Drones for Law Enforcement & Crash Investigation

Presented By
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UAS Instructor, UMass, Amherst

GPI

umass SAFE Traffic Safety Research Program

Here's What We Are Going Talk About

- Legal Issues
- Court Cases
- Four Types of Drone Pilots
- What is Needed to Fly a Drone Legally
- Part 107 Knowledge Requirements
- Common Types of Drones
- Common Software
- Documentation
- WORKFLOW
- Demo Outside – DJI M30T

4th Amendment Rights

Thomas Lee Causby

- *Circa 1946, Greensboro, NC*
- *Air Commerce Act of 1926*
- *"Cuius est solum, eius est usque ad coelumet ad inferos* " ("whoever owns the soil, it's theirs, all the way to heaven and hell")
- Case was a "win win"

Lindley Field Today is known at Piedmont Triad International Airport

Raphael Pirker (2011)

- **Pirker Case (2014)**
  - Cause for Today's FAA Drone Regulations

https://www.youtube.com/watch?v=OZnJeuAja-4

Legal Routes Toward Drone Flights

- **333 Exemption (2015)**
  - FAA Licensed Current Pilot Required
- **Part 107 Remote Pilot (2016)**
  - *Written Test Required*
  - *License/Waiver(s) goes to person, not company or agency*
- **Part 91 Public Use Certificate of Authorization**
  - Gov't Workers
  - Long Application Process
  - In-House Training Allowed
  - No Written Test Requirement
  - Can Get Blanket Waivers
- **Part 101 Recreational Use**
  - Still Needs to Follow Laws
  - Cannot Be Compensated or Benefit Your Business

Law Enforcement and Part 107

- **Advantages:**
  - Relatively Easy
- **Disadvantages:**
  - Each pilot is licensed individually with the FAA.
  - Pilots must train and pass FAA Knowledge Exam.
  - Liability? Pilot or Agency?
  - When the employee terminates employment the license leaves with them.
  - May not operate at night, over emergency scenes, or over people unless they have a waiver.

Certificate of Authorization (COA)

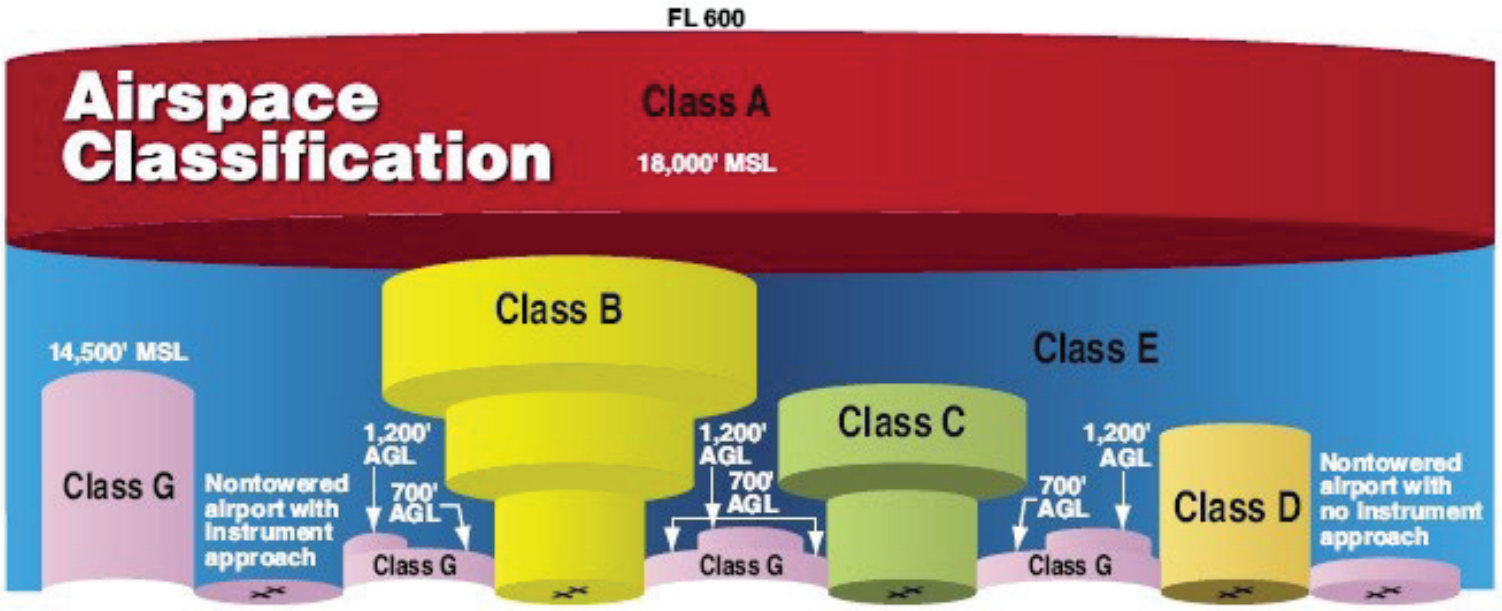
- **Advantages:**
  - Professional program that is FAA reviewed and approved
  - More control and flexibility for operations in various airspace, times of day, and weather
  - Allows for “Self Certification” of pilots with internal training program

- **Disadvantages:**
  - Application process requires extensive knowledge and understanding of Federal Aviation Regulations to be completed correctly.

Before We Talk About The Things That Can Be Done With Drones

You MUST Know the Following Topics for the FAA Remote Pilot Test:

Airspace


FL 600
Airspace Classification
Class A
18,000' MSL
Class B
14,500' MSL
Class E
Class C
1,200' AGL
700' AGL
1,200' AGL
700' AGL
1,200' AGL
700' AGL
Class G
Nontowered airport with instrument approach
Class G
Class G
Class G
Class D
Nontowered airport with no instrument approach

