

Mapping on a Budget Using Drones and Digital Data*

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Abstract

Small drones, both fixed wing and multirotor, are tools well suited to capturing the imagery required for aerial mapping. The requirements for getting started in the UAV mapping business can be less than one might think, but there's a significant difference between an attractive looking map and an accurate, survey-grade product that would be useful to surveyors, engineers, and contractors.

This presentation will show how someone with a limited budget and very little background can enter the drone mapping field on an incremental basis – “dipping one toe into the water” to help determine if you have the passion, aptitude, and patience for providing UAV mapping services without a major capital investment.

UAV mapping is about a lot more than just something that looks like a Google satellite map. While it encompasses the traditional orthomosaic image that you'd see on Google Earth, many don't realize all the other products that can be obtained.

...Build a visual 3D model for inspection, market a project, or reconstruct an accident scene Determine the volume of piles of materials, generate a cut and fill map of the quantity, and location required to achieve a desired field profile.... Determine watershed runoff including elevation contours or slope directions.... Plan for the installation of security cameras or lighting through a viewshed... Determine the health and biomass of crops using multispectral cameras...

- What are the two main classes of drones (fixed wing and multirotor) and what are their advantages, disadvantages, and cost of entry?
- What are the overall components needed for UAV mapping and how do they all fit together, from flight planning through final deliverable?
- What are some possible implementation strategies, along with the best way to obtain the skills and knowledge?
- What kind of accuracy can be obtained, and what other equipment and procedures are needed to obtain survey-grade accuracy?

Obtain the answers to these questions and ask some of your own, from a UAV mapping training and services provider with real world experience

Mapping on a Budget

Using Drones & Digital Data

Jeff Campbell





Mapping with Minimal Investment

- UAS Mapping suited to Incremental Approach
- Large Up front investment not necessary.
- Determine if you have
 - Passion, Aptitude, Patience
- Start small, scale as necessary
 - Consumer Grade Multicopter UAV
 - UAV Image Capture App
 - Trial – Pix4D (or Drone Deploy)
- Product content, develop knowledge
- Generate income, then scale up

Agenda

1. Introduction
2. UAV Mapping Explained
3. Mapping Products
4. Technology
5. Training Methods



Vertical Aspect

- Specializing in Unmanned Aerial Vehicle (UAV) Mapping
 - Consultation
 - Training (Face-to face and Remote)
 - Services
- Offer related hardware / software
 - Robota Eclipse Fixed Wing – Texas Dealer
 - Pix4D Pro Mapping / Virtual Surveyor Software
 - V-Map Ground Control Targets
- FAA Certified, Insured



Our Background

- Jeff Campbell
 - Retired Navy Rotary Wing Pilot
 - Lockheed Martin Program Manager
 - Involved in UAS since 2012
- Mark Paulson
 - Registered Professional Surveyor
 - Private Pilot
 - Sales / training of UAS since 2013

UAS Mapping Explained



UAS vs. Conventional Surveying

- Higher Speed of Capture
- Smaller Crew size
- More Data Points
- Less Cost
- Higher Efficiency
- Safer
- Less Impact on Operations
- Comparable accuracy (w/Ground Control)

