Does a (sUAS) Drone Work?

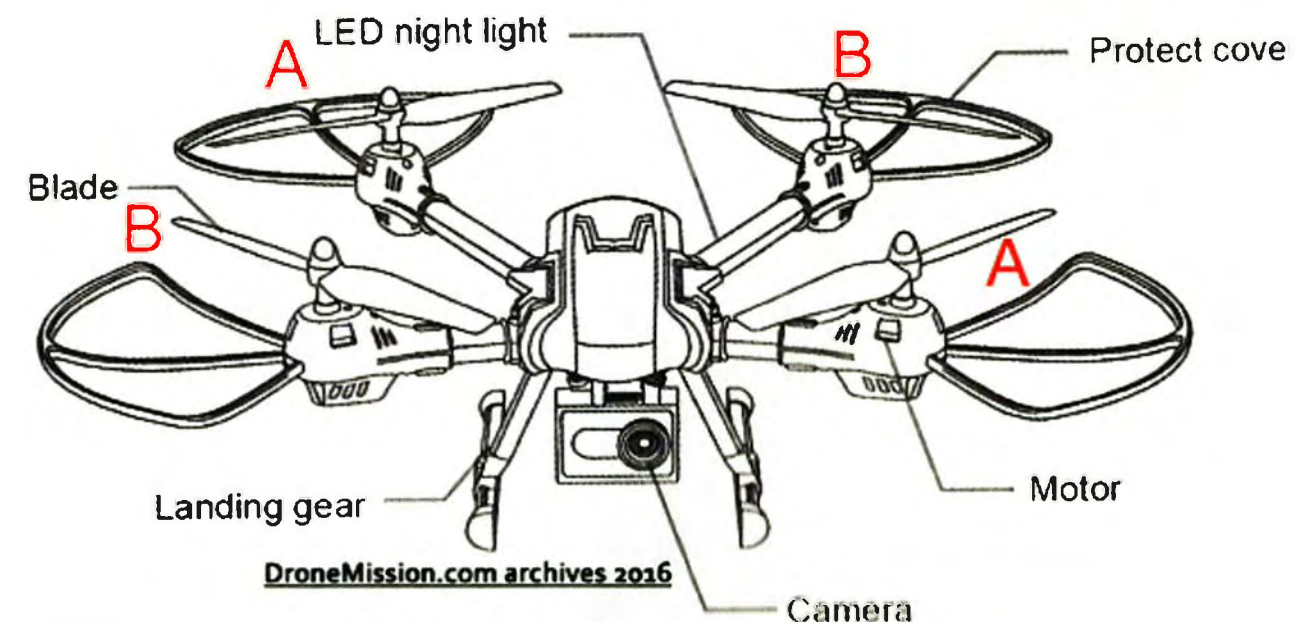
An unmanned aerial vehicle system has two main parts: drone itself and control system

Majority of (sUAS) used by hobbyists or for commercial use have multi-rotors

Multi-rotor drones are inherently unstable and require an on-board computer to stabilize flight.



## Major parts



DroneMission.com archives 2016



# Additional Components

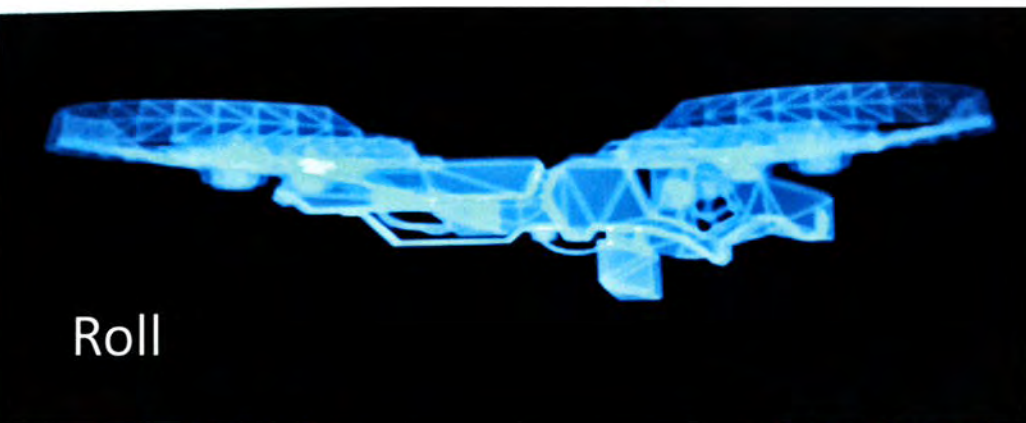
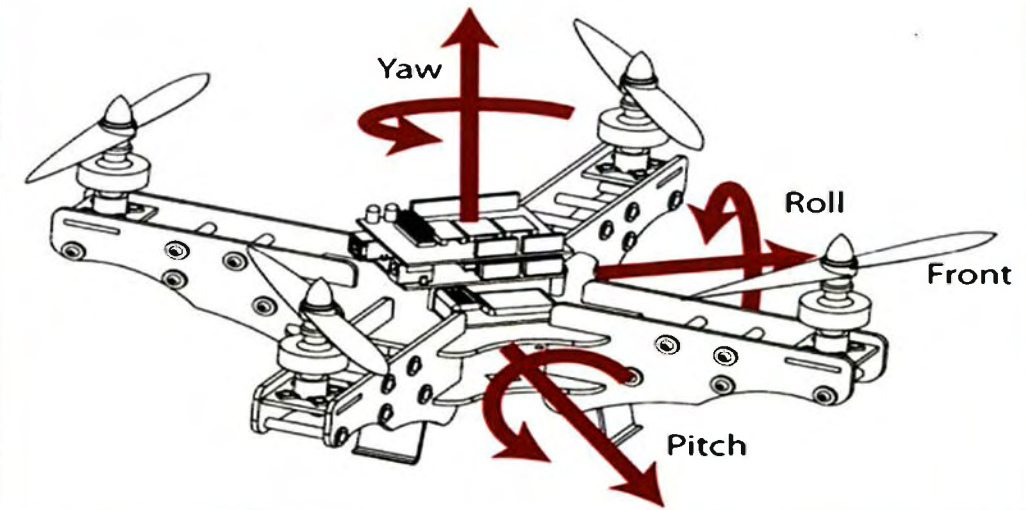
- Rechargeable Lithium-based batteries are used for power.
- Battery Life – Approx. 25 minutes.
- Camera
  - Photographs
  - Video
  - Thermal Imaging





