ILLINOIS TOLLWAY

Emerging Technologies: Drone Training

Illinois Tollway, Illinois Tollway GEC, Sitech Midway and Topcon Solutions

April 15, 2024

AGENDA

Introduction

Drone applications

Real-time applications and technologies

Preliminary aeronautical knowledge test

Open discussion, questions and answers and demonstration

INTRODUCTION

INTRODUCTION: WHY DRONE TRAINING?

INTRODUCTION: BACKGROUND

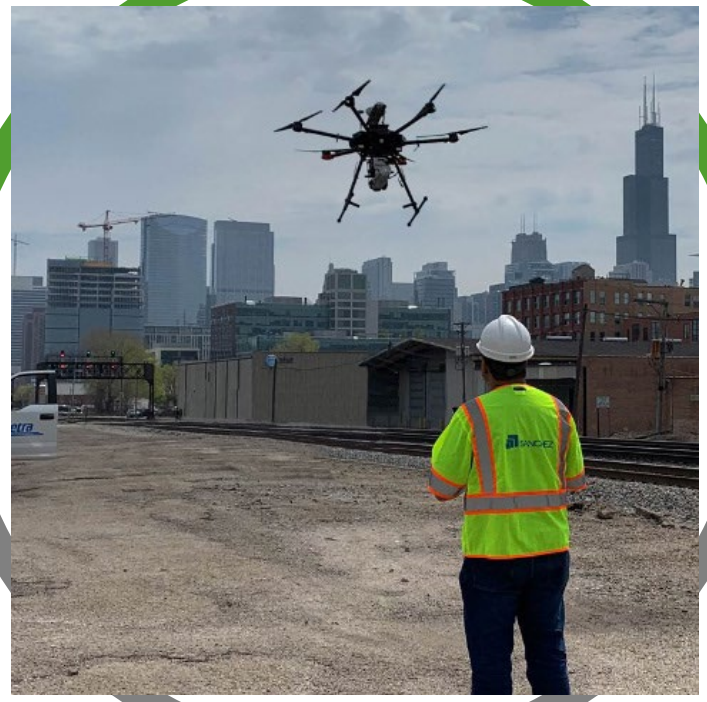
Relevance

Traction gained in construction industry

Small and diverse businesses use and knowledge

INTRODUCTION: WHY USE DRONES?

Enhance productivity, reduce manpower needs



Access difficult or hazardous terrain safely

Achieve superior data accuracy and resolution

Minimize or eliminate affect to traffic

DRONE APPLICATIONS

DRONE APPLICATIONS

Surveying

Purpose

- Better define work area
- Identify potential hazards
- Accurate work area representation

Benefits for contractors

- Surveying area they will work
- Drone vs. foot surveying
  - Time and cost savings
  - Safety

DRONE APPLICATIONS

Project documentation

Purpose

- **Better track project progress**
- **Understanding progress and status of project's schedule**
- **Supplements information for progress meetings**

DRONE APPLICATIONS

Project documentation

Benefits

- Captures aerial imaging of contract's progression
- Identifies status of schedule based on field observation
    - Assists in budget use coordination

DRONE APPLICATIONS

Project documentation

Applicable drone use

- Design
  - Documentation/imaging provides insights for design submittals (i.e., geotechnical or structural wall reports benefited by documentation and imaging)
- Contractor
  - Example: Track progression of roadway patching and plaza canopy repairs/plaza reconstruction
  - Example: Track progress of projects (i.e., new facilities development from design plans through construction)

DRONE APPLICATIONS

Communication

Purpose

- Early communication and identification of issues helps scope work
- Consistent communication helps alleviate issues throughout project, rather than pushing them to end