Use Cases / Outputs

Orthomosaic



Stitching vs. Orthorectification

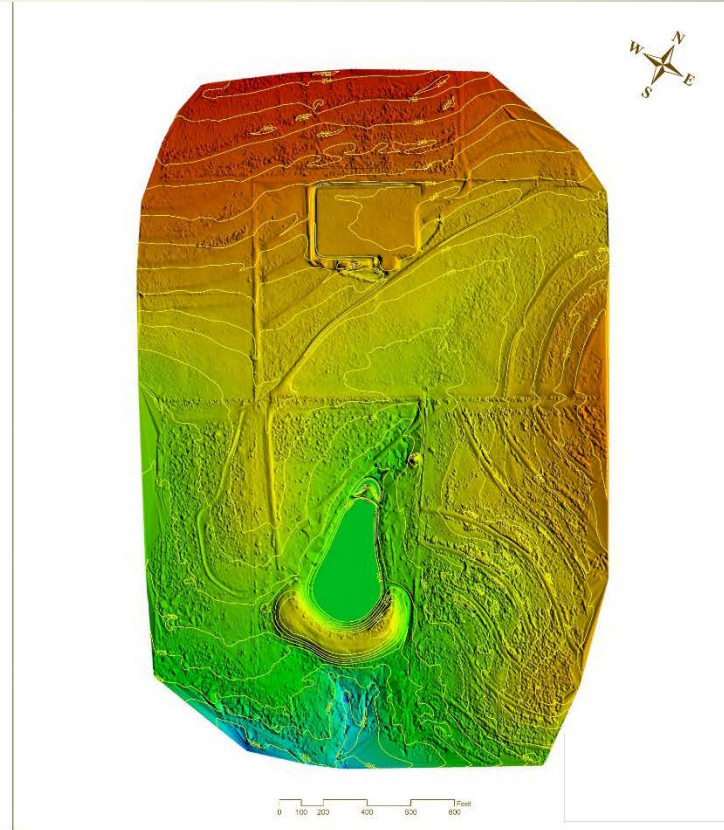
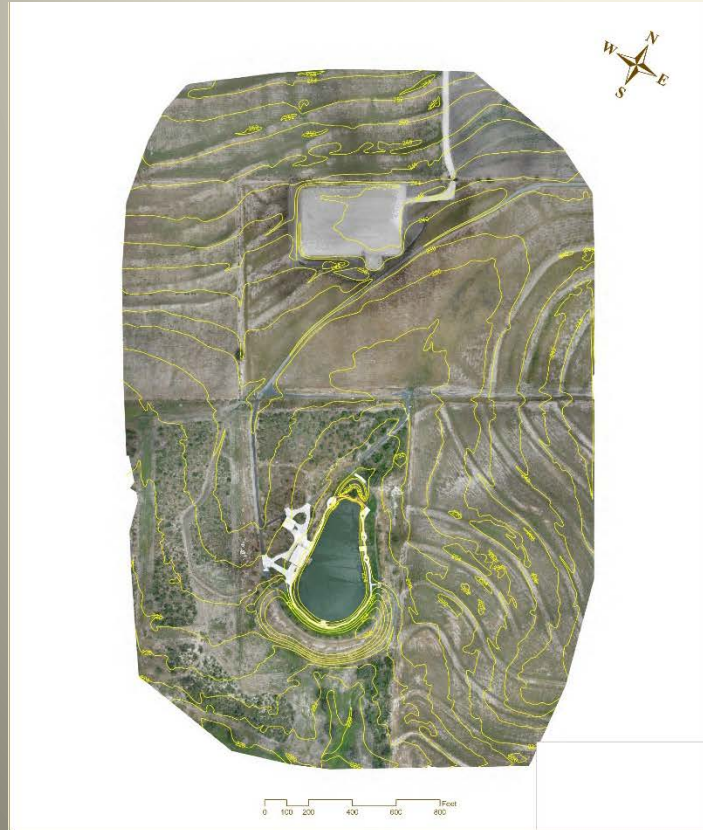