# How Does a (sUAS) Drone Work?

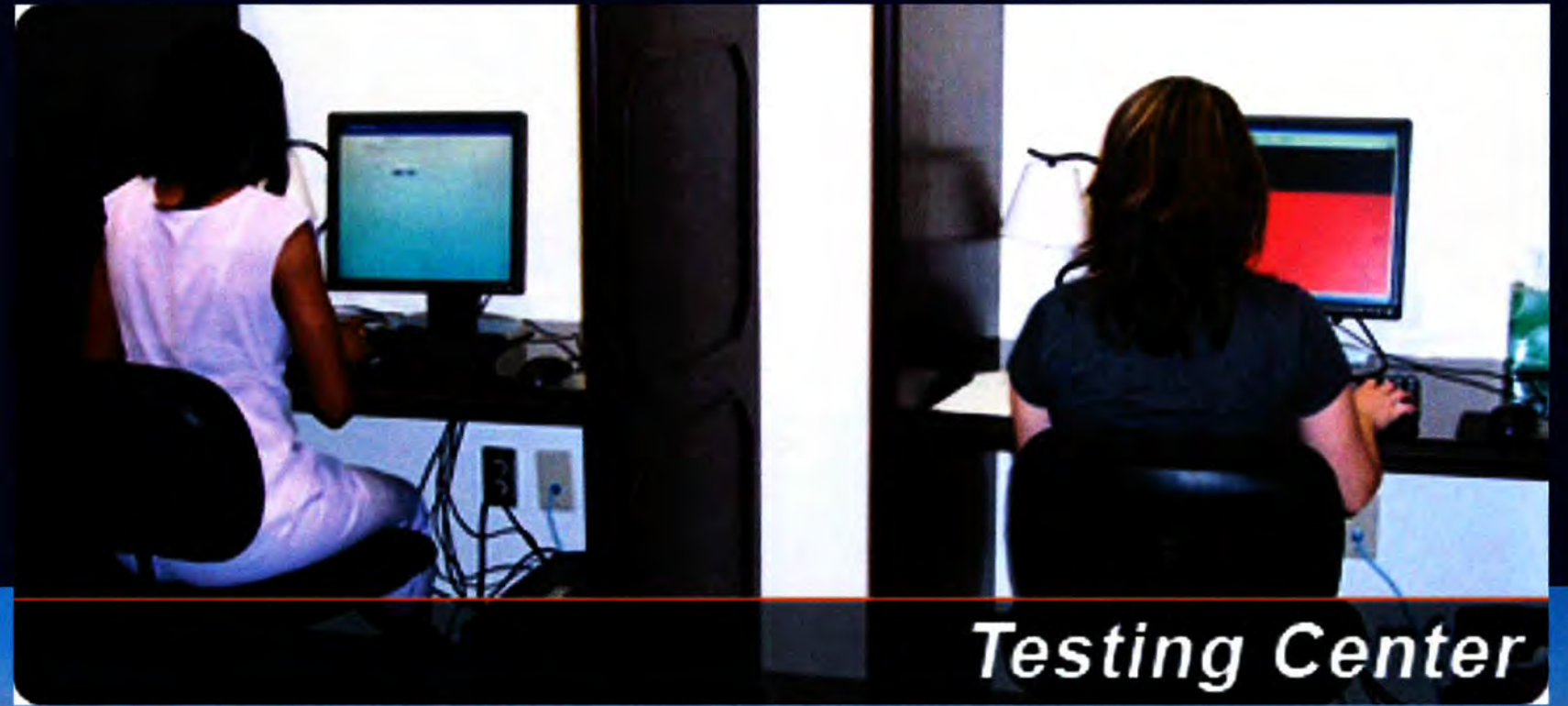
- ▶ Roll, pitch, yaw, and thrust can be changed by speeding up or slowing down
  - ▶ Roll – moves the UAS side to side
  - ▶ Pitch – moves the UAS forward or backwards
  - ▶ Yaw – changes the direction the UAS faces





# FAA Regulations

- ▶ 2015 – FAA created regulations and rules for drone use due to safety concerns
- ▶ Ch 14 CFR – Part 107
- ▶ Certification originally required for hobbyist and for commercial pilots (Pilot Certificate)
  - ▶ As of 2017 certification is only required for commercial pilots