Benefits for contractors

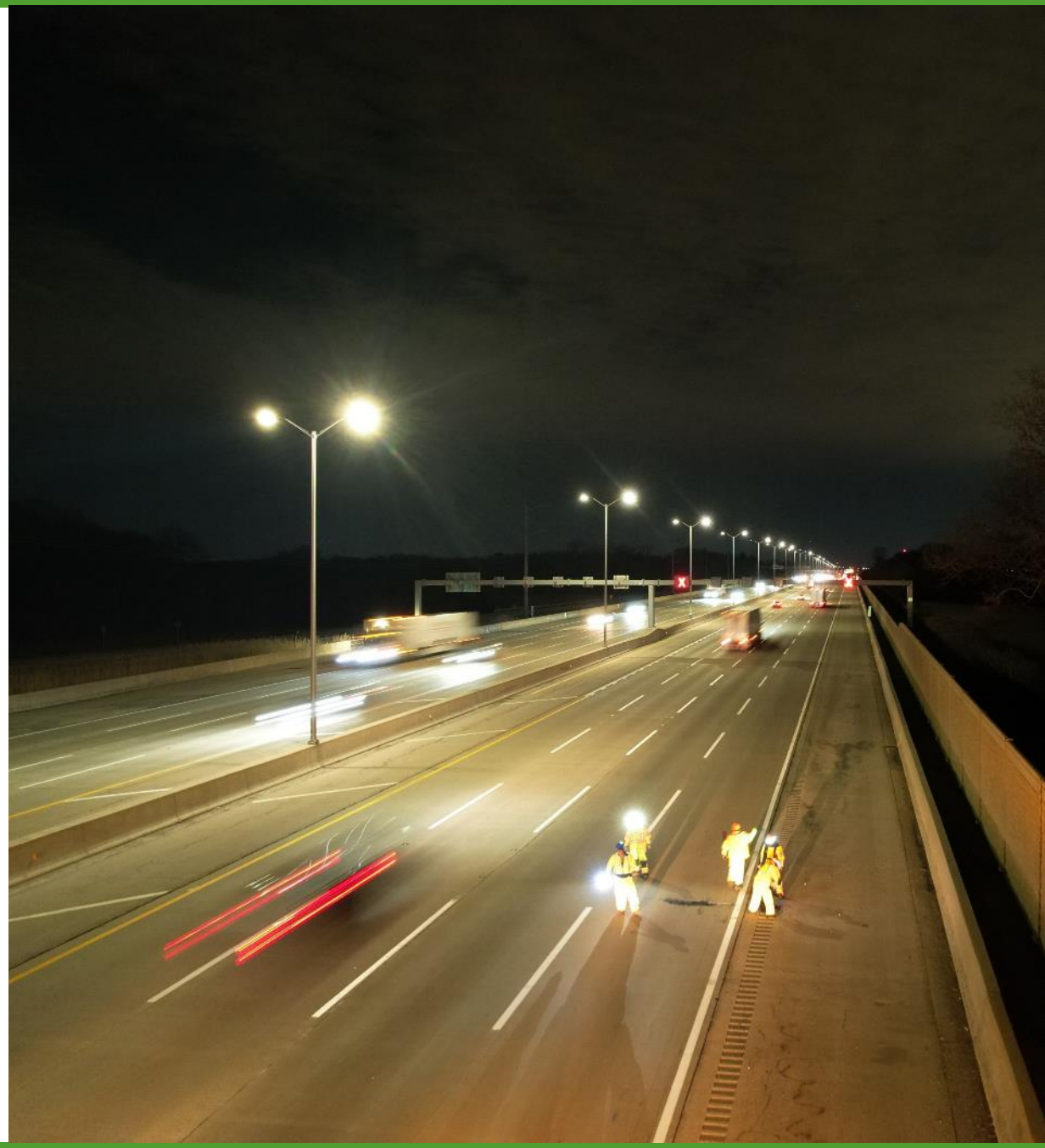
- Drives importance of project communication
- Support client in keeping project on task by identifying potential issues in field and getting ahead on developing solutions
- Allows for timelier resolutions of potential issues

DRONE APPLICATIONS

Communication

Applicable drone use

- Supports deliverance of project closeout
  - Capturing images and data of punch-list items needing to be completed
  - Example: Drone documenting pavement markings requirement from punch list
  - Capturing before and after images to show progress and completion of work



DRONE APPLICATIONS

Collaboration

Purpose

- Increase transparency with client and internal project team
- Supports best practices from field for contractor to coordinate internally and with Illinois Tollway (and its consultant partners) for future projects

Benefits for contractors

- Drives scoping/plan of action amongst team as project progresses
- Improves efficiency amongst project team
- Example: Allows project team to coordinate pre-project site elements, better prepare and discuss how work will lay out