Aviation Weather Sources

Effects of Weather on Unmanned Aerial Vehicles

UAV Loading

Emergency Procedures

Cockpit Resource Management

DRONE CONSULTANT GROUP

Radio Communications

Determining Performance of Unmanned Aerial Vehicles

Slow Drone
DJI S1000

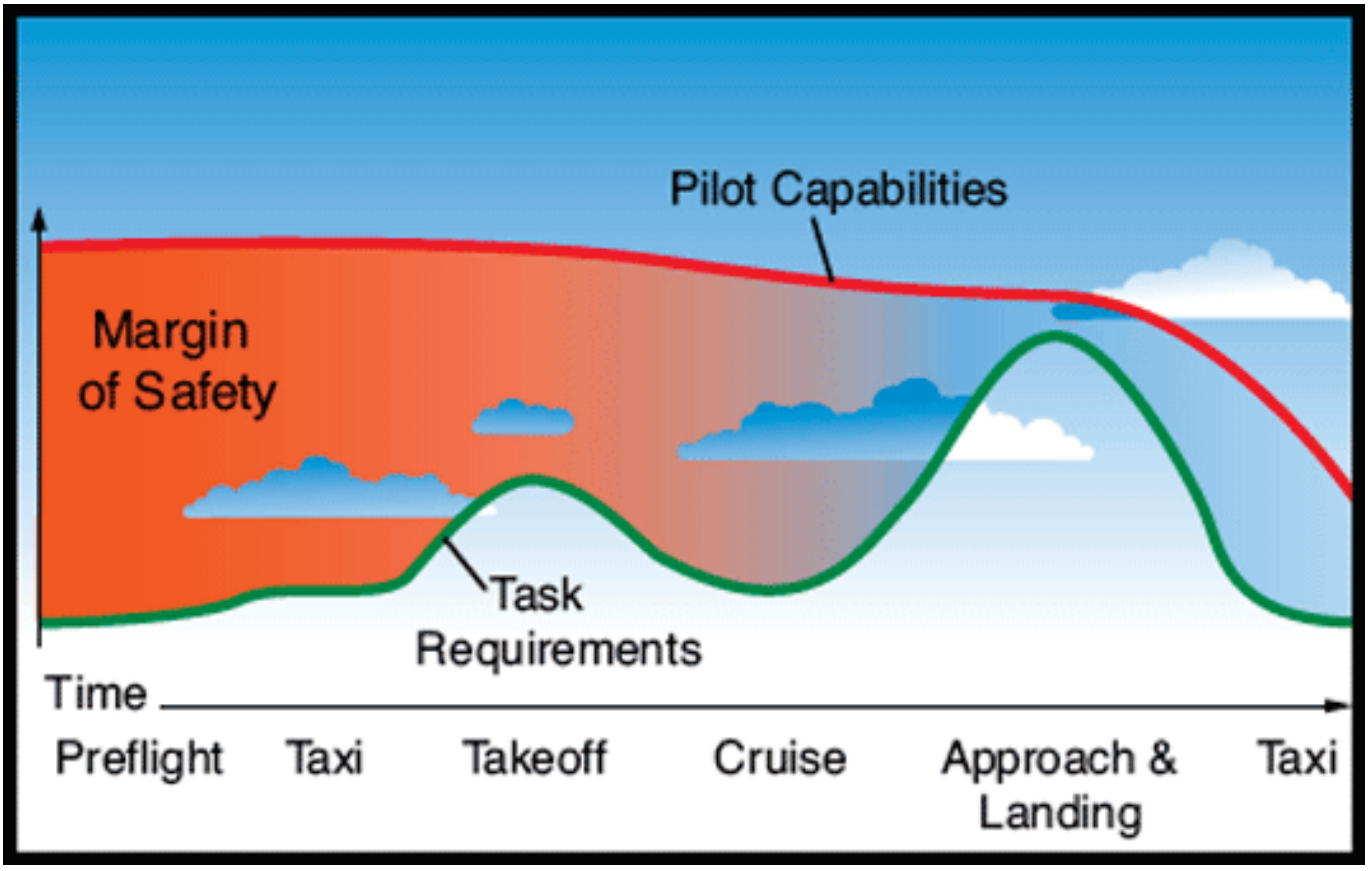
Fast Drone
Walkera F210

Physiological Factors

PILOT FITNESS CHECKLIST

I LLNESS
M EDICATION
S TRESS
A LCOHOL
F ATIGUE
E MOTION

Aeronautical Decision Making



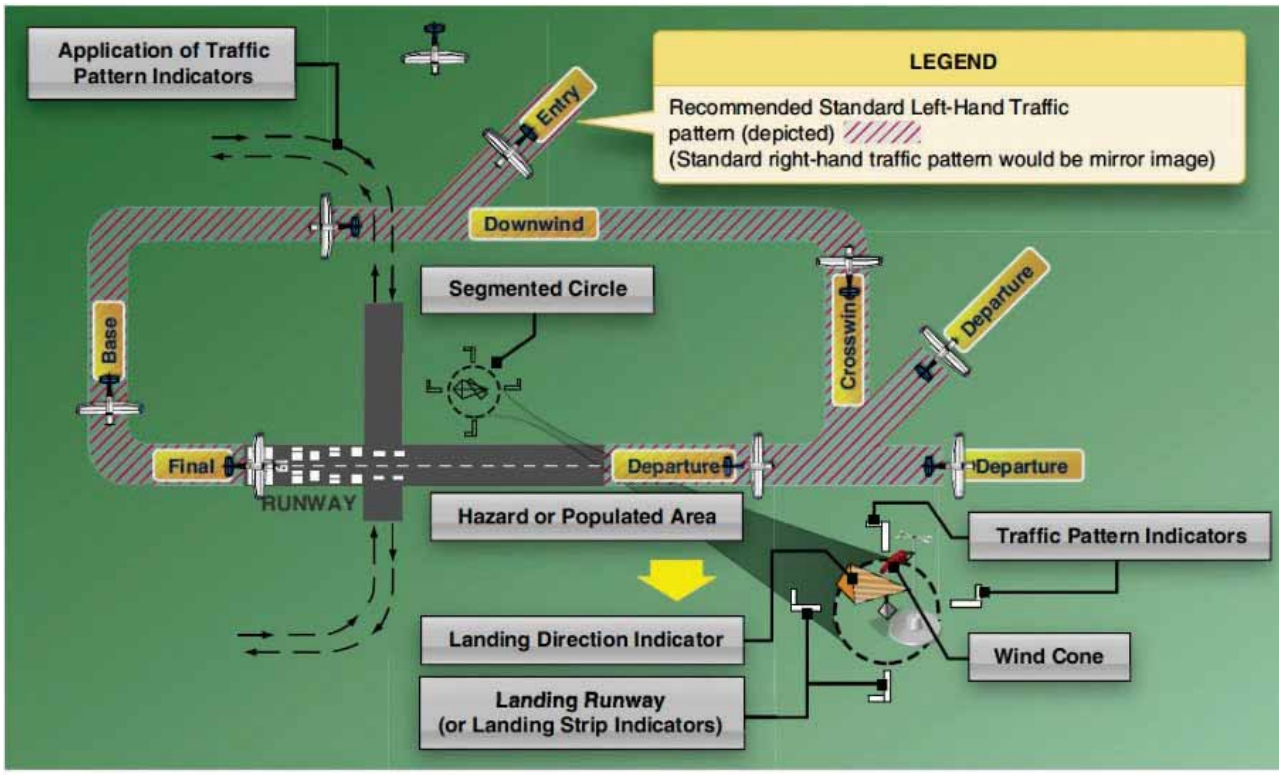
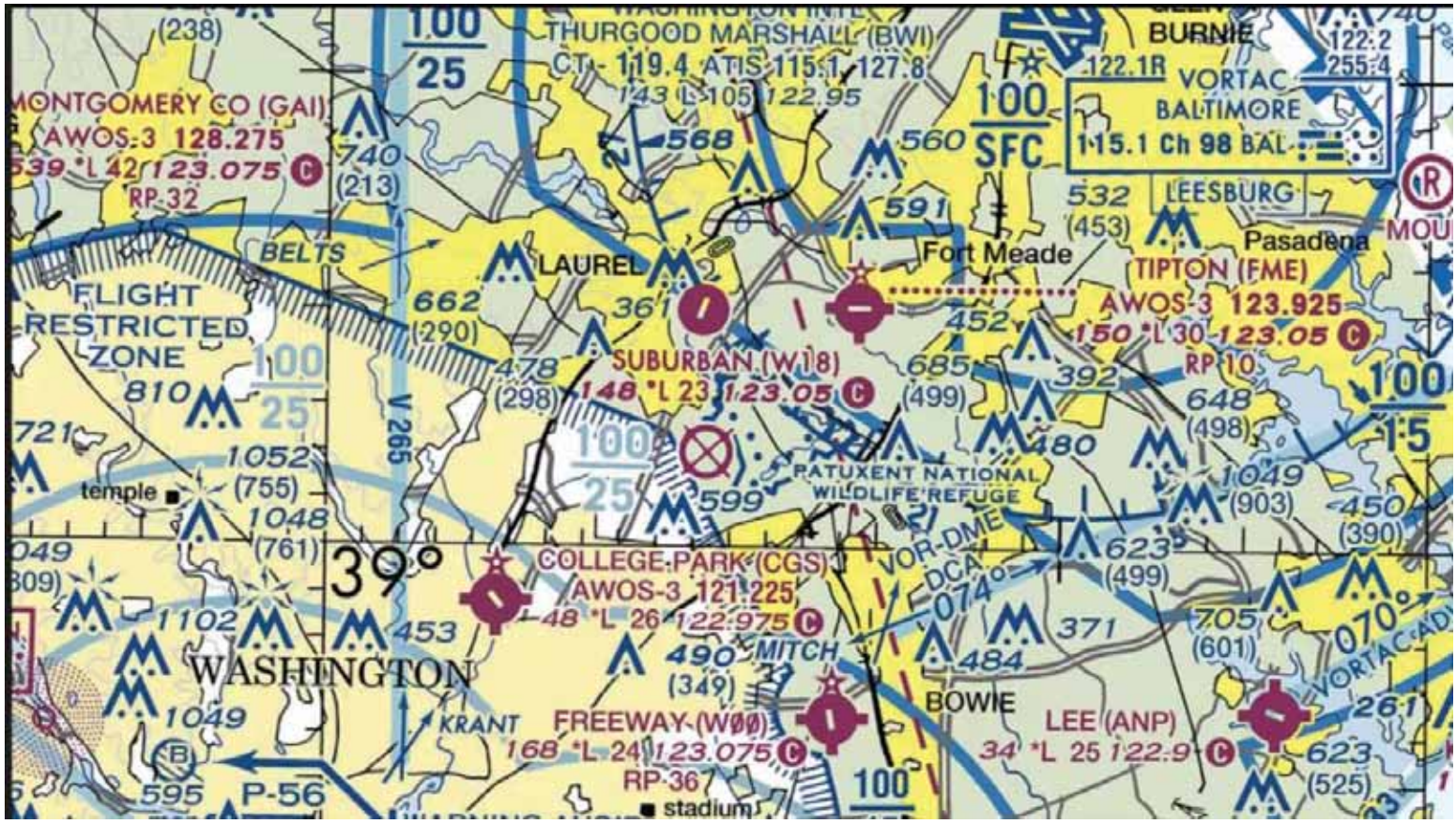
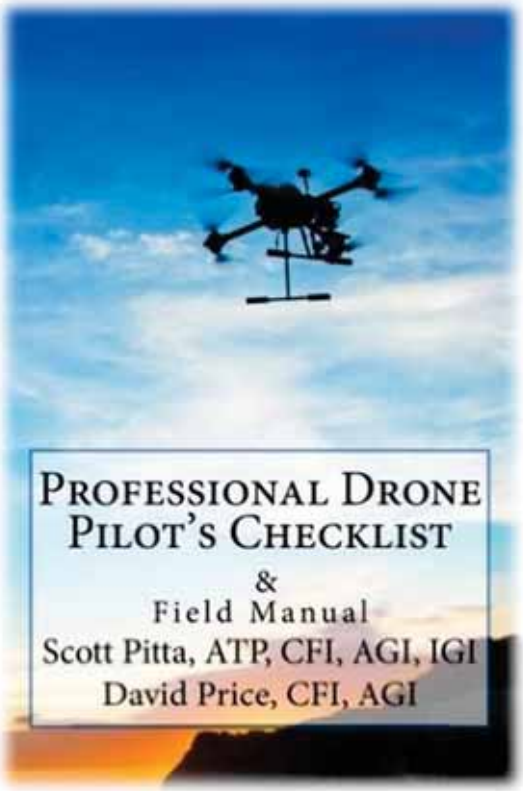