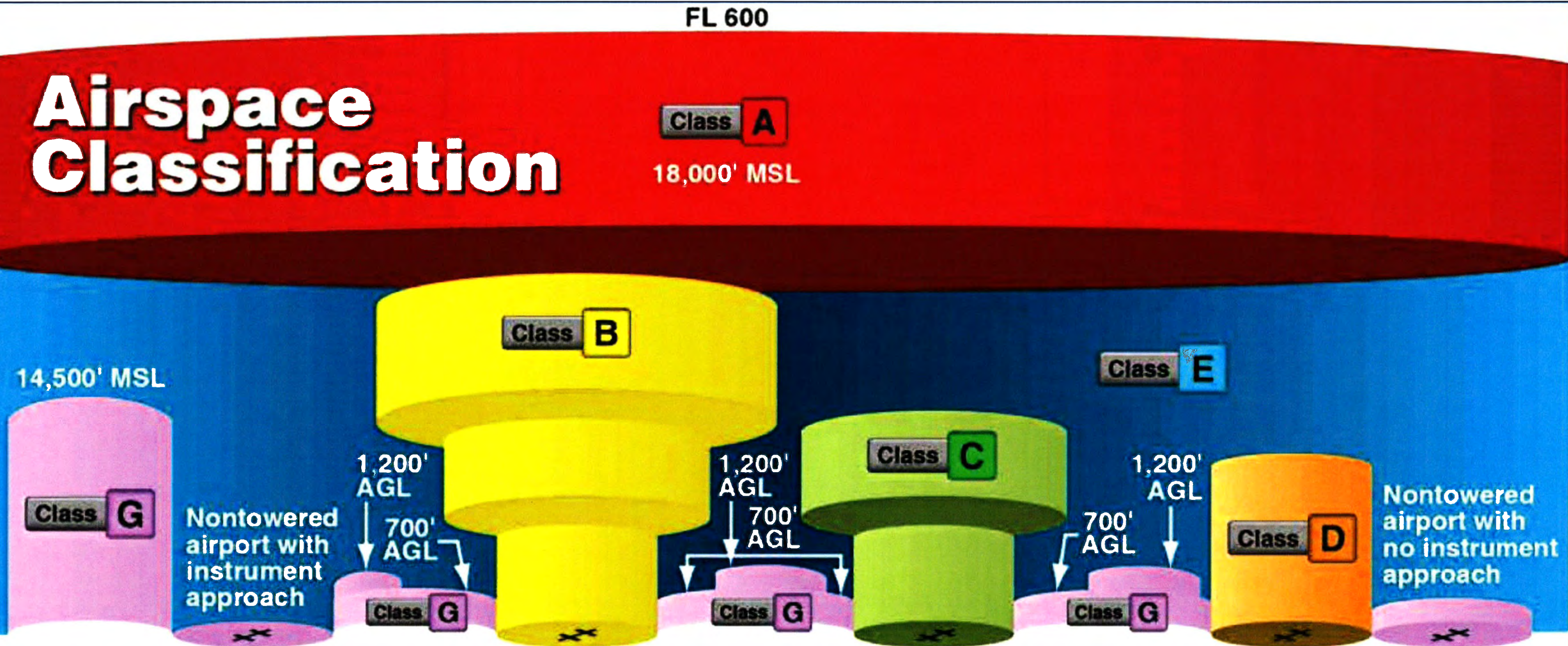


# Rules for Operating an Unmanned Aircraft

|                           | Fly for Fun   | Fly for Commercial Use  |
|---------------------------|---|---|
| Pilot Requirements        | No pilot requirements   | <ul style="list-style-type: none"> <li>Must have Remote Pilot Airman Certificate</li> <li>Must be at least 16 years old</li> <li>Must pass TSA vetting</li> </ul>   |
| Aircraft Requirements     | <ul style="list-style-type: none"> <li>Must be less than 55 lbs.</li> <li><b>Must be registered</b> if over 0.55 lbs. Failure to register can result in up to \$250,000 in fines or up to 3-yrs in prison.</li> </ul>   | <ul style="list-style-type: none"> <li>Must be less than 55 lbs.</li> <li>Must be registered if over 0.55 lbs. (online)</li> <li>Must undergo pre-flight check to ensure UAS is in condition for safe operation</li> </ul>  |
| Location Requirements     | 5 miles from airports without prior notification to airport and air traffic control   | Class G airspace*   |
| Operating Rules           | <ul style="list-style-type: none"> <li>Must ALWAYS yield right of way to manned aircraft</li> <li>Must keep the aircraft in sight (visual line-of-sight)</li> <li>Must follow community-based safety guidelines</li> <li>Must notify airport an air traffic control tower before flying within 5 miles of an airport</li> <li>Must NOT be physiologically impaired</li> </ul> | <ul style="list-style-type: none"> <li>Must keep the aircraft in sight (visual line-of-sight)*</li> <li>Must fly under 400 feet above ground level*</li> <li>Must fly during the day*</li> <li>Must fly at or below 100 mph (ground speed)*</li> <li>Must yield right of way to manned aircraft*</li> <li>Must NOT fly over people*</li> <li>Must NOT fly from a moving vehicle*</li> <li>Must NOT be physiologically impaired</li> </ul> |
| Example Applications      | Educational or recreational flying only   | <ul style="list-style-type: none"> <li>Flying for commercial use (e.g. providing aerial surveying or photography services)</li> <li>Flying incidental to a business (e.g. doing roof inspections or real estate photography)</li> </ul>   |
| Legal or Regulatory Basis | Public Law 112-95, Section 336 – Special Rule for Model Aircraft<br>FAA Interpretation of the Special Rule for Model Aircraft   | Title 14 of the Code of Federal Regulation (14 CFR) Part 107  |



# Airspace Classification



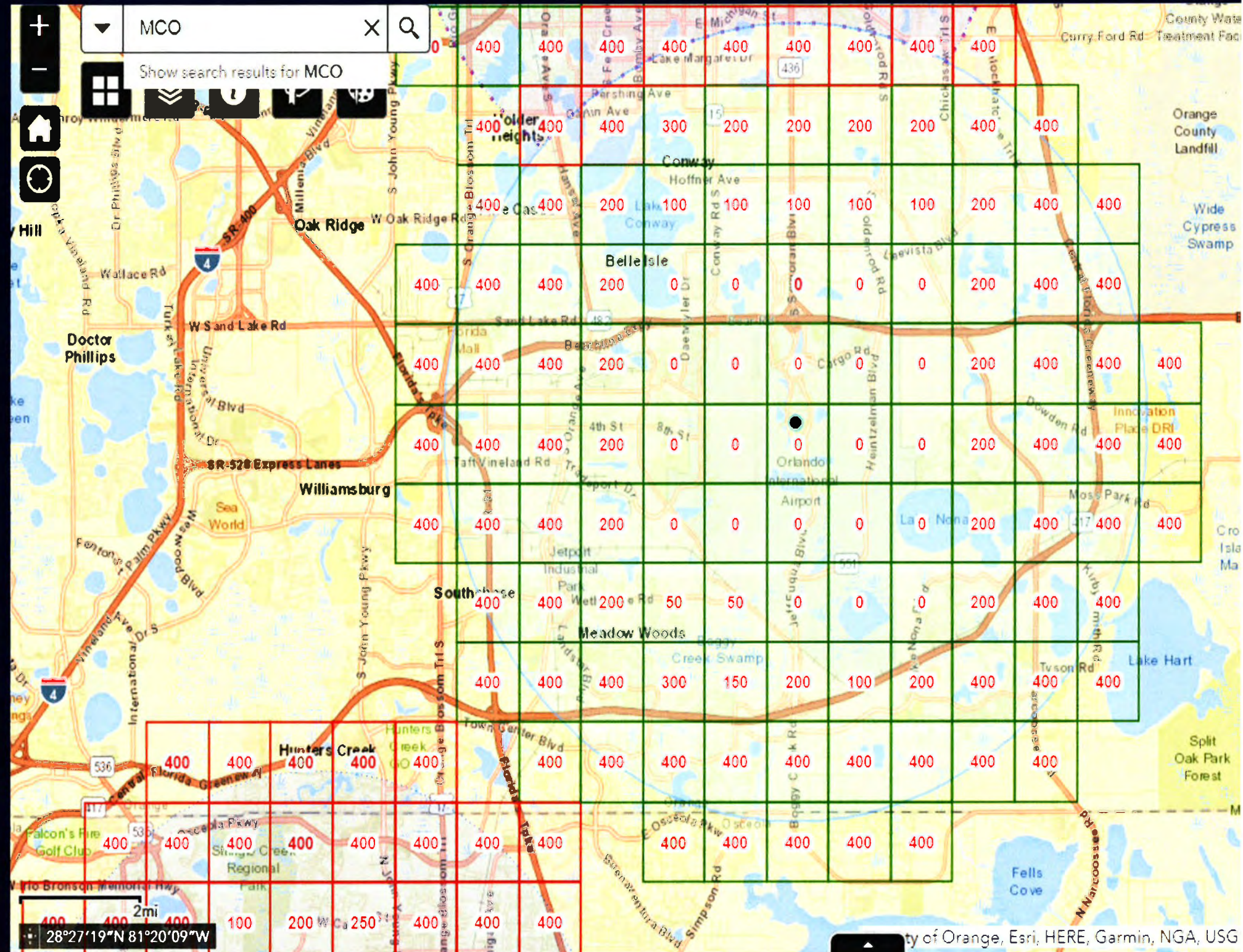
- ▶ Commercial sUAS pilots typically operate in Class G Airspace
- ▶ Class G airspace extends from the surface to the base of the overlying Class E airspace
- ▶ A remote pilot will not need ATC authorization to operate in Class G airspace