DRONE APPLICATIONS

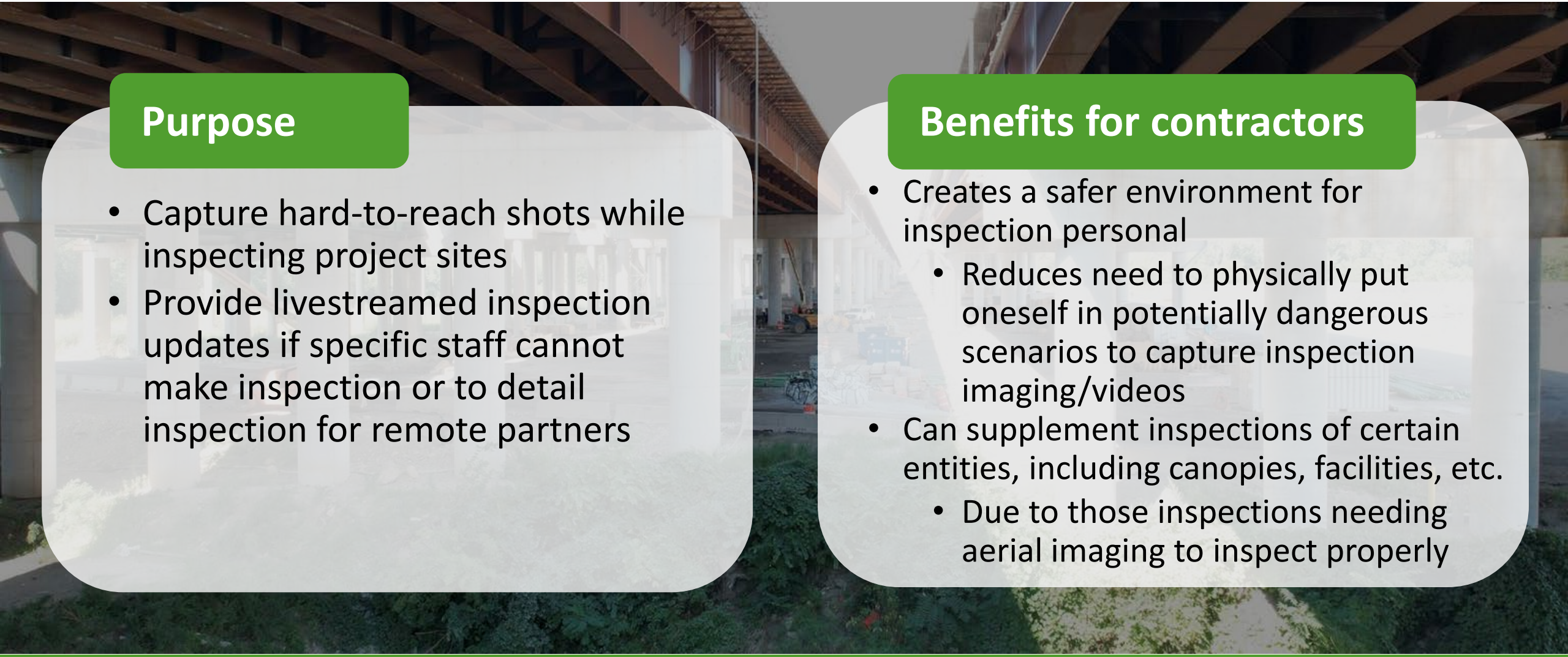
Collaboration

Applicable drone use

- Example: Better define scope and work for bridge rehabilitation project from drone imaging and video of pre-work site status
- Example: Drone supports ease of bridge inspection and level of work needed to rehabilitate

DRONE APPLICATIONS

Inspections and safety management



Purpose

- Capture hard-to-reach shots while inspecting project sites
- Provide livestreamed inspection updates if specific staff cannot make inspection or to detail inspection for remote partners

Benefits for contractors

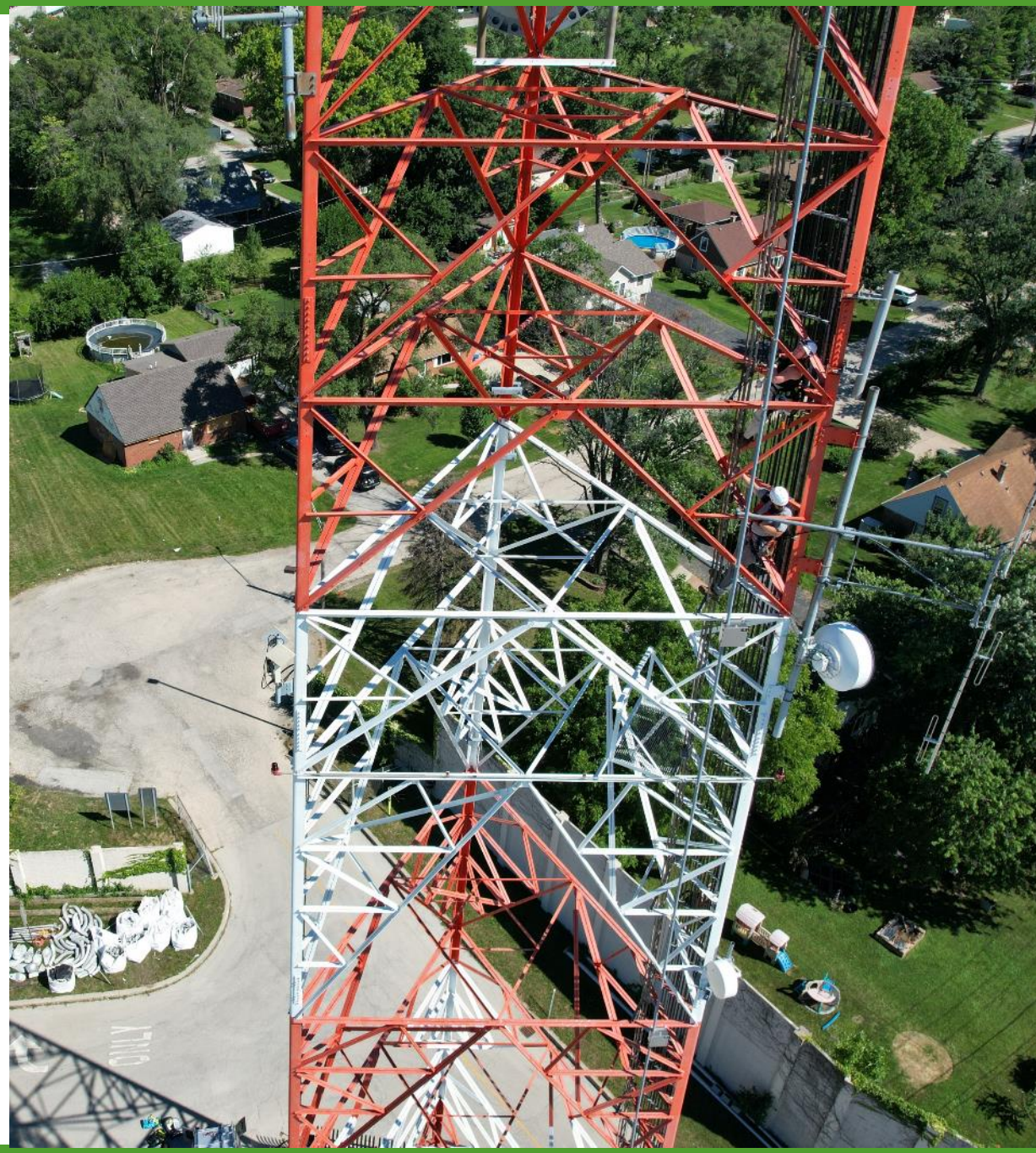
- Creates a safer environment for inspection personal
  - Reduces need to physically put oneself in potentially dangerous scenarios to capture inspection imaging/videos
- Can supplement inspections of certain entities, including canopies, facilities, etc.
  - Due to those inspections needing aerial imaging to inspect properly