Figure 13-14. *Traffic pattern operations—single runway.*

VFR Sectionals



Maintenance and Preflight



Regulations

My Top Ten Rules

1. **Remote Pilot Certificate**: All commercial drone pilots must obtain a Remote Pilot Certificate from the FAA by passing the Part 107 exam.

2. **Registration**: All drones weighing between 0.55 pounds and 55 pounds must be registered with the FAA. The registration number must be marked on the drone.

3. **Maximum Altitude**: Drones must be flown at or below 400 feet above ground level (AGL) to minimize the risk of collision with manned aircraft.

4. **Line of Sight**: The drone must remain within the visual line of sight (VLOS) of the pilot or a visual observer at all times during flight.

5. **Daylight Operations**: Drones can only be flown during daylight hours or civil twilight (30 minutes before official sunrise and 30 minutes after official sunset) with appropriate anti-collision lighting.

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My Top Ten Rules

6. **Airspace Authorization**: Pilots must obtain authorization from the FAA to operate in controlled airspace (Class B, C, D, and E) through the Low Altitude Authorization and Notification Capability (LAANC) or by applying for a waiver.

7. **Yield Right of Way**: Drones must yield the right of way to all manned aircraft and cannot interfere with other aircraft operations.

8. **Speed Limit**: The maximum groundspeed for drones is 100 miles per hour (87 knots).

9. **No Fly Zones**: Drones are prohibited from flying over people, moving vehicles, or in restricted areas like national parks, military bases, and emergency response scenes without special permissions or waivers.

10. **Reporting Accidents**: Any drone accident that results in serious injury, loss of consciousness, or property damage exceeding $500 must be reported to the FAA within 10 days

Don’t Forget Insurance

Costs

Short Term - $5 -$250/hr

Annual - <$1,000/yr (No Hull Coverage)

Coverage

$1,000,000 Liability (No Hull Coverage)

>$2,000/yr (Liability + $15,000 Aircraft)

What If You Break The Law?

- **Federal Fines Starting at $25K Per Violation**
- **Political Fall of “Illegal Drone”**
- **Negative Press Reports**
- **Higher Likelihood of Accidents Causing Injury or Damage**
- **Liability Insurance Can Refuse to Cover Damages**

Enrique Iglesias may never regain full sensation in finger following drone injury

- BY FACT, JUN 5 2015

You **WILL NOT** be covered and **WILL BE** at risk of civil/criminal penalties if the following regulations are not adhered to:

§107.1 Applicability, §107.3 Definitions, §107.5 Falsification, reproduction or alteration., §107.7 Inspection, testing, and demonstration of compliance., §107.9 Accident reporting, §107.11 Applicability, §107.12 Requirement for a remote pilot certificate with a small UAS rating, §107.13 Registration, §107.15 Condition for safe operation, §107.17 Medical condition, §107.19 Remote pilot in command, §107.21 In-flight emergency, §107.23 Hazardous operation, §107.25 Operation from a moving vehicle or aircraft, §107.27 Alcohol or drugs, §107.29 Daylight operation, §107.31 Visual line of sight aircraft operation, §107.33 Visual observer, §107.35 Operation of multiple small unmanned aircraft, §107.36 Carriage of hazardous material, §107.37 Operation near aircraft; right-of-way rules, §107.39 Operation over human beings, §107.41 Operation in certain airspace, §107.43 Operation in the vicinity of airports, §107.45 Operation in prohibited or restricted areas, §107.47 Flight restrictions in the proximity of certain areas designated by notice to airmen, §107.49 Preflight familiarization, inspection, and actions for aircraft operation, §107.51 Operating limitations for small unmanned aircraft, §107.53 Applicability, §107.57 Offenses involving alcohol or drugs, §107.59 Refusal to submit to an alcohol test or to furnish test results, §107.61 Eligibility, §107.63 Issuance of a remote pilot certificate with a small UAS rating, §107.64 Temporary certificate, §107.65 Aeronautical knowledge recency, §107.67 Knowledge tests: General procedures and passing grades, §107.69 Knowledge tests: Cheating or other unauthorized conduct, §107.71 Retesting after failure, §107.73 Initial and recurrent knowledge tests, §107.74 Initial and recurrent training courses, §107.77 Change of name or address, §107.79 Voluntary surrender of certificate 14 CFR Part 48 - Registration and Marking Requirements for Small Unmanned Aircraft 14 CFR Part 91 - General Operating and Flight Rules, particularly: §91.13 - Careless or reckless operation §91.119 - Minimum safe altitudes §91.126-135 - Operating on or in the vicinity of an airport 14 CFR Part 61 - Certification: Pilots, Flight Instructors, and Ground Instructors 14 CFR Part 101 - Moored Balloons, Kites, Amateur Rockets, Unmanned Free Balloons, and Certain Model Aircraft Operations 14 CFR Part 99 - Security Control of Air Traffic (pertaining to air defense identification zones and security control of air traffic)

Other Federal Laws and Regulations

Privacy and Data Collection - Comply with applicable federal privacy laws such as the Privacy Act and regulations governing data collection and use.

National Telecommunications and Information Administration (NTIA) Guidelines - Follow the voluntary best practices for UAS privacy, transparency, and accountability.

State and Local Regulations

State Aviation Laws - Each state may have its own laws governing the use of UAS, which can include restrictions on where and how drones can be operated.

Local Ordinances - Cities and towns may have specific ordinances regarding drone usage, such as restrictions on flying over certain properties or within certain distances from people or structures.