# LAANC

## *Low Altitude Authorization and Notification Capability*

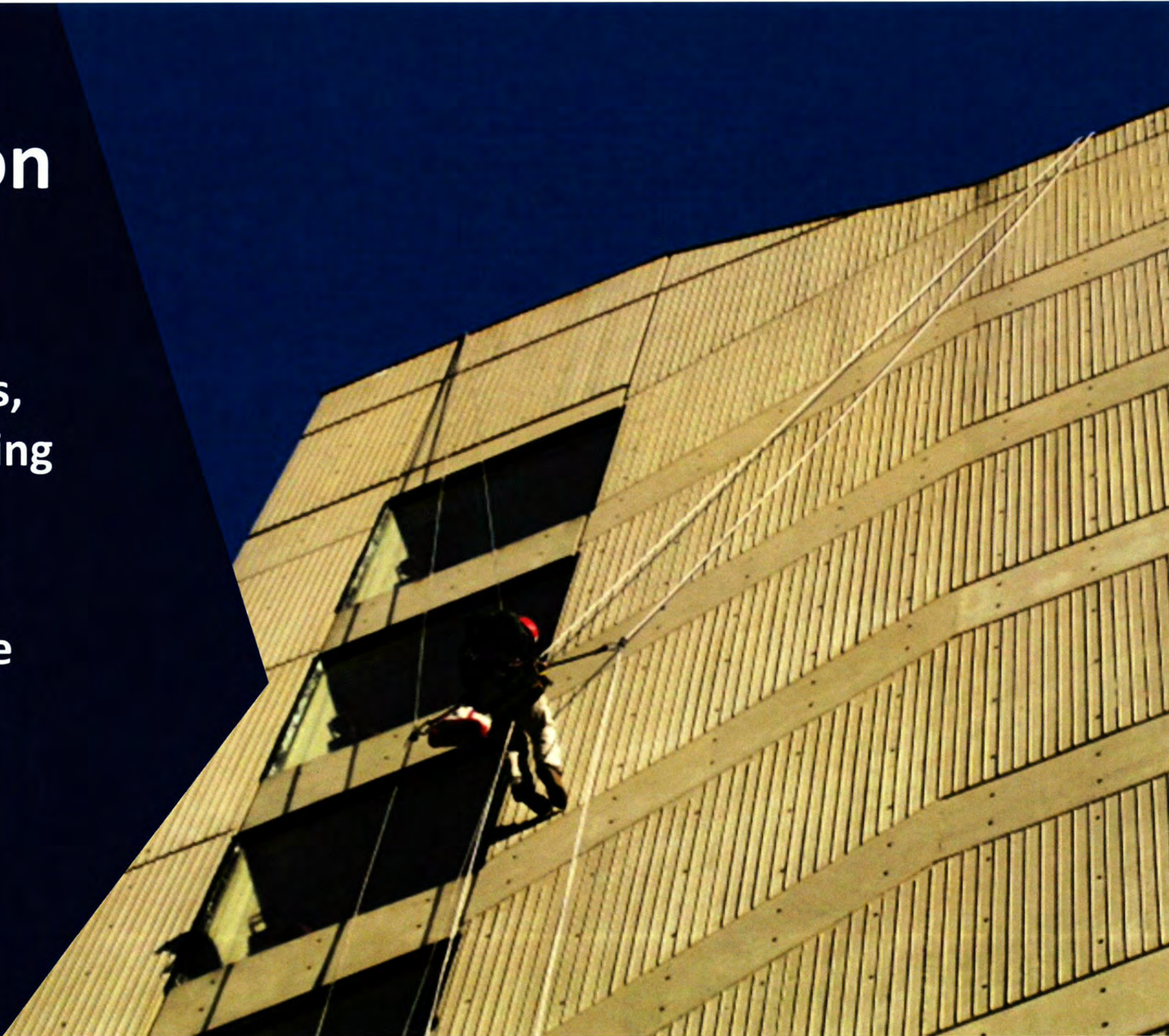
- ▶ The FAA has an automated air space waiver program for all other airspaces, fully operational in fall 2018.
- ▶ The image is an example of flight limits around Orlando International Airport. Areas showing a limit of 0 require a formal request thru the FAA, which can take up 90 days.





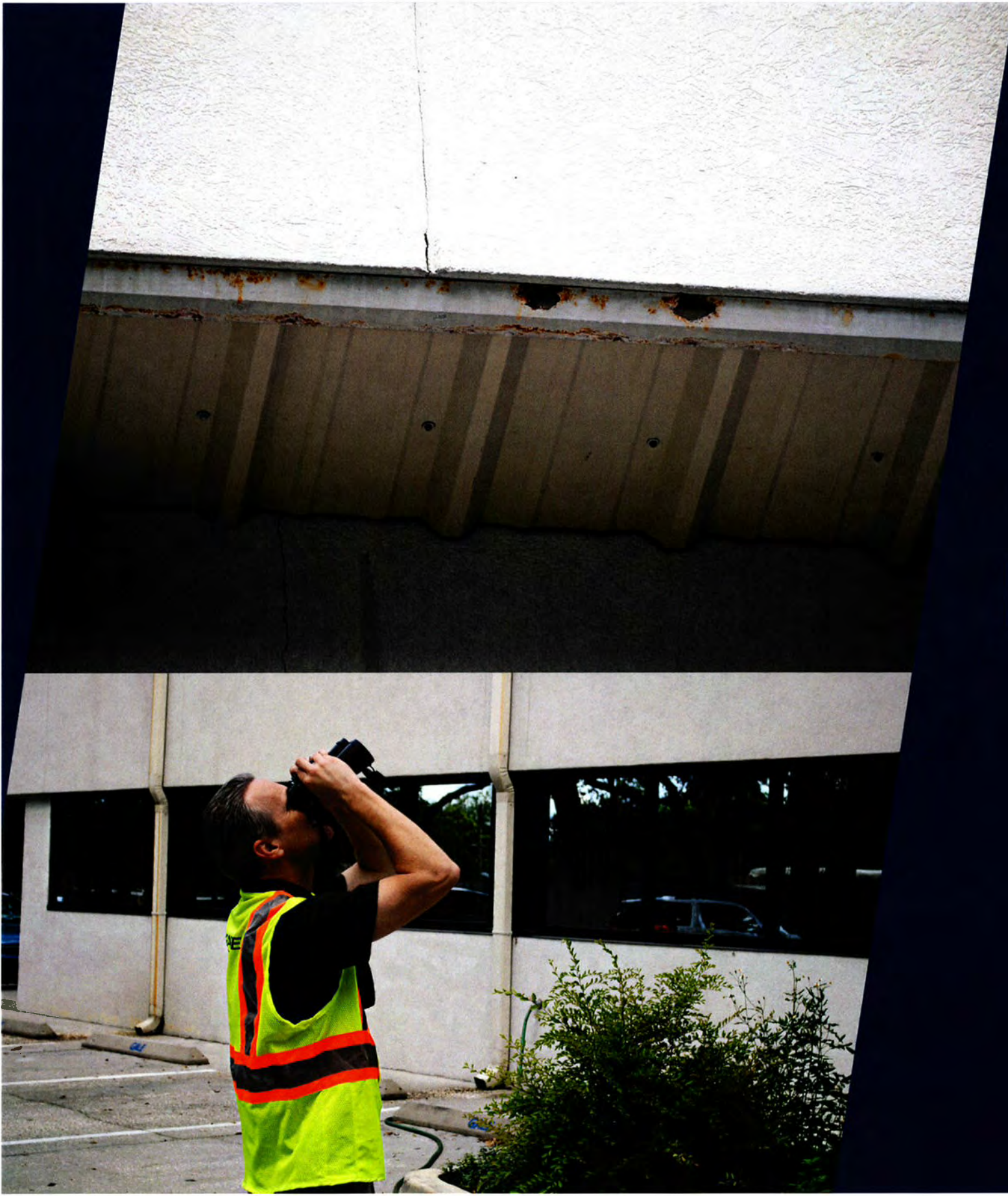
# Facade Inspection Methods

- ▶ Typically use ladders, lifts, hoists, rope access or swing staging
- ▶ These methods are time consuming and expensive
- ▶ The more complex the configuration, the more expensive