DRONE APPLICATIONS

Inspections and safety management

Applicable drone use

- Inspecting hard-to-reach and high-up field elements, including bridges, roof/top of buildings and communication towers
- Capturing shot of inspecting both sides of noisewall more efficiently without having to go back and forth on each side
- Taking prolonged shot of structural repair segment (i.e., retaining wall)



DRONE APPLICATIONS

Inspections and safety management

Purpose

- Determine level of safety throughout entire worksite
- Identify potential hazards at worksite and better determine how to pre-plan around unavoidable hazards

Benefits for contractors

- Understand what potential hazards may be in field that cannot normally be seen from ground level
- Allows contractors to go into work with better safety plan, pending potential hazards on worksite

DRONE APPLICATIONS

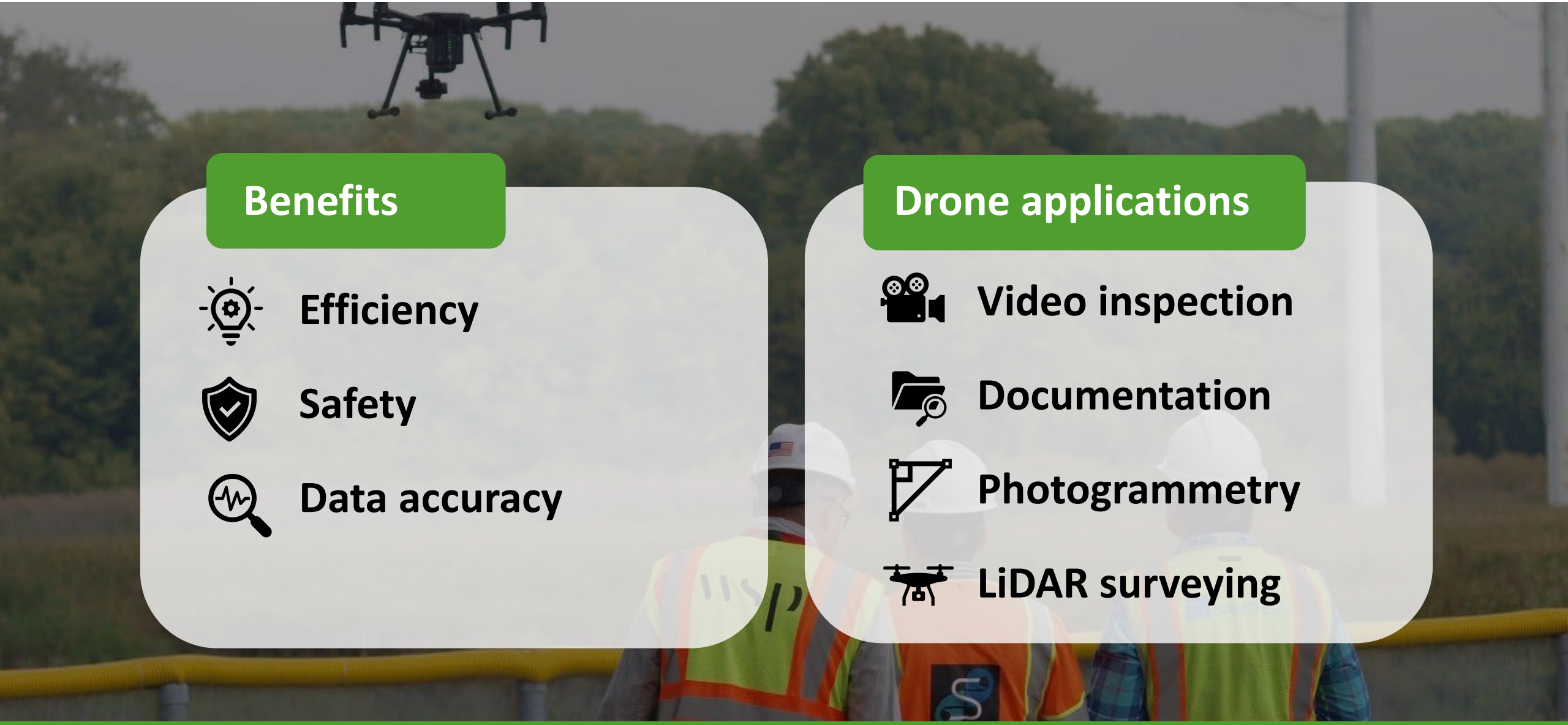
Inspections and safety management

Applicable drone use

- Aerially scan worksite to identify potential hazards
  - Example: Overheating equipment on site if capturing thermal-imaging drone shots
- Identify damaging property on worksite
  - Example: Crack on top of noisewall
- Assessing structural stability of bridges, noisewalls, overhead signs, etc.