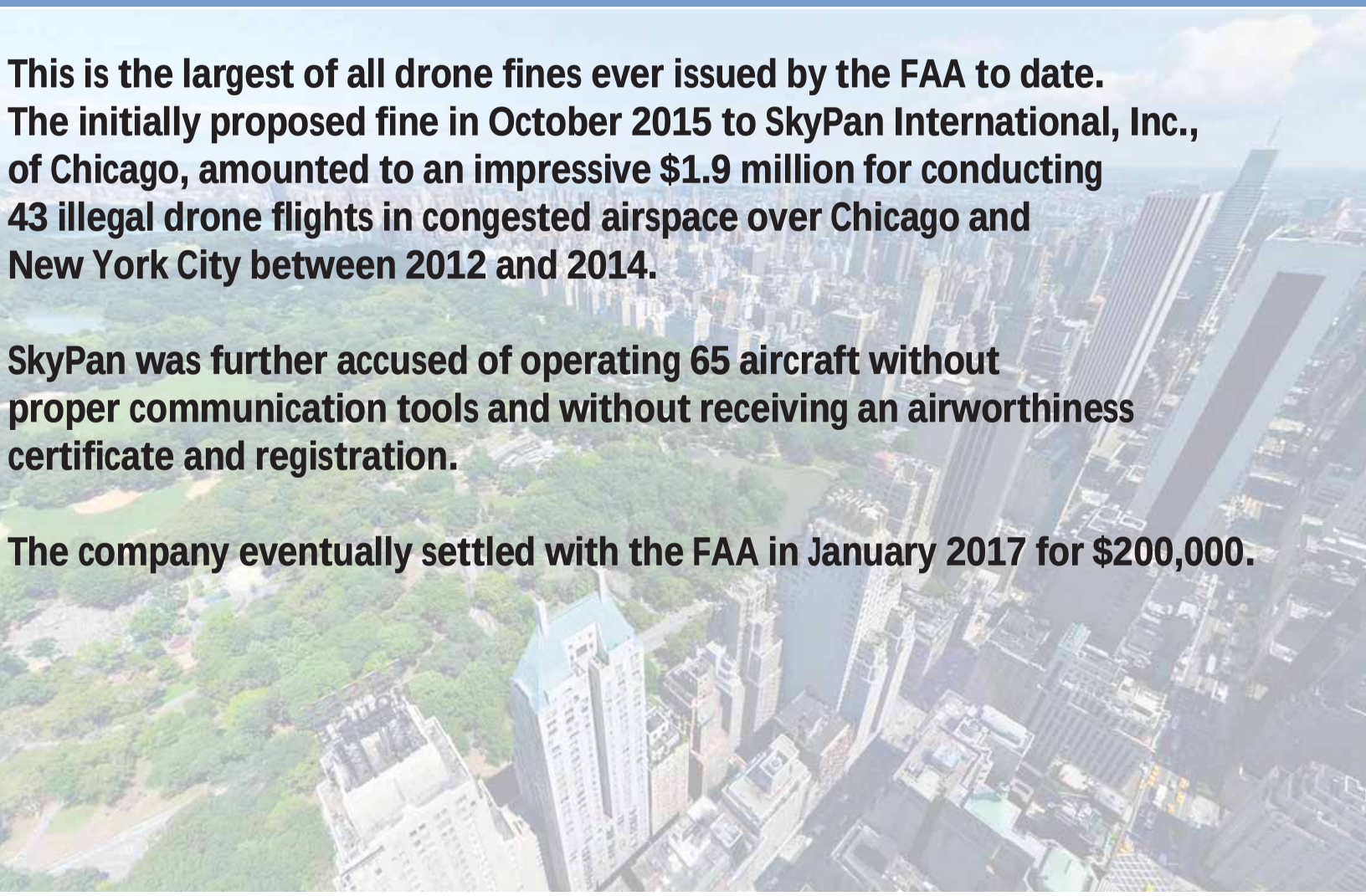
Additional Considerations

National Park Service Regulations - Drones are generally prohibited in national parks unless specific permission is granted.

Federal Communications Commission (FCC) Regulations - Ensure compliance with FCC regulations on radio frequency spectrum use.

Airspace Authorizations and Restrictions - Obtain necessary airspace authorizations from the FAA when operating in controlled airspace, and comply with temporary flight restrictions (TFRs) and other notices to airmen (NOTAMs).

SKYPAN INTERNATIONAL - $1,900,000



This is the largest of all drone fines ever issued by the FAA to date. The initially proposed fine in October 2015 to SkyPan International, Inc., of Chicago, amounted to an impressive $1.9 million for conducting 43 illegal drone flights in congested airspace over Chicago and New York City between 2012 and 2014.

SkyPan was further accused of operating 65 aircraft without proper communication tools and without receiving an airworthiness certificate and registration.

The company eventually settled with the FAA in January 2017 for $200,000.

Mical Caterina - $55,000

The FAA has also imposed other substantial fines on various operators for a range of violations. For instance, a recent enforcement action saw fines totaling $341,413 against 27 drone operators for unsafe or unauthorized flights between October 2022 and June 2024, with individual fines reaching up to $75,000 DroneDJ.

Common Types of Drones

Fixed Wing

Quadcopter

Hexacopter

Octocopter

Top of the Line (Not Needed)

Matrice 350 RTK with Multi-Spectral (left) and Laser Methane Detector(right)

$80,000

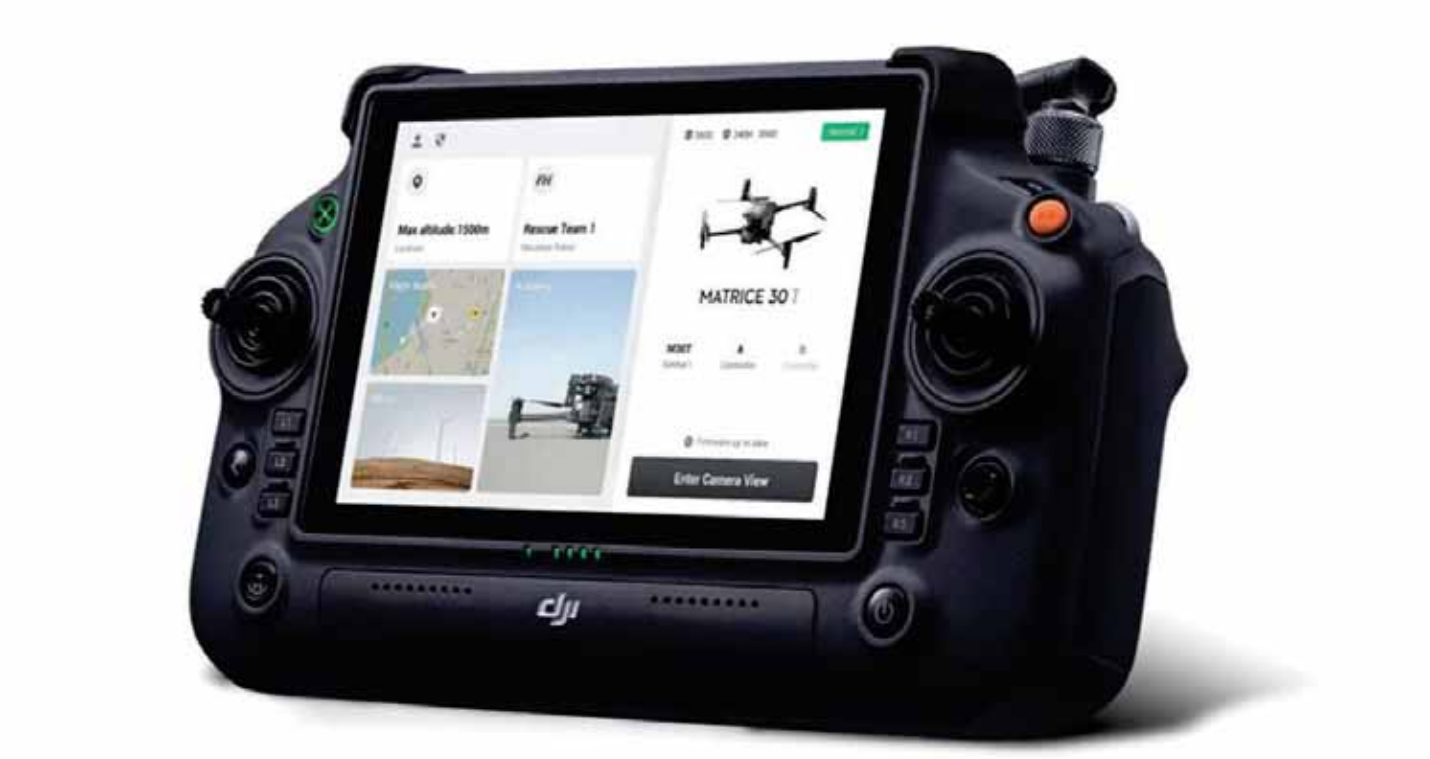
(Suggested) Mavic 30T Drone

Max Weight: 8.9 lbs 4069 grams	Max Speed: 41 mph	Max Wind: 26.8 mph
Max Flight Time: 41 min.	Service Ceiling: 22,965 ft.*	Storage: 128GB (SD)
Temp Range: -4F - +122F	Sensor: Sony 48 MP	Thermal Sensor: 640x512
Video: 4K@30P	Range Finder 3937 ft	Range: 9 miles

(Budget) Mavic 3T Drone

Max Weight: 2.2 lbs 1,050 grams	Max Speed: 47 mph	Max Wind: 26.8 mph	Max Flight Time: 45 min.
Service Ceiling: 19,685 ft.*	Storage: 128GB (SD)	Temp Range: -14F - +104F	Sensor: Sony 48 MP
Thermal Sensor: 640x512	Video: 4K@30P	Range Finder 3937 ft	Range: 9 miles

21st Century Cockpit



Is This Legal?