# Binocular Inspection





# Man Lift







# Swing Staging





# Rope Access Methods





# Small Unmanned Aircraft Systems (sUAS) - Drones



# Avoids Expensive Access Methods

- ▶ Allows access to hard to reach locations
- ▶ Up to 400 feet above the structure\*





# Costs for Traditional Access Methods

|                             | Average Costs for Evaluation Use   | Limitations  |
|-----------------------------|--|--|
| <b>Binoculars</b>           | \$135/hour   | No ability to capture images observed for later use.   |
| <b>High Reach Equipment</b> | \$2,500/120' lift per week<br>(not including operator or engineer)   | Costly, coordination with facility operations critical, potential for mechanical failure. Tremendous attention to safety.                  |
| <b>Swing Stage</b>          | Initial installation \$2,000<br>Relocate for each drop \$1,200 (if on same building level)<br>\$1,000 per drop for operator and engineer   | Costly, coordination with facility operations critical,. Delay in observation due to mobilization and relocation of staging for each drop. |
| <b>Helicopter</b>           | \$1500 to \$2000 per hour.   | Weather and FAA Clearance  |
| <b>Drone</b>                | The average cost for drone survey is approximately \$3,000-\$4000 total (this includes pilot, engineer and report). Exact price may vary depending on your area and project details. | FAA Regulations, Battery Life, Weather (wind, rain, etc.)  |