REAL-TIME APPLICATIONS AND TECHNOLOGIES

SURVEYING



Benefits

- Efficiency
- Safety
- Data accuracy

Drone applications

- Video inspection
- Documentation
- Photogrammetry
- LiDAR surveying

VIDEO INSPECTION

DOCUMENTATION

Storage

- On-site server
- Large hard drives
- Cloud storage
- Network attached storage

GPS

- Garmin VIRB 360
- GoPro Hero Cameras
- DJI

Software

- Telemetry Extractor
- ArcGIS

PHOTOGRAMMETRY

Products of photogrammetry

Orthomosaics

- Base maps
- Planimetrics
- Documentation

3D model

- Volume calculations
- 3D survey and terrain models
- Point clouds

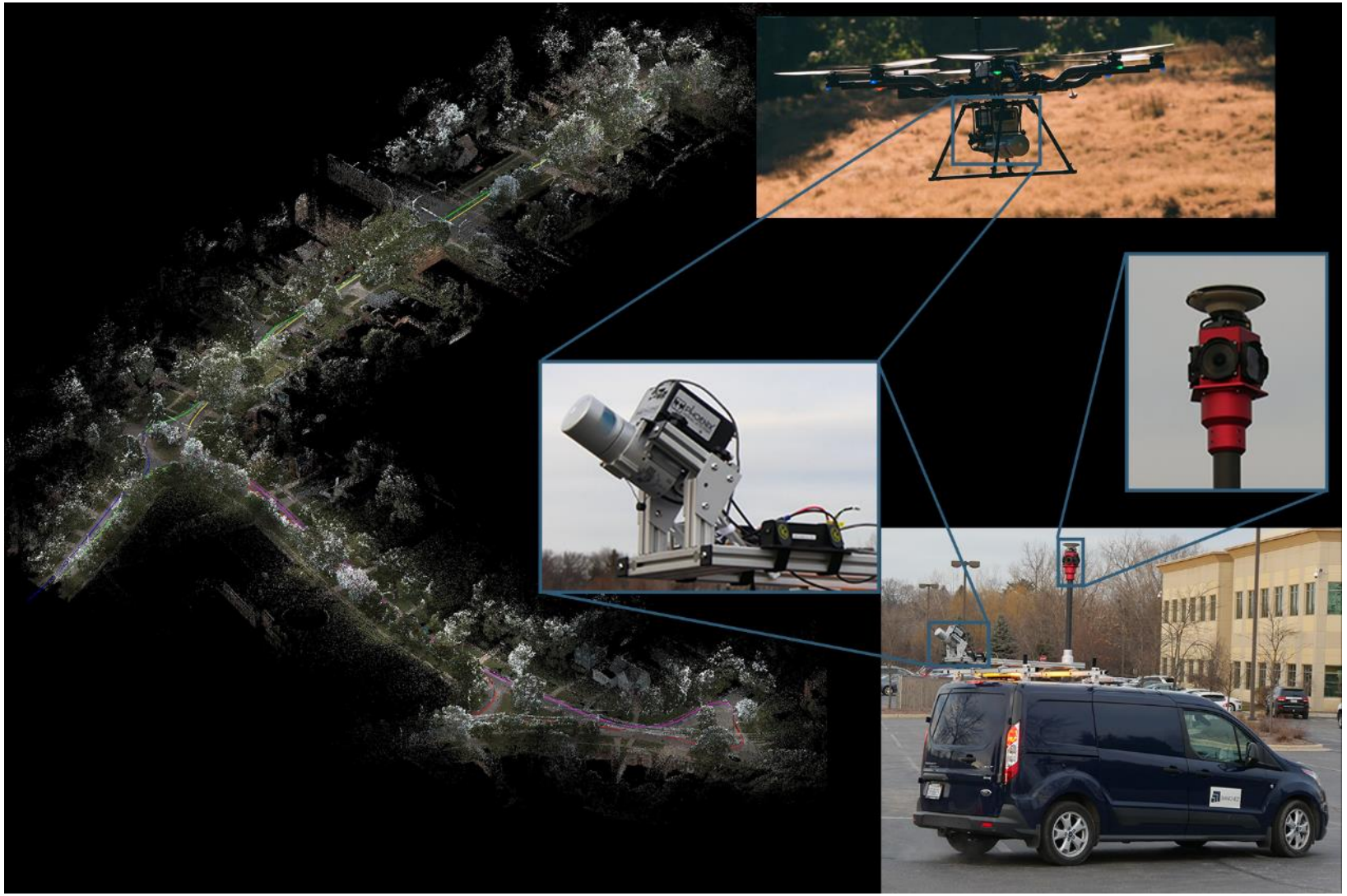
LiDAR

Point clouds

- Surface models
- Topographic surveys
  - Feature extraction
  - Line work
  - Contours

Typical projects

- Railroads
- Highways
- Airports



DRONES FOR VIDEO INSPECTION

Ideal for inspecting tall structures or difficult terrain

Inspection done remotely