Flight Planning Websites

DJI Go 4

Aloft

SkyVector

UAV Forecast

Windy

AIRDATA

Federal Websites

- Drone Registrations
- Airspace Authorizations
- Waivers

- Pilot Registry Database
- Aircraft Registry Database

Mapping Software

Drone Deploy

Easy to Use Apps (for E-Services)

Flightradar 24 (just fun)

What a Remote Pilot Needs

Step One - See If They Are Legal

https://amsrvs.registry.faa.gov/airmeninquiry/Main.aspx

Airplane Pilot

Drone Pilot

What a Remote Pilot Needs

United States Department of Transportation

FAA UAS Declaration of Compliance

✓ Accepted **Tracking #: OOP000000172** Created: 8.2.2024

Operations Over People Declaration of Compliance

Category: Category 2

Make:

Aerial Vehicle Safety Solutions (AVSS)

Model:

ASTM F3322 Compliant PRS for DJI Mavic 3 Enterprise

Serial #:

MOC Tracking Numbers: (AVSS-04052024-MOC) AVSS Part 107 OOP MOC

Small UAS Certificate of Registration

Registered Owner: Greenman-Pedersen, Inc.

UAS Manufacturer: DJI

UAS Model: Mavic 3E RTK

Serial Number: 1581F5FHD22CG00C8PY7

Registration Number: FA3H3HCXCC

Issued: 02/08/2023 Expires: 02/08/2026

Car Accident Workflow for Drone Mapping

Pre-Flight Planning

A. Site Assessment

- Assess the crash site for any hazards such as power lines, trees, and buildings.
- Identify takeoff and landing zones that are safe and provide clear visibility of the crash site.

B. Regulatory Compliance

- Obtain any necessary permissions or waivers from the FAA, especially if flying in controlled airspace.
- Ensure compliance with local laws and regulations regarding drone use.

C. Equipment Check

- Verify that the drone is in good working condition, including battery levels, propeller integrity, and camera functionality.
- Confirm that the drone's firmware and software are up to date.

D. Flight Plan Development

- Plan the flight path to cover the entire crash scene, ensuring overlap in the images for 3D modeling or photogrammetry.
- Set parameters for altitude, speed, and camera settings based on the specifics of the crash site and environmental conditions.

Car Accident Workflow for Drone Mapping

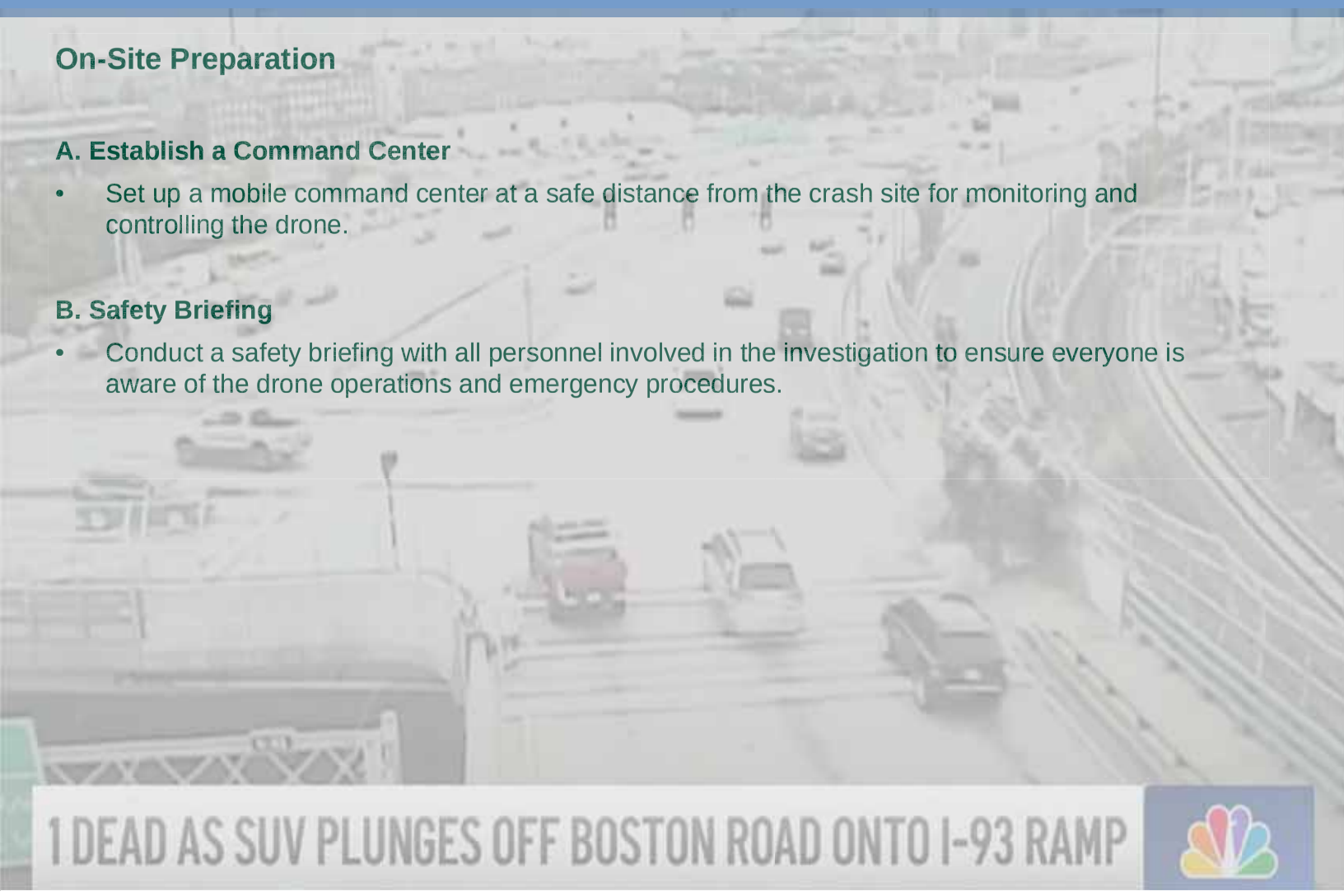
On-Site Preparation

A. Establish a Command Center

- Set up a mobile command center at a safe distance from the crash site for monitoring and controlling the drone.

B. Safety Briefing

- Conduct a safety briefing with all personnel involved in the investigation to ensure everyone is aware of the drone operations and emergency procedures.



Car Accident Workflow for Drone Mapping

Flight Operations

A. Pre-Flight Check

- Perform a final check of the drone and equipment.
- Verify GPS signal and calibrate the drone's compass if necessary.

B. Launch and Data Collection

- Launch the drone and follow the pre-planned flight path.
- Capture high-resolution images and videos of the crash site from multiple angles.
- Use specialized sensors, such as LiDAR or thermal cameras, if required.

C. Monitoring

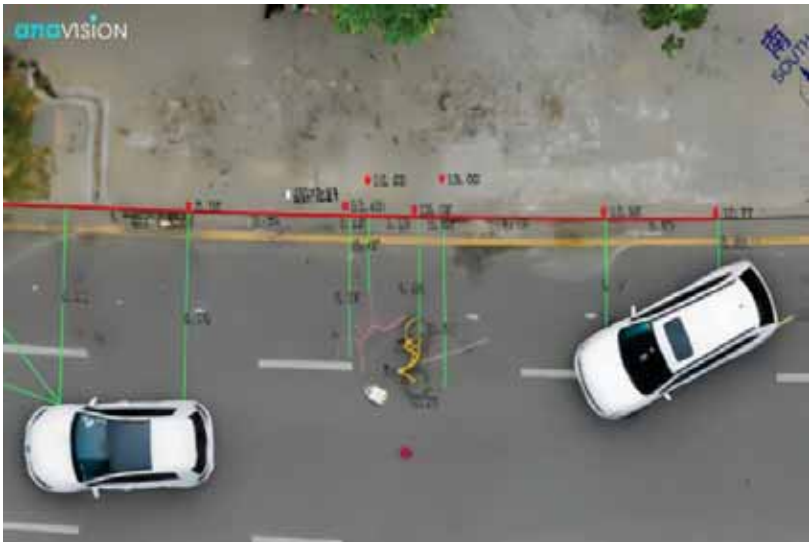
- Monitor the drone’s flight in real-time, making adjustments as necessary to ensure complete coverage of the crash site.
- Be prepared to take manual control of the drone if automatic flight systems fail.

Car Accident Workflow for Drone Mapping

Post-Flight Procedures

A. Data Retrieval

- Download all data from the drone's storage devices, including images, videos, and sensor data.
- Ensure the integrity and completeness of the data collected.