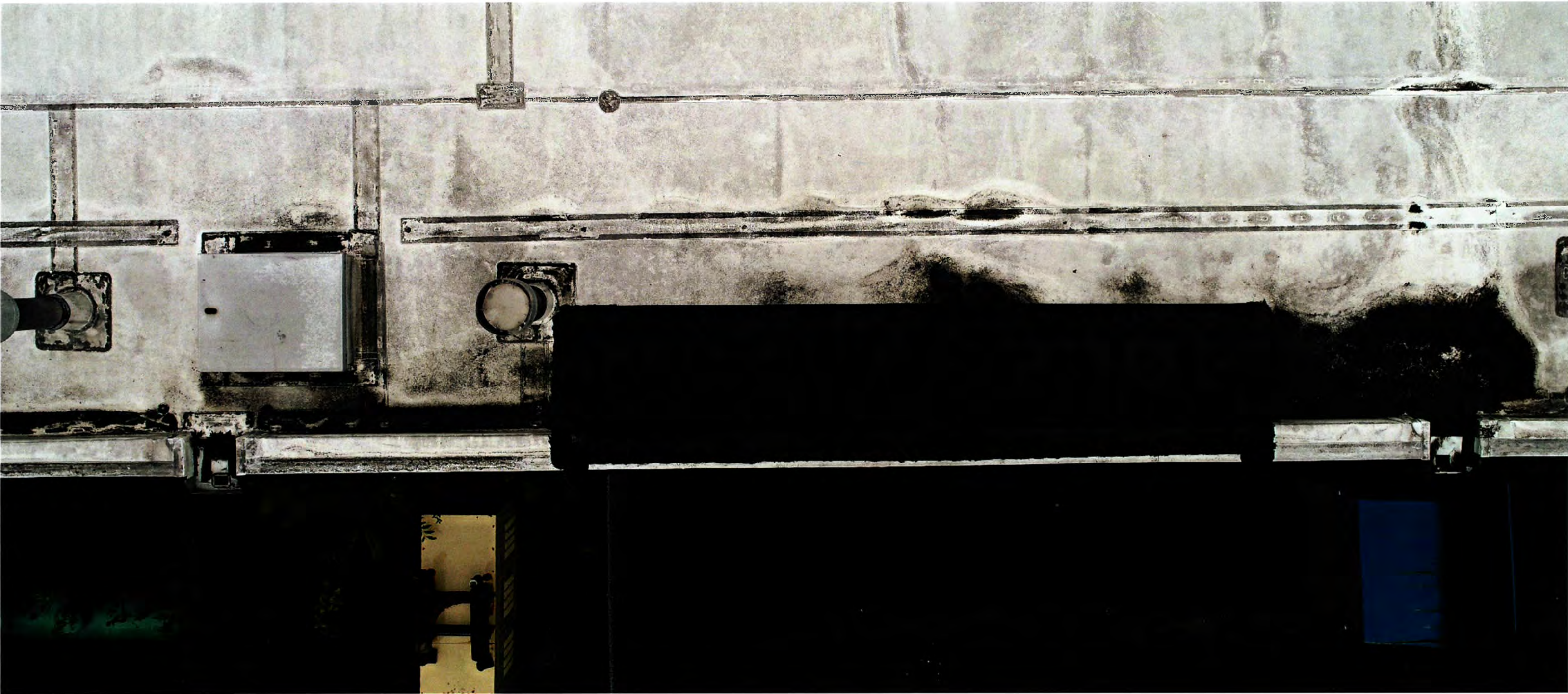






# Building Enclosure Evaluations





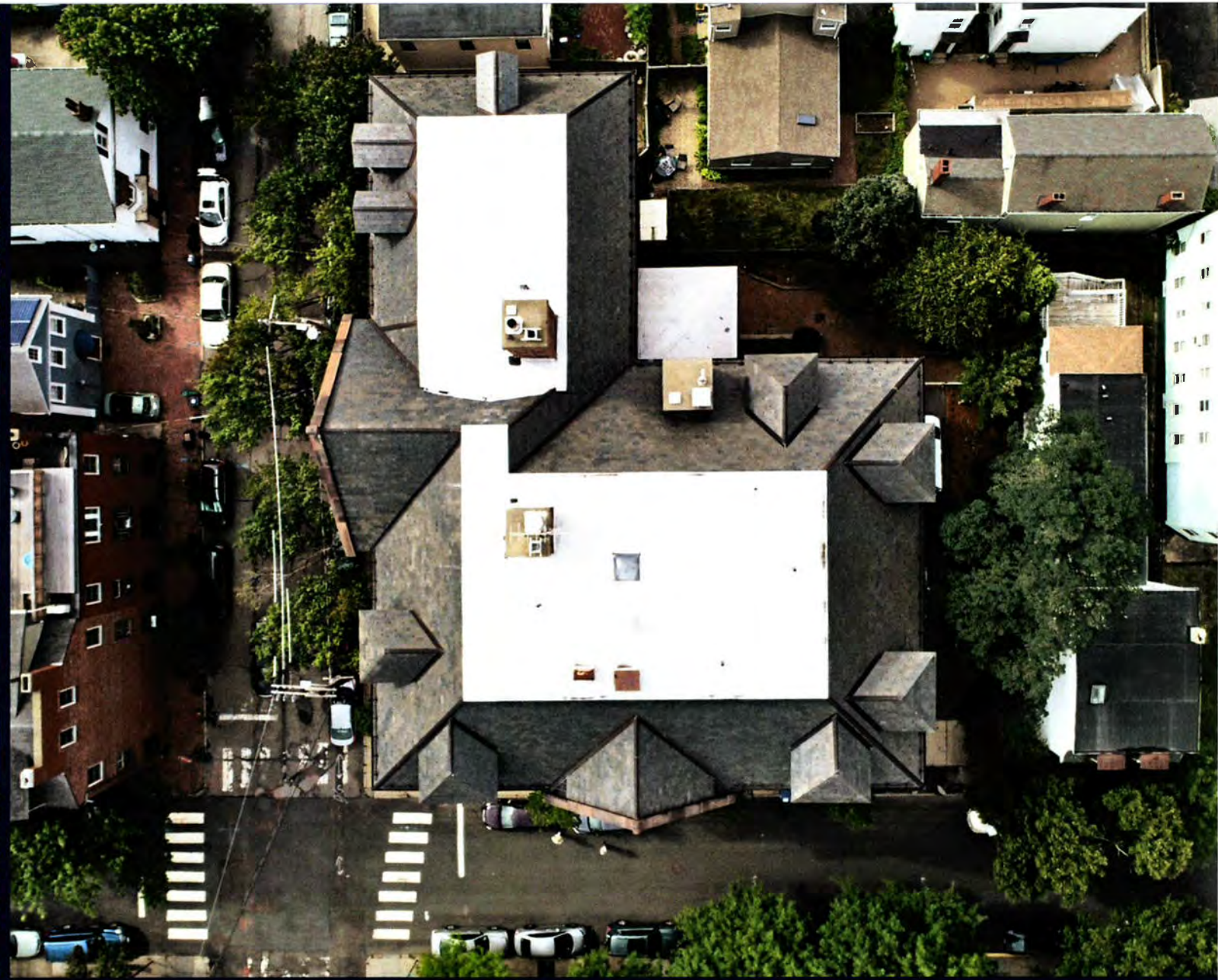
# Building Enclosure Evaluations





# Building Enclosure Evaluations





# Aerial Views for Measure Ups

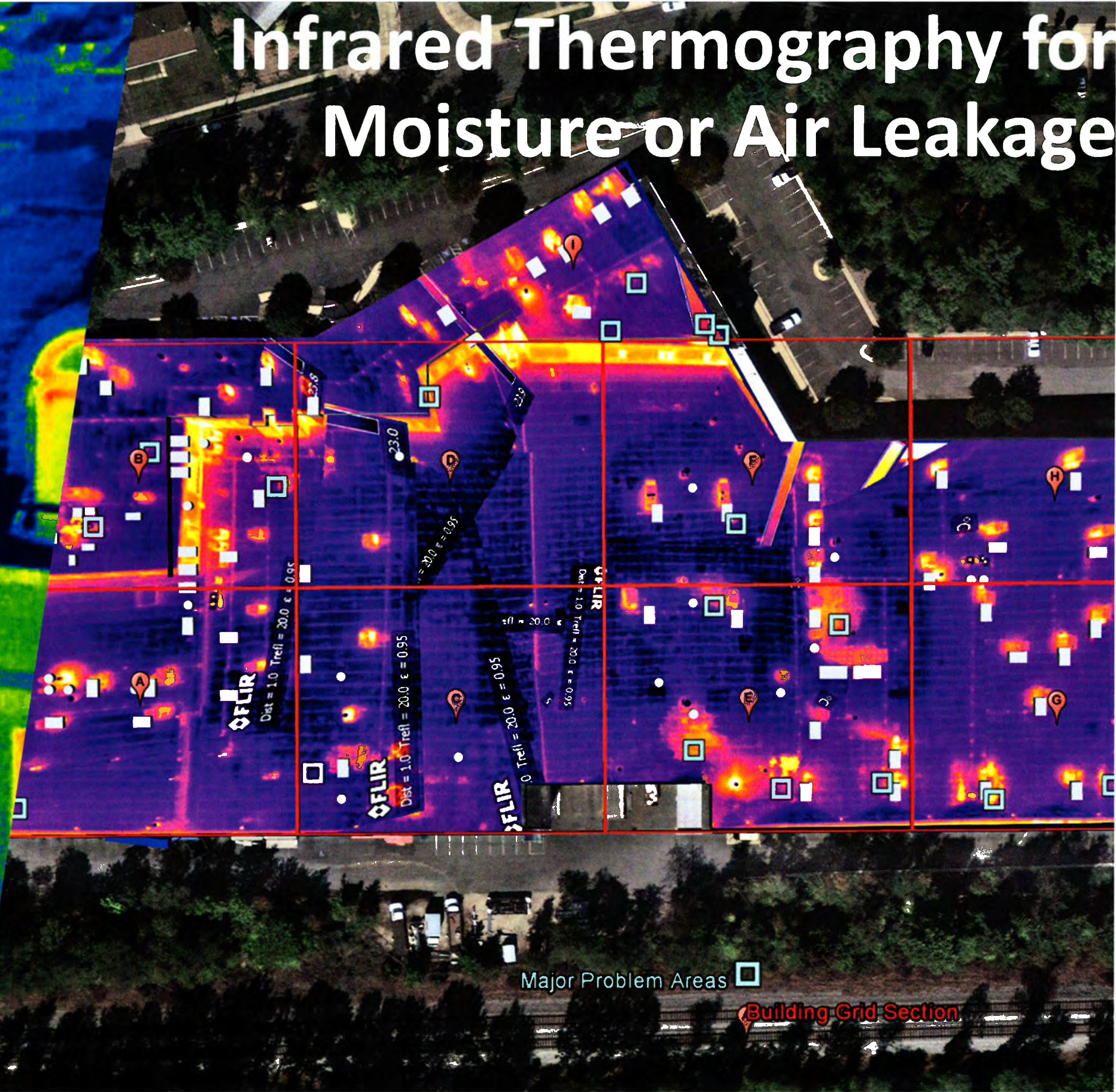
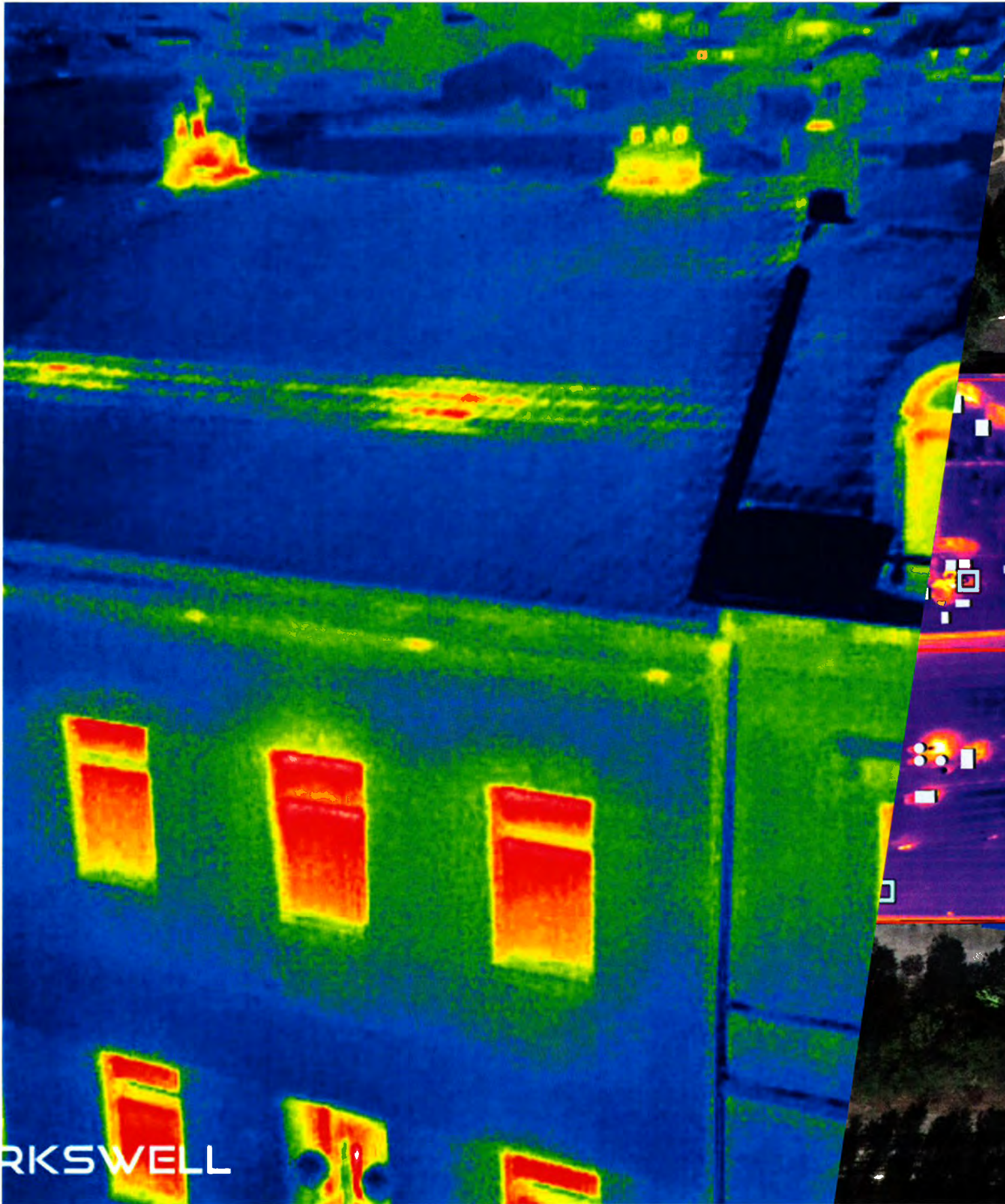