- Pictures not aligned
- Unsuitable for measurements

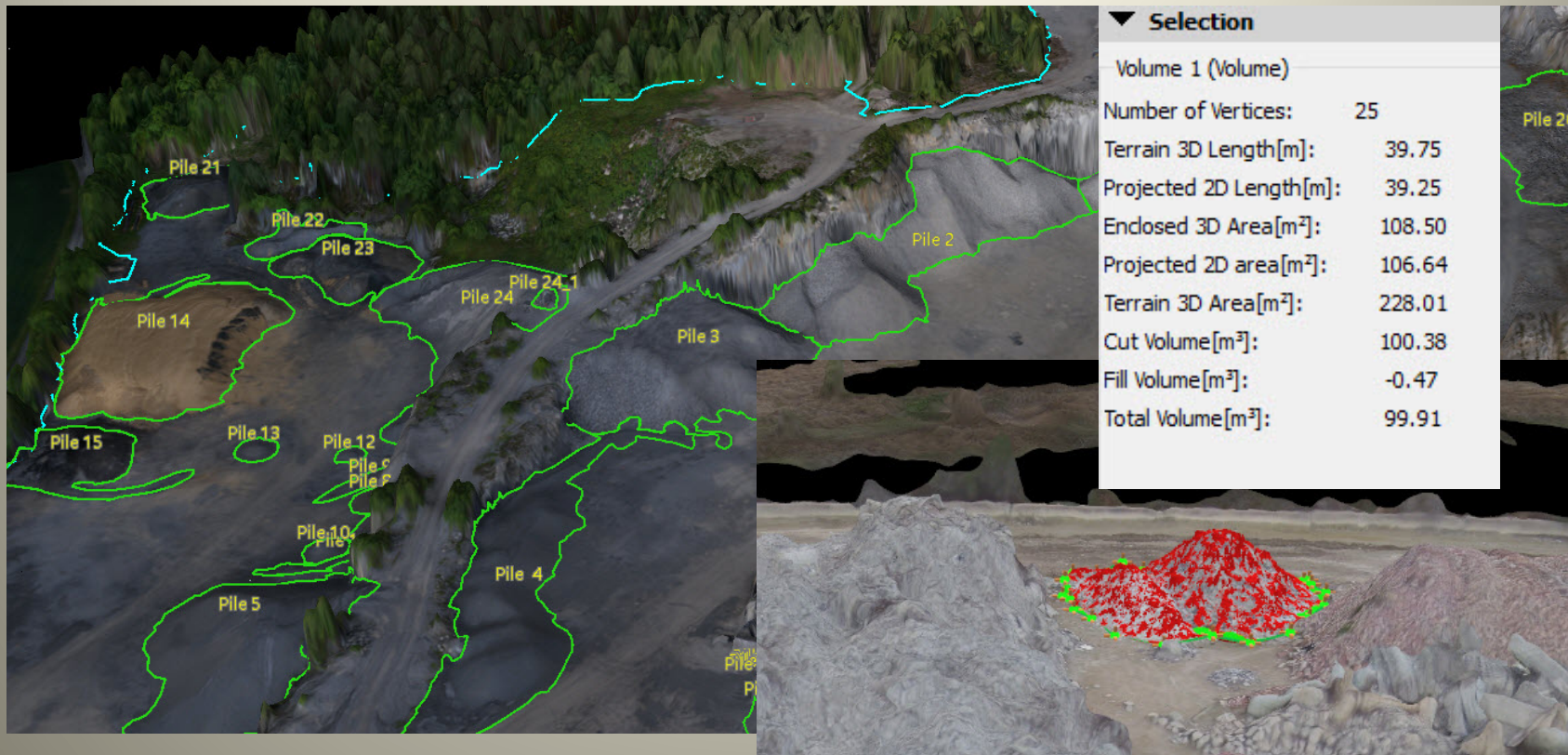


- Removes perspective distortions