B. Preliminary Analysis

- Conduct a preliminary analysis on-site to ensure all necessary data has been captured.
- Re-fly any areas if required data is missing or unclear.

Car Accident Workflow for Drone Mapping

Data Processing and Analysis

A. Data Processing

- Use software to stitch together images for 3D modeling or photogrammetry.
- Process sensor data to create detailed maps or reconstructions of the crash site.

B. Detailed Analysis

- Analyze the processed data to determine the positions of vehicles, debris, skid marks, and other relevant evidence.
- Generate reports and visualizations to aid in the investigation.

Car Accident Workflow for Drone Mapping

Reporting and Documentation

A. Report Generation

- Compile findings into a detailed report, including maps, 3D models, and other visual aids.
- Provide analysis and conclusions based on the data collected.

B. Legal Documentation

- Ensure that all documentation is in compliance with legal standards and can be used in court if necessary.
- Archive all data and reports securely.

Car Accident Workflow for Drone Mapping

Review and Evaluation

A. Review Procedures

- Review the entire process to identify any areas for improvement.
- Conduct debriefings with all team members involved in the investigation.

B. Continuous Improvement

- Update protocols and procedures based on lessons learned from the investigation.
- Train personnel on any new techniques or equipment.

Goal Slide

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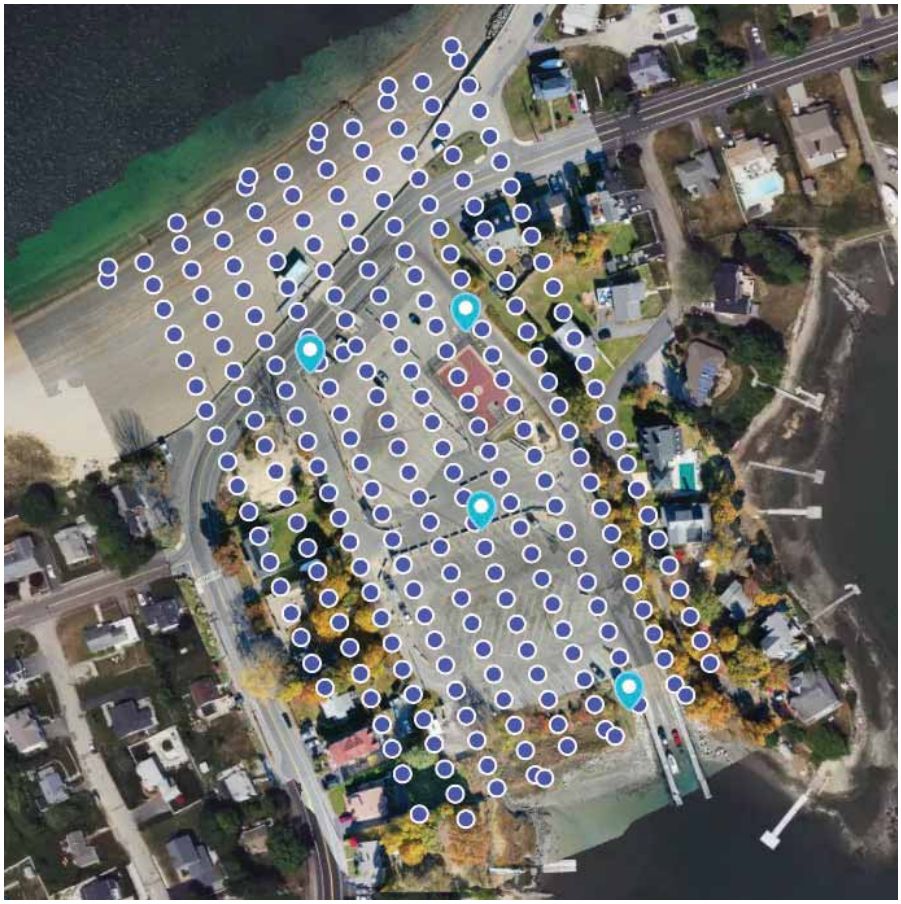
Non E-Services Applications

Multi-Stereo Digital Ortho-photogrammetry
Surveying
Inspections
Real Estate
Agriculture
Volumetrics
Traffic Monitoring
Tower Inspections
Erosion Assessment

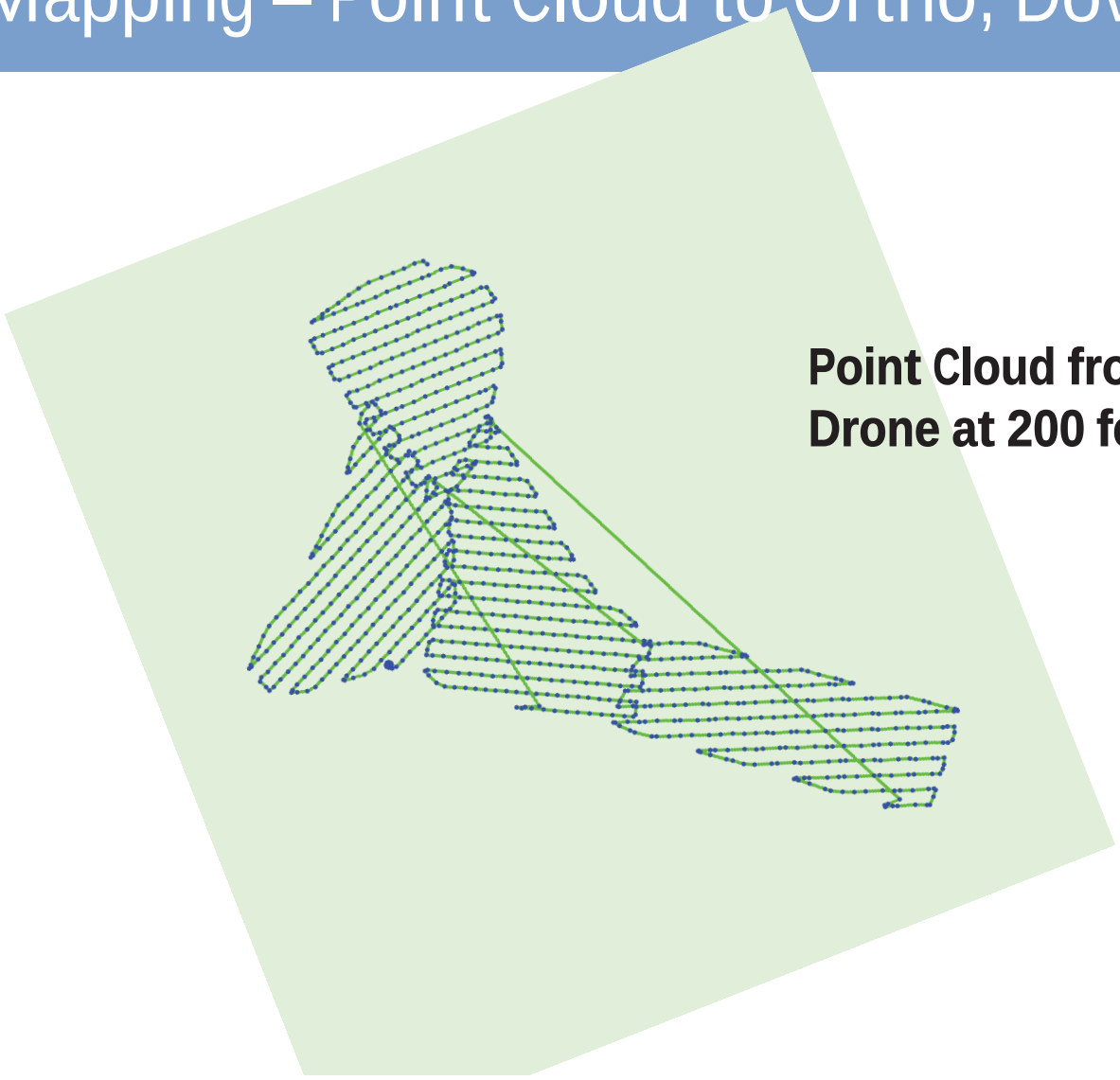
Drones Do The Jobs That Are:
Dull, Dirty Dangerous!