**Overall View of an Entire Site**



# Infrared Thermography for Moisture or Air Leakage

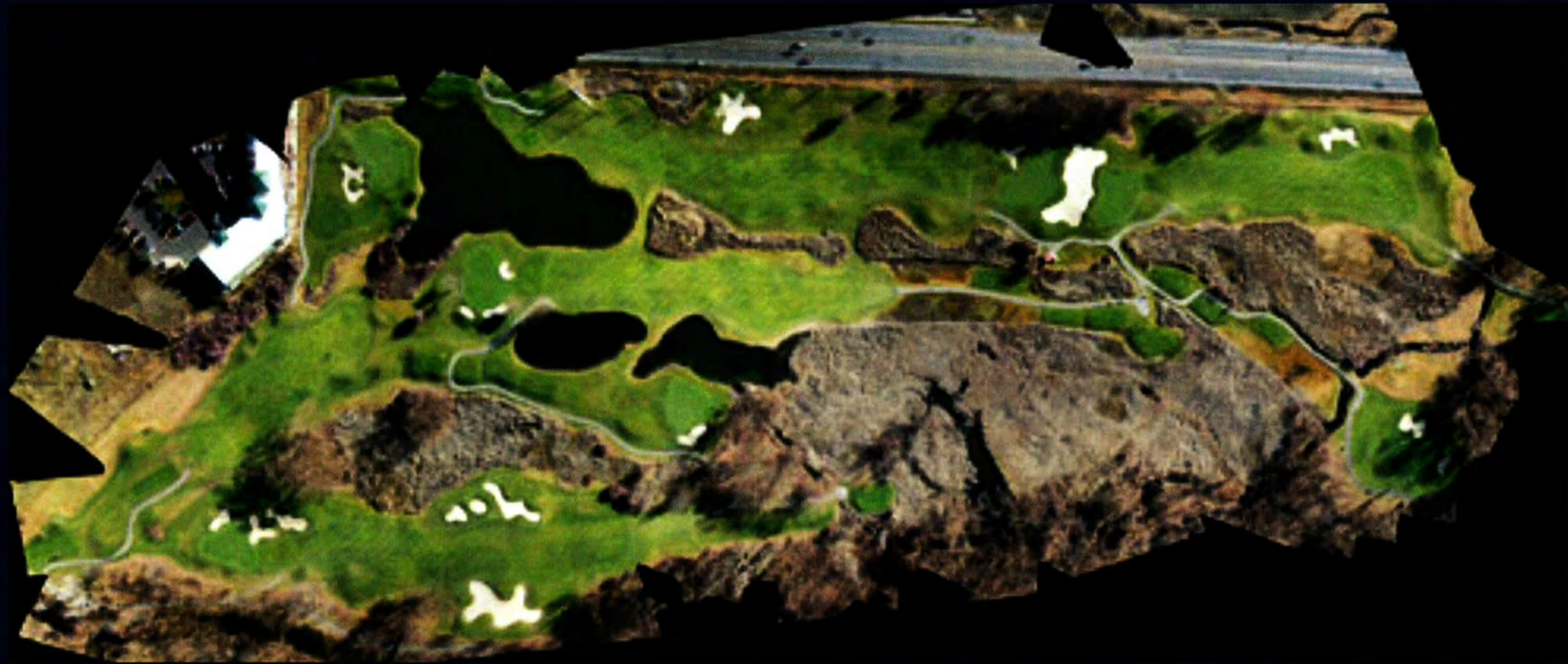






**3D Modeling**





**Orthomosaic**



# Storm Damage Assessment

- ▶ Quickly assess damage to facilities
- ▶ Easy access
- ▶ Minimal safety issues







# Evaluation after a Major Weather Event

- ▶ **FAA issued 137 authorizations to local, state and federal agencies for support to Hurricane Harvey Recovery**
- ▶ **Insurance, utility, and AE firms used drones to assess damage**



**ACORD** **CERTIFICATE OF LIABILITY INSURANCE** SITESP1 OP ID: PB

DATE (MM/DD/YYYY) 04/09/12

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsements.