Mid-level training

Drones: DJI Mavic Series, DJI Matrices Series, Autel Robotics EVO II Dual, Skydio

Equipment: High-resolution video cameras, gimbal for stabilization or 360 cameras

Cost: $2,000 - $12,000

DRONES FOR PHOTOGRAMMETRY

Create detailed maps and 3D models from aerial photos

Higher detail than satellite imagery

- Google Earth
- Google Maps

Mid-level training

Drones: DJI Mavic, Phantom, or Matrice

Equipment: High-resolution camera, multispectral cameras and preferably RTK

Cost: $1,200 - $17,000

DRONES FOR AERIAL LIDAR

Surveying

Advanced technology for mapping and surveying

Higher level of training and implementation

Drones: DJI Matrice 300 series or 600 Pro, FREEFLY Alta X

Equipment: LiDAR Sensors, IMU, GNSS Receivers

Cost: $40,000 - $350,000+

DRONES FOR DOCUMENTATION AND MONITORING

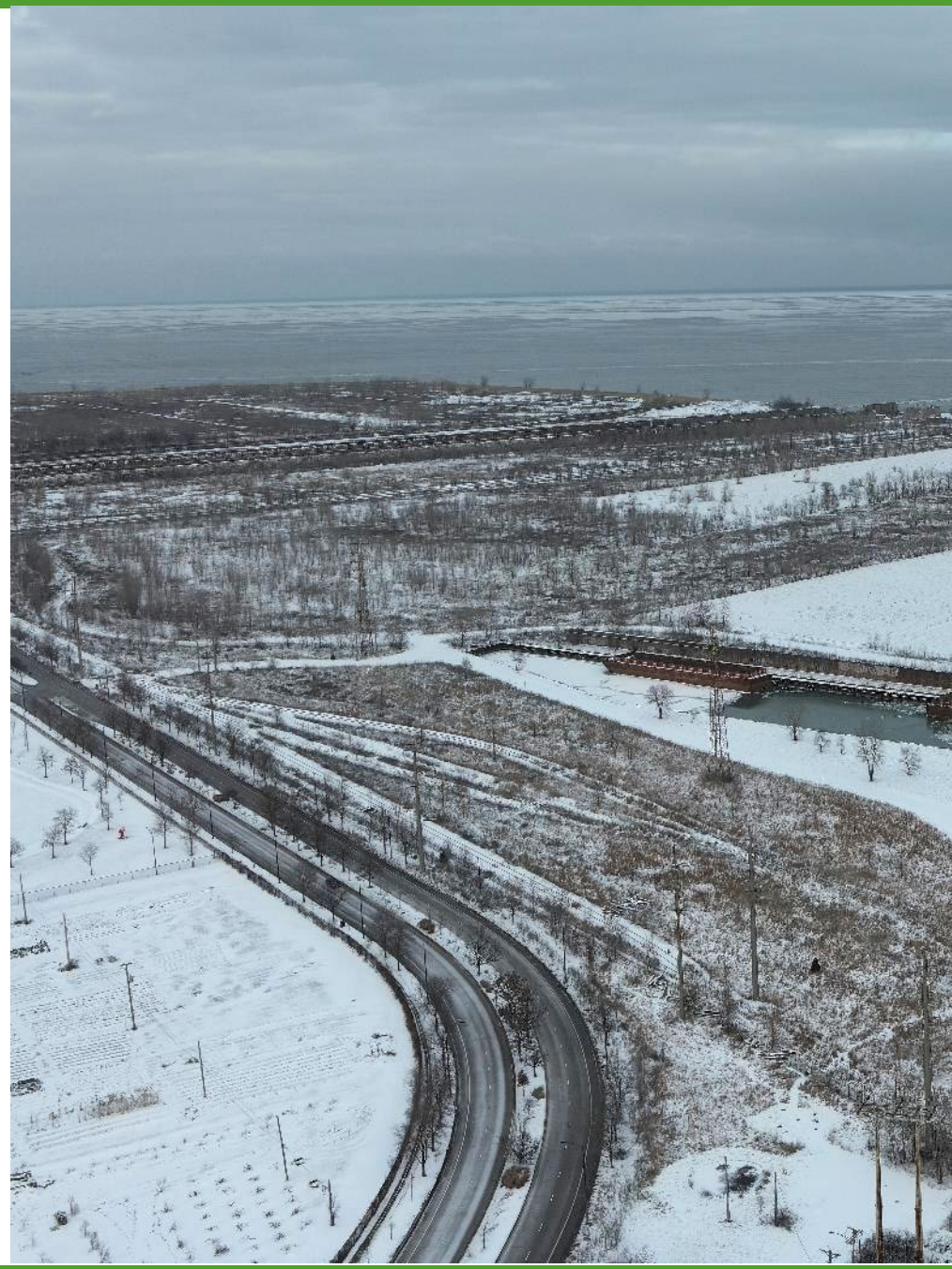
Essential for precise project documentation and monitoring