Accurate Point Clouds
(One Official Name Is)
Multi-Stereo Ortho-Photogrammetry



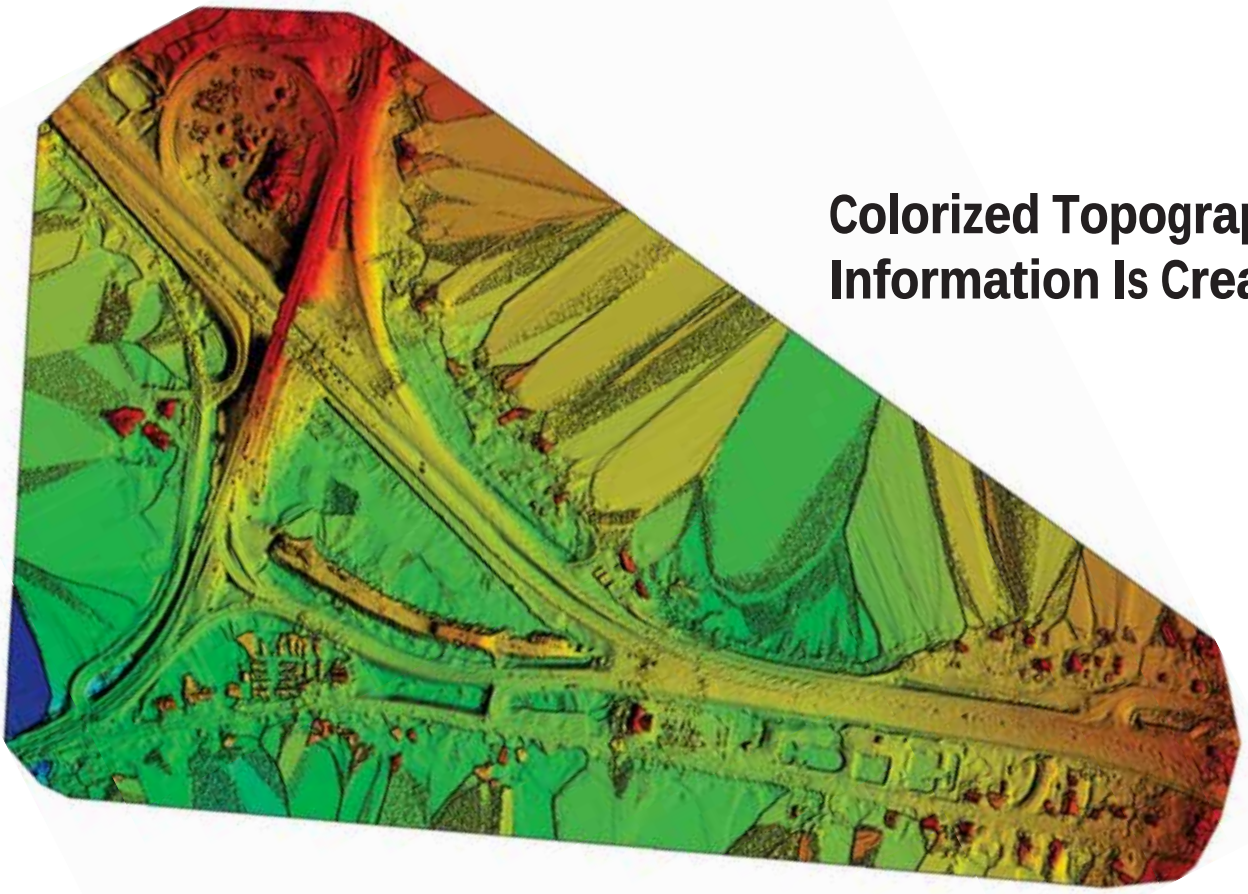
Point Clouds Are Measurable

Mapping – Point Cloud to Ortho, Dover NH



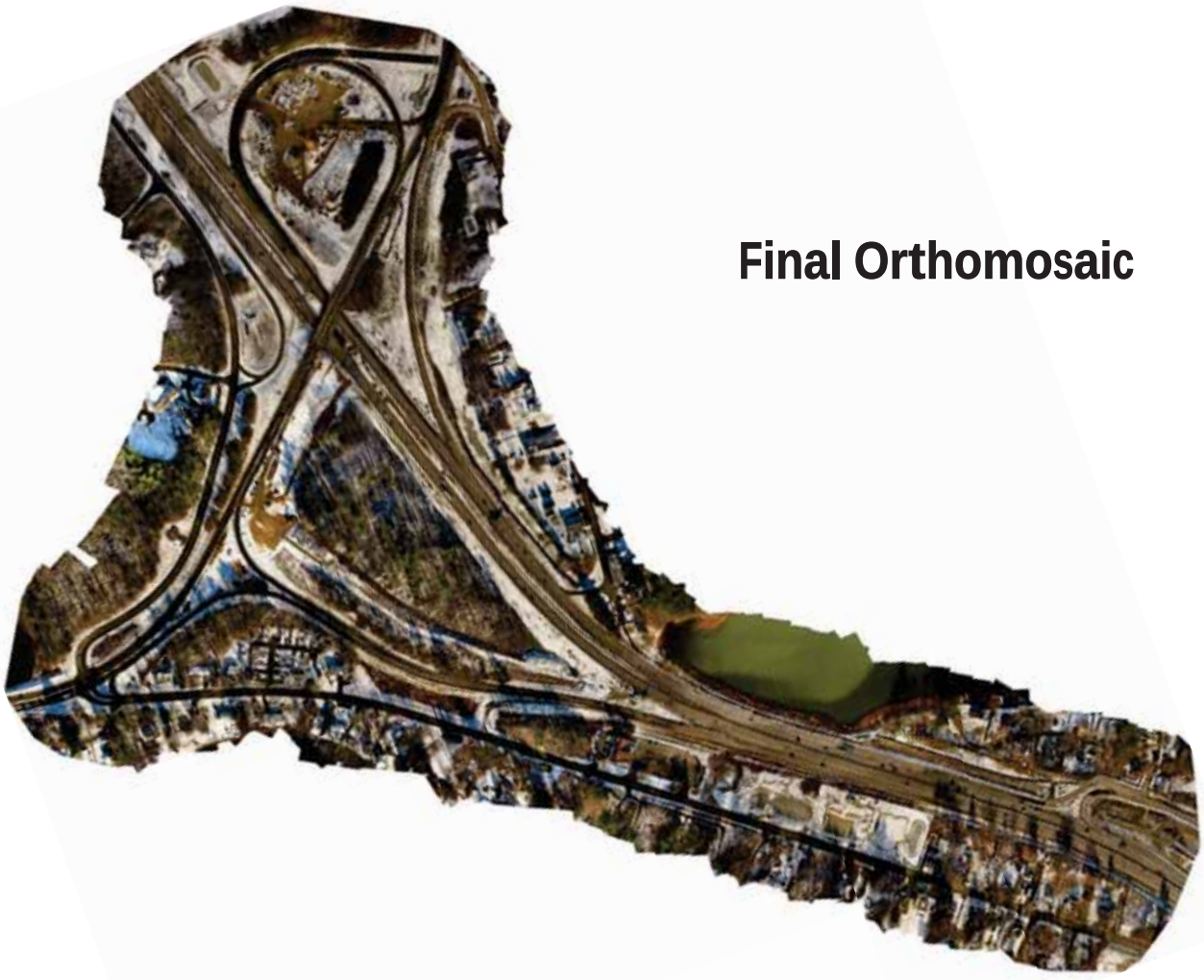
Point Cloud from Drone at 200 feet

Mapping – Point Cloud to Ortho, Dover NH



Colorized Topographical Information Is Created

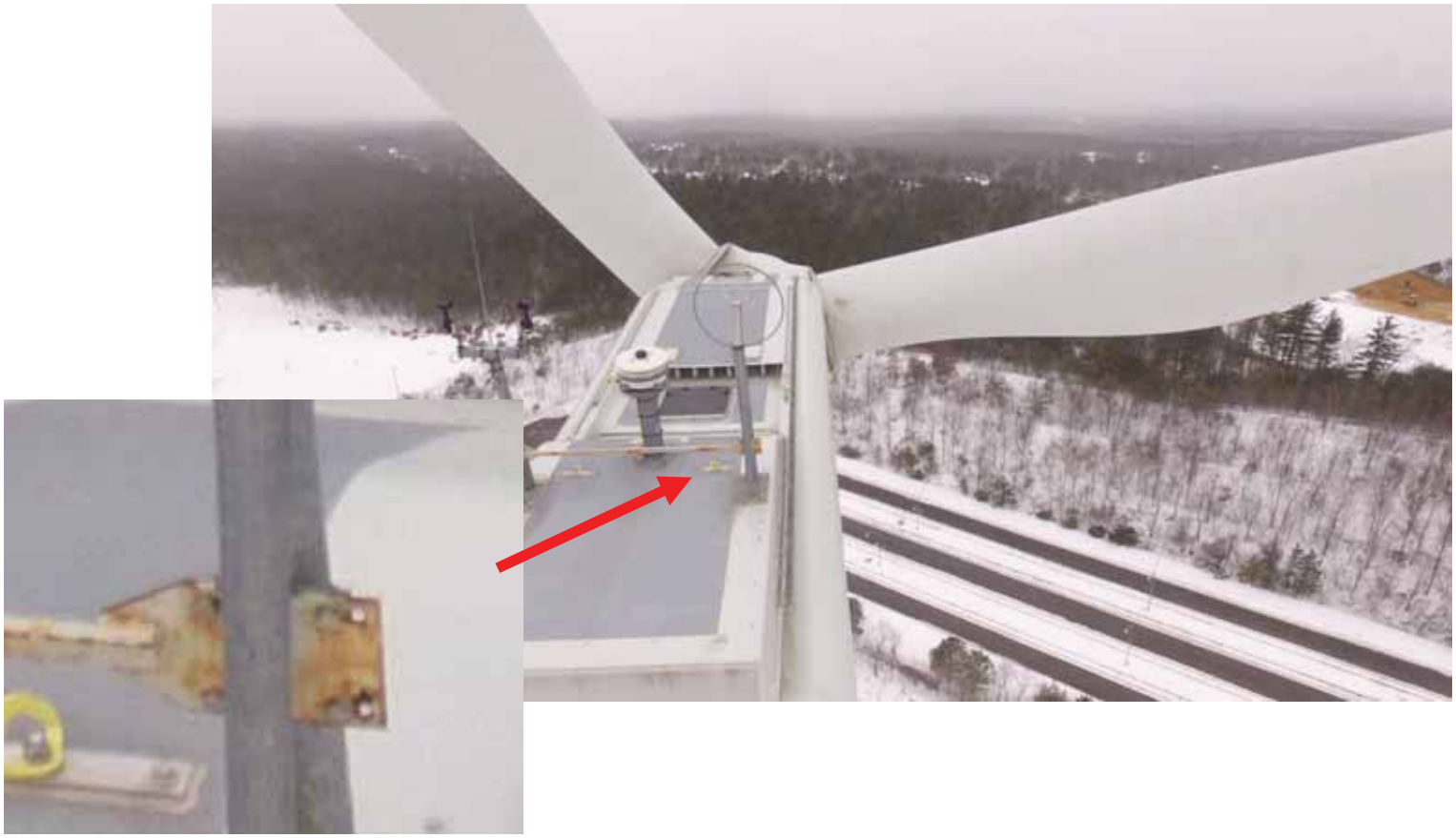
Mapping – Point Cloud to Ortho, Dover NH



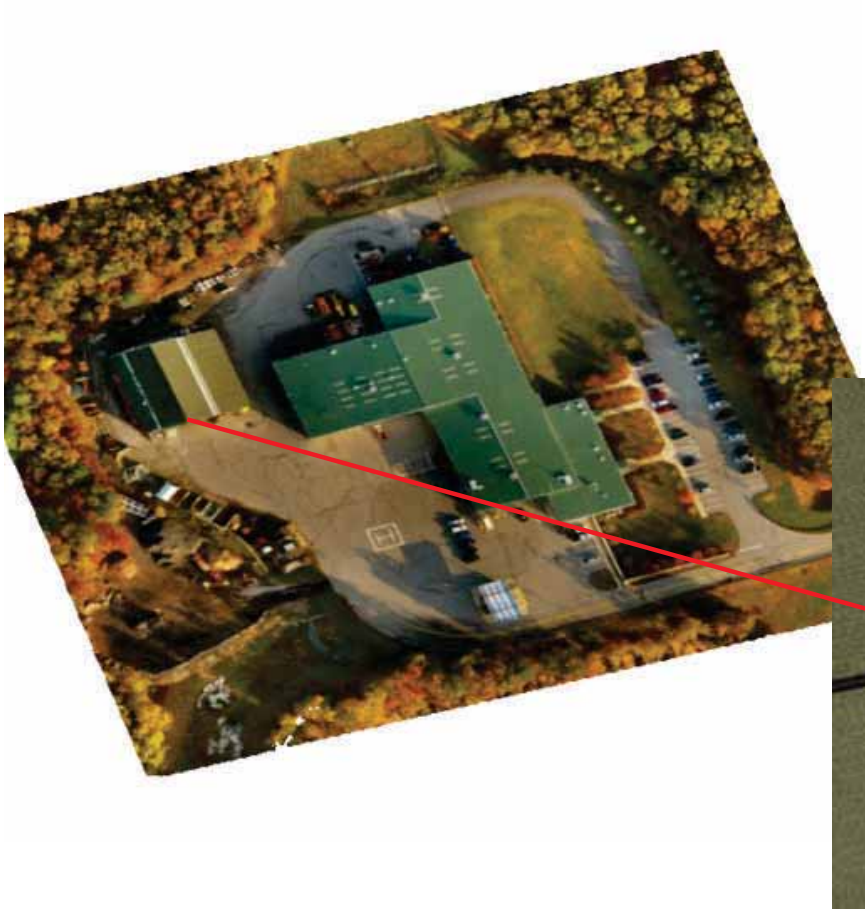
Final Orthomosaic

Bridge Inspections

Wind Turbine Inspections



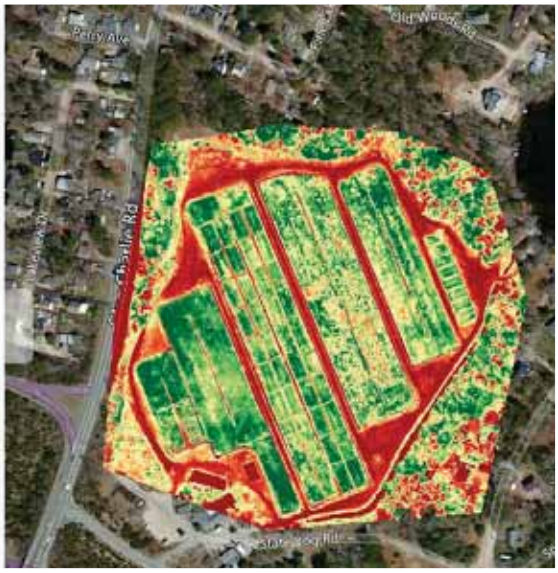