- Accurate scale and position

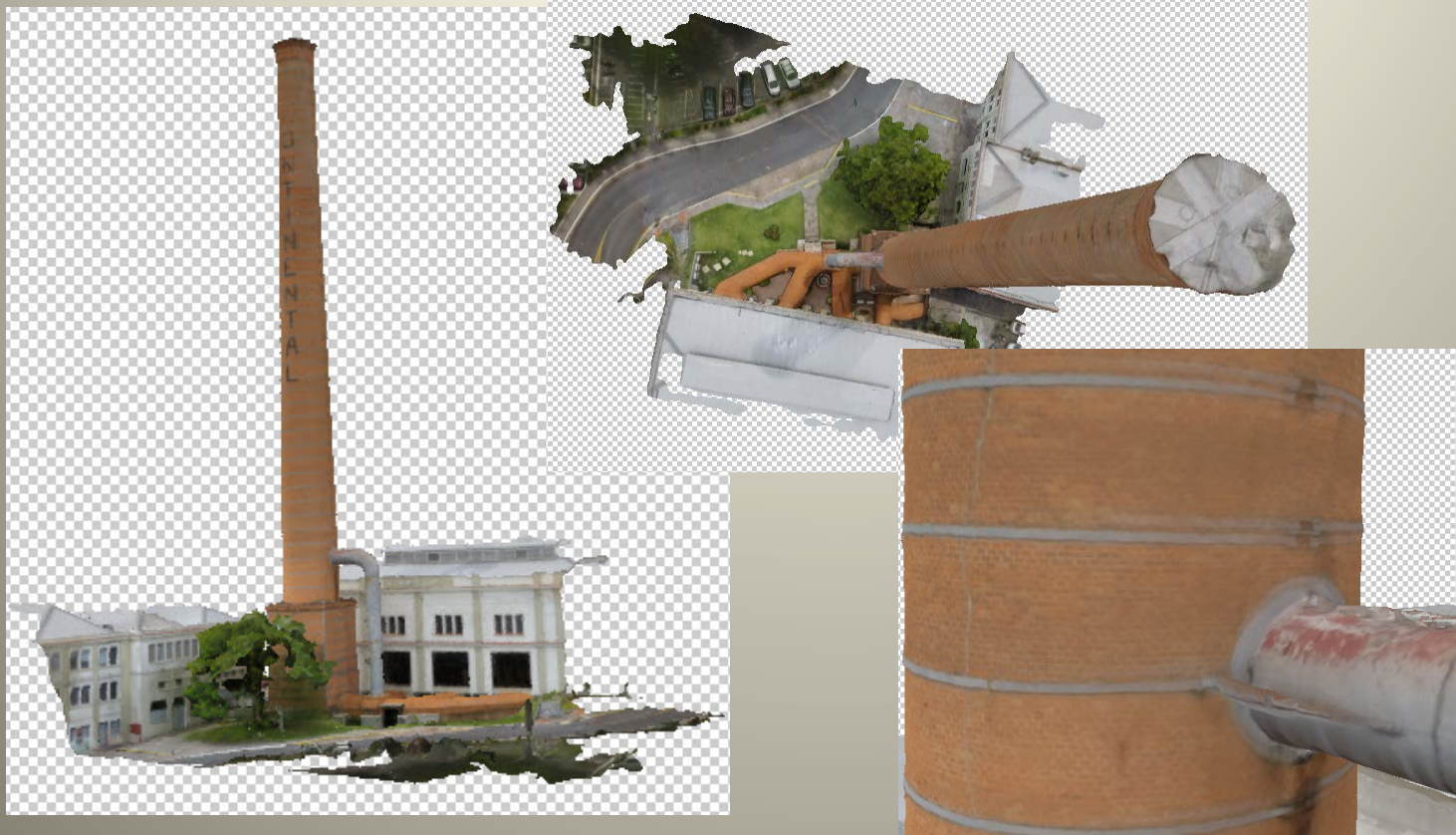
Topographic