Not much training needed

Drones: DJI Matrice, Phantom, Mavic, Mini, Air, Skydio, Parrot Anafi

Equipment: 4K video cameras, GPS for location

Cost: $700 - $17,000



BEST PRACTICES FOR DRONES

Adherence to legal and safety standards

Adherence to Illinois Tollway procedures

Regular equipment checks and updates

Continuous learning for team skill improvement

Use of drone spotter, when required

FUTURE OF DRONE SURVEYING

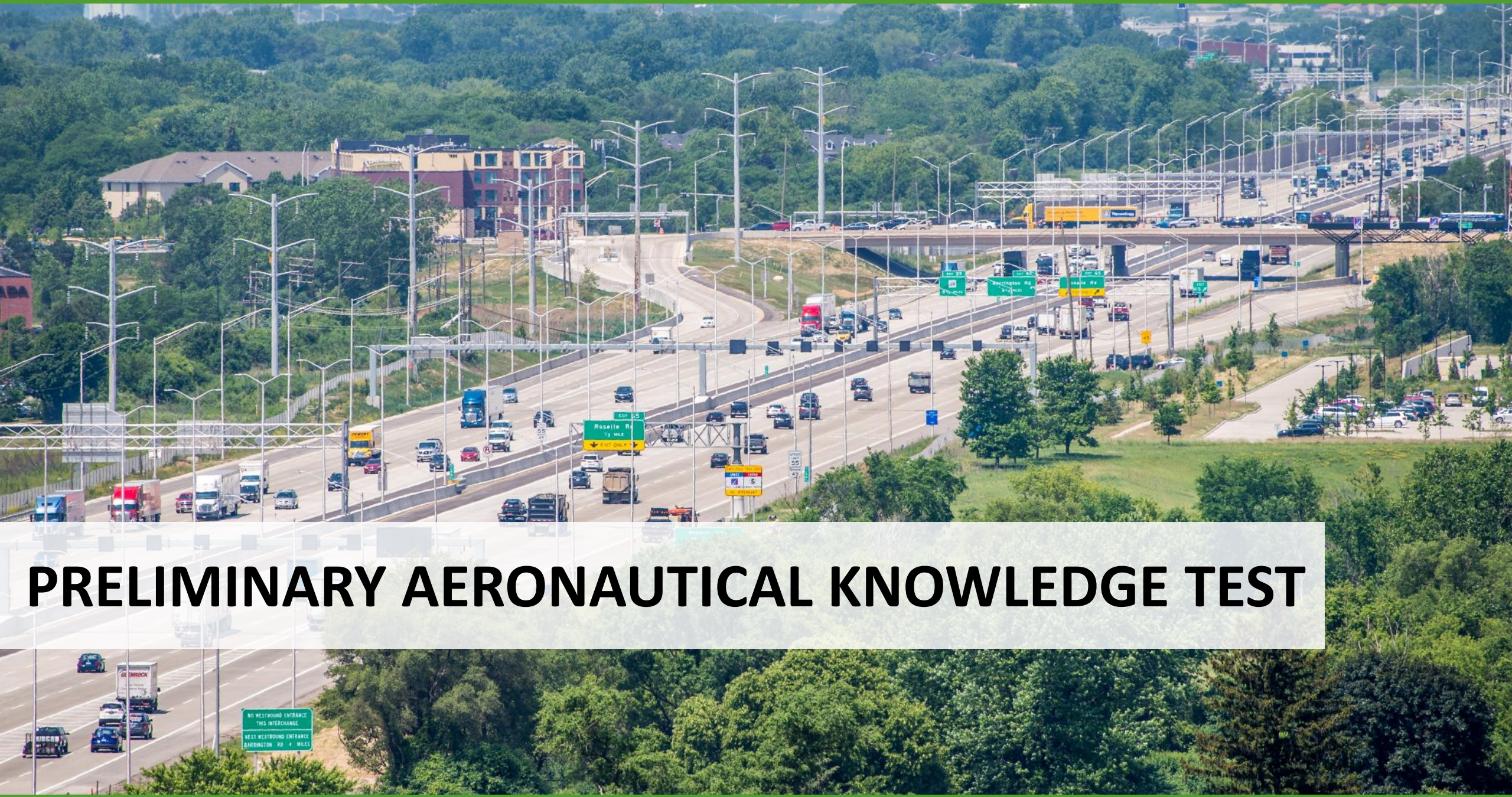
Drones changing way we inspect, document and land survey