Roof Inspections



Westford Highway Department – Roof Inspection

Real Estate

Agriculture and Drones



Mapping – Plymouth, MA

Saquish Lighthouse Erosion Assessment

Improved Safety

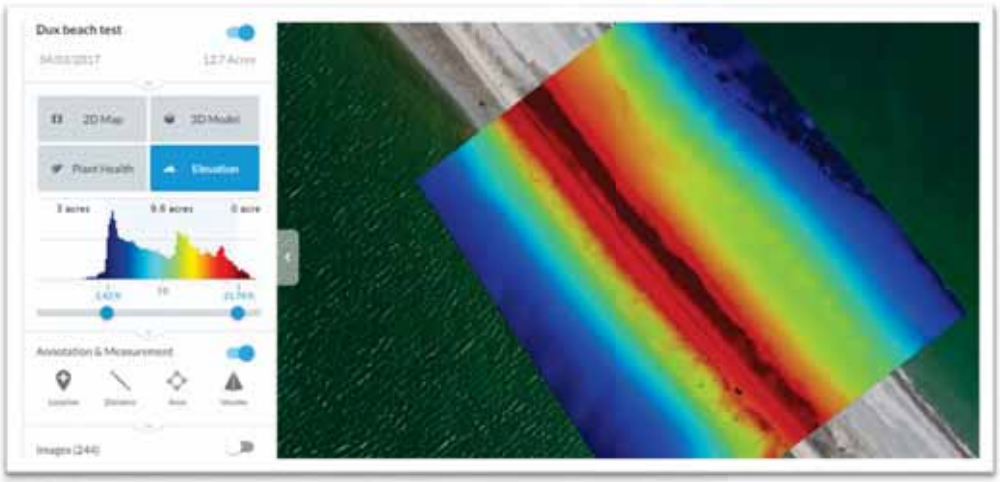
Accuracy to less than 6 cm.
Volumetrics to approx. 1/10th percent

Mapping for Erosion – Plymouth, MA

Erosion Assessment

Environmental

- Survey & Mapping
- Coastal Erosion
- Wildlife Detection/Observation
- Wetland Monitoring
- Agricultural Monitoring



Commercial Street, Portland, ME

A Picture is Nice . . .

But A Video Can Be Better

Nice Pic - NH Rt. 93 Exit 3