PRODUCER: Jones Insurance Agency, Inc. 919-772-0233  
P O Box 407 919-779-4025  
Garner, NC 27529  
Hal Averette, CIC, CWCA

CONTACT NAME: \_\_\_\_\_  
PHONE: \_\_\_\_\_  
FAX: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_

INSURER(S) AFFORDING COVERAGE

|   |              |
|---|--------------|
| INSURER A: Cincinnati Insurance Company | NAIC # 10677 |
| INSURER B: Builders Mutual Ins Company  | 10844        |
| INSURER C:                              |              |
| INSURER D:                              |              |
| INSURER E:                              |              |
| INSURER F:                              |              |

INSURED: Site Specific Contracting, Inc.  
4237 Landsburg Dr  
Raleigh, NC 27603-8507

CERTIFICATE NUMBER: \_\_\_\_\_ REVISION NUMBER: \_\_\_\_\_

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

| LINE | TYPE OF INSURANCE            | ADDL. SURR. DATA | POLICY NUMBER | POLICY EFF. DATE | POLICY EXP. DATE | LIMITS  |
|------|------------------------------|------------------|---------------|------------------|------------------|---|
| A    | COMMERCIAL GENERAL LIABILITY |                  | ENP0096221    | 07/08/11         | 07/08/12         | EACH OCCURRENCE DAMAGE TO RENTED \$ 1,000,000 |

# Insurance

- ▶ Typically exclude coverage for claims arising out of the use of aircraft
- ▶ Endorsements to current policy
- ▶ Coverage for property damage
- ▶ Privacy violations, trespassing, harassment
- ▶ Bodily injury
- ▶ Professional Liability against drone pilots

Uninsured

Insured

**INSURANCE**  
**POLICY**

Limits of liability





# Owner Polices

(i.e., College, Universities ,Hospitals)

- ▶ Must register drone with Owner
- ▶ Provide an insurance certificate
- ▶ Do not use the drone to monitor or record areas where there is a reasonable expectation of privacy
- ▶ Do not monitor or record sensitive institutional or personal information
- ▶ Must obtain a photo and video location release form





# Considerations for a Drone Policy

- ▶ Designated UAS Team/Committee
- ▶ UAS Registration/Certification
- ▶ Mission Authorization
- ▶ Operating Procedures
- ▶ Pre-flight/Post-flight Checklist
- ▶ Accidents/incidents reporting
- ▶ Insurance Requirements
- ▶ Develop an organizational wide policy





# Additional Uses

- ▶ Amazon announced it was exploring using drones to deliver packages in 2014
- ▶ Exploration of delivering medicine
- ▶ Law Enforcement & Emergency Rescue
  - ▶ Used to deliver life jackets to flood victims
  - ▶ Use IR on Drones for Search & Rescue
  - ▶ Disaster Relief
- ▶ Real Estate Surveys
- ▶ Mining and Transportation – Site Assessments and Geological Mapping
- ▶ Used in Africa for Anti-Poaching Missions
- ▶ Agriculture – Crop Monitoring





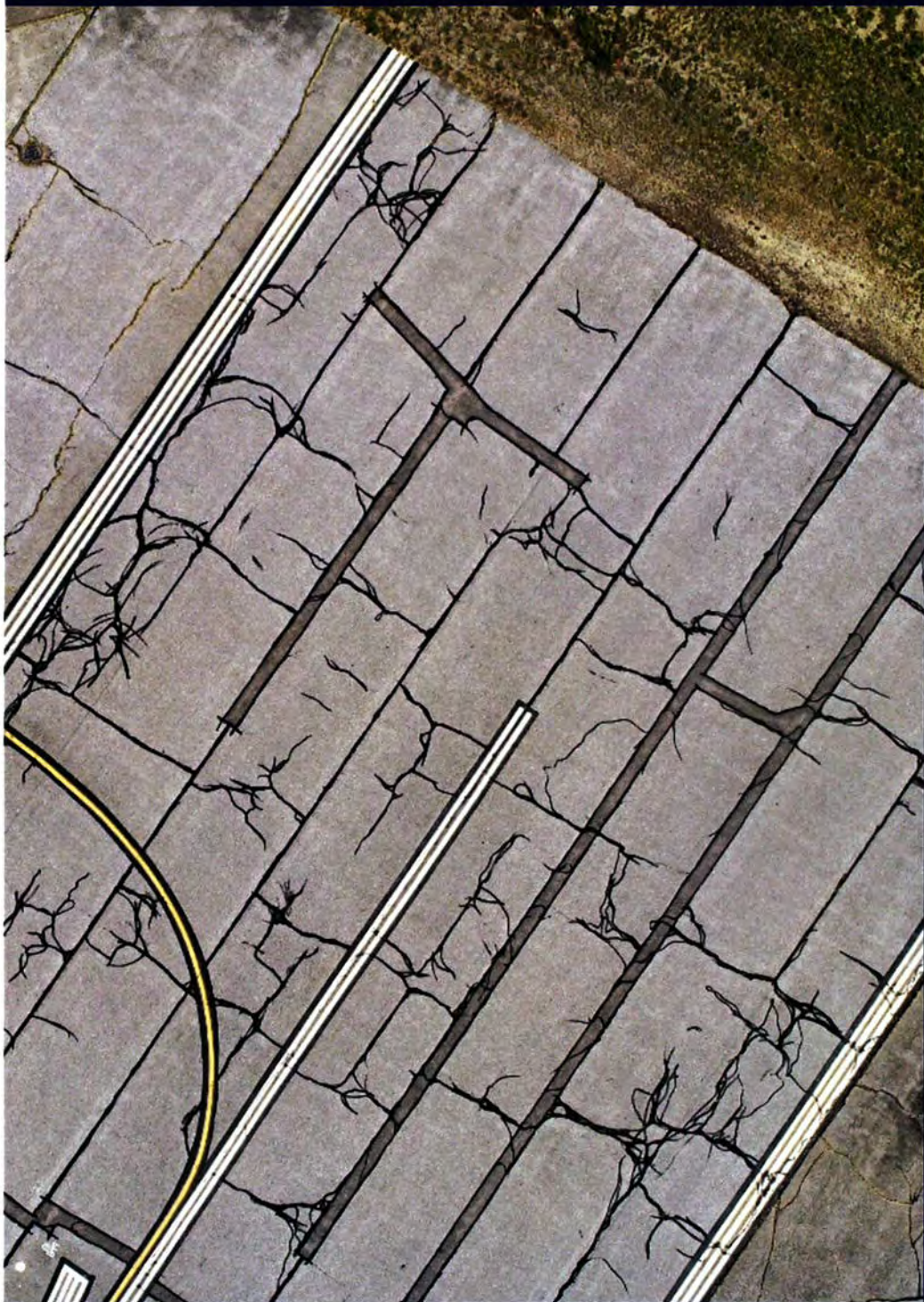


OUT SCHOOL - SYNTHETIC TURF PROJECT



# Photos for Design and Renderings





**Aerial View for Paving Analysis**



# Limitations

- ▶ sUAS should be considered a tool and not a solution to a problem
- ▶ Professionals are needed to analysis and interpret the data
- ▶ **Visibility:** drone must be in line of sight of the pilot
- ▶ **Weather:** cannot be flown in 20+ mph





# Drone Capabilities

- ▶ Aerial photography
- ▶ Aerial Thermography
- ▶ Laser Scanning for As-Builts
- ▶ 3D Mapping
- ▶ Facade Condition Studies
- ▶ Allows Focus on Actual Issues
- ▶ Storm Damage Assessments
- ▶ Structure Inspections







# Conclusion

**“The Drone Age” is here to stay**

- ▶ **They inspect hard to reach places**
- ▶ **They can be deployed quickly**
- ▶ **They are popular – multiple uses**
- ▶ **Evaluating building enclosures can be performed annually at lower costs**



CELEBRATING 55 YEARS



[www.galeassociates.org](http://www.galeassociates.org)

# Thank you!



**Tony B. Robinson, RRC, BECxp, LEED<sup>®</sup> AP**

Associate and Certified Remote Pilot

[tbr@gainc.com](mailto:tbr@gainc.com)