Future trends

- AI integration
- Improved autonomy
- Regulatory evolution

Drones revolutionizing

- Continue to revolutionize precision, efficiency and safety in many practices
  - Land surveying
  - Engineering
  - Construction
  - Real estate



PRELIMINARY AERONAUTICAL KNOWLEDGE TEST

PRELIMINARY AERONAUTICAL KNOWLEDGE TEST

How to get certified with Federal Aviation Administration

Take time to study

- Questions will be about airspace and FAA regulations, not on your ability to fly drone

Use online resources

- Remote Pilot - Small Unmanned Aircraft Systems Study Guide
- Unmanned Aircraft General (UAG) Sample Questions
- YouTube

Expected subject matter

- Applicable regulations relating to small unmanned aircraft system rating privileges, limitations and flight operation
- Airspace classification and operating requirements and flight restrictions affecting small unmanned aircraft operation
- Emergency procedures
- Airport operations
- Operation at night

PRELIMINARY AERONAUTICAL KNOWLEDGE TEST

How to get certified with Federal Aviation Administration

Registering to take exam

You must obtain FAA tracking number before registering for exam

- iacra.faa.gov/IACRA/default.aspx
- Create your profile

Find test site

Schedule exam date

- Registration fee: $175
- You will receive confirmation email on your test date and specifics

Receive full refund if cancellation within 24 hours before appointment (if needed)

Test Site	Distance	Address	
IT Expert System, Inc. - Naperville	7 Miles	1560 Wall Street, Suite 111 Naperville , IL 60563	Directions
Illinois Aviation Museum at Bolingbrook	10 Miles	130 S. Clow International Parkway Bolingbrook , IL 60490	Directions
Illinois Aviation Academy	11 Miles	32W751 Tower Rd West Chicago , IL 60185	Directions
Avel Flight School	11 Miles	3N040 Powis Rd West Chicago , IL 60185	Directions
Lewis University	13 Miles	One University Prkwy Campus Box 282 Romeoville , IL 60446	Directions
IT Expert System- Des Plains	16 Miles	2400 E. Devon Ave, Suite 257 Des Plaines , IL 60018	Directions
IT Expert System, Inc - Schaumberg	17 Miles	951 N Plum Grove Rd , Suite A Schaumburg , IL 60173	Directions
Aviation Institute of Maintenance - Chicago	19 Miles	3711 South Ashland Ave Chicago , IL 60609	Directions
PSI Examination Services-Chicago	21 Miles	332 S Michigan Ave Chicago , IL 60604	Directions
JA Flight Training	21 Miles	43W700 US Route 30 Sugar Grove , IL 60554	Directions
Blue Skies Pilot Shop dba Blue Skies Flying Services Inc	31 Miles	8411 Pyott Road Suite 106 Lake in the Hills , IL 60156	Directions
Griffith Aviation Inc.	36 Miles	1705 E. Main Street Griffith , IN 46319	Directions
Merrillville Training and Testing Center	41 Miles	1443 E 84th Place Merrillville , IN 46410	Directions
Skill Aviation Services LLC	42 Miles	2346 West Beach Road Waukegan , IL 60087	Directions

PRELIMINARY AERONAUTICAL KNOWLEDGE TEST

How to get certified with Federal Aviation Administration

Exam

- You have **two hours** to answer **60 questions**
  - Passing score is **70 percent**

According to 14 CFR Part 107, how may a Remote Pilot in Command (Remote PIC) operate an unmanned aircraft in Class C airspace?
A. The remote PIC must contact the ATC facility after launching the unmanned aircraft
B. The remote PIC must monitor the ATC frequency from launch to recovery
C. The remote PIC must have prior authorization from the Air Traffic Control (ATC) facility having jurisdiction over that airspace.

Unless otherwise authorized, what is the maximum airspeed at which a person may operate an sUAS below 400 feet?
A. 80 mph
B. 100 mph
C. 200 knots

What action should the remote PIC take upon GPS signal loss?
A. Perform the planned flyaway emergency procedure
B. Follow normal sUAS operational procedure, noting any mode or control changes that normally occur if GPS is lost.
C. Land the unmanned aircraft immediately prior to loss of control

PRELIMINARY AERONAUTICAL KNOWLEDGE TEST

How to get certified with Federal Aviation Administration

Post exam

- If you pass, complete FAA form 8710-13
  - Provides you confirmation of passing test and informs FAA to send you license
- A TSA background check will be conducted
  - Automatically conducted upon submitting application
- Remote pilot certificate will be mailed to you
  - Always keep on hand when flying
- If you were unable to pass, can take exam again after 14 days
  - You will be provided with topics you could improve on, not exactly which questions you got wrong

OPEN DISCUSSION, QUESTIONS AND ANSWERS


THANK YOU