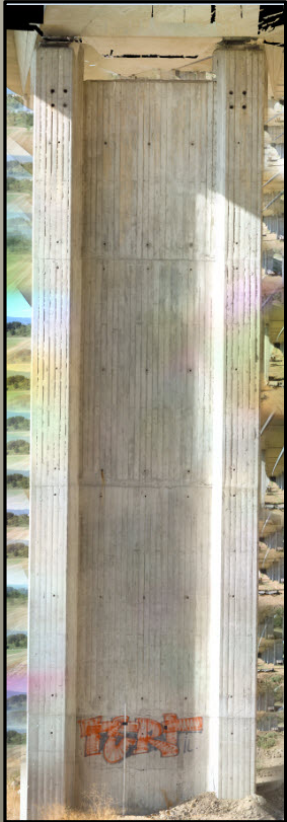
Stockpile Volume Calculations



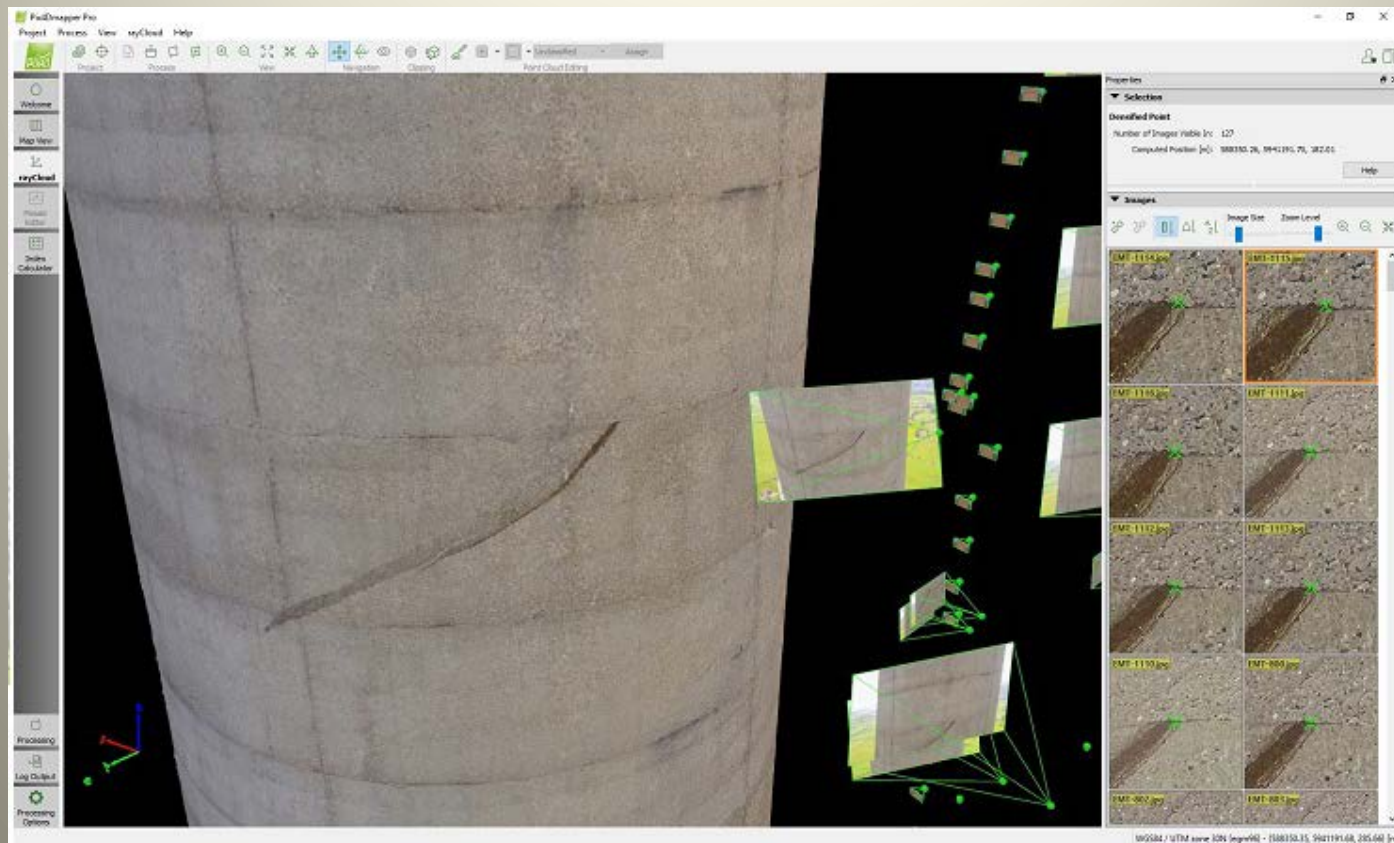
3D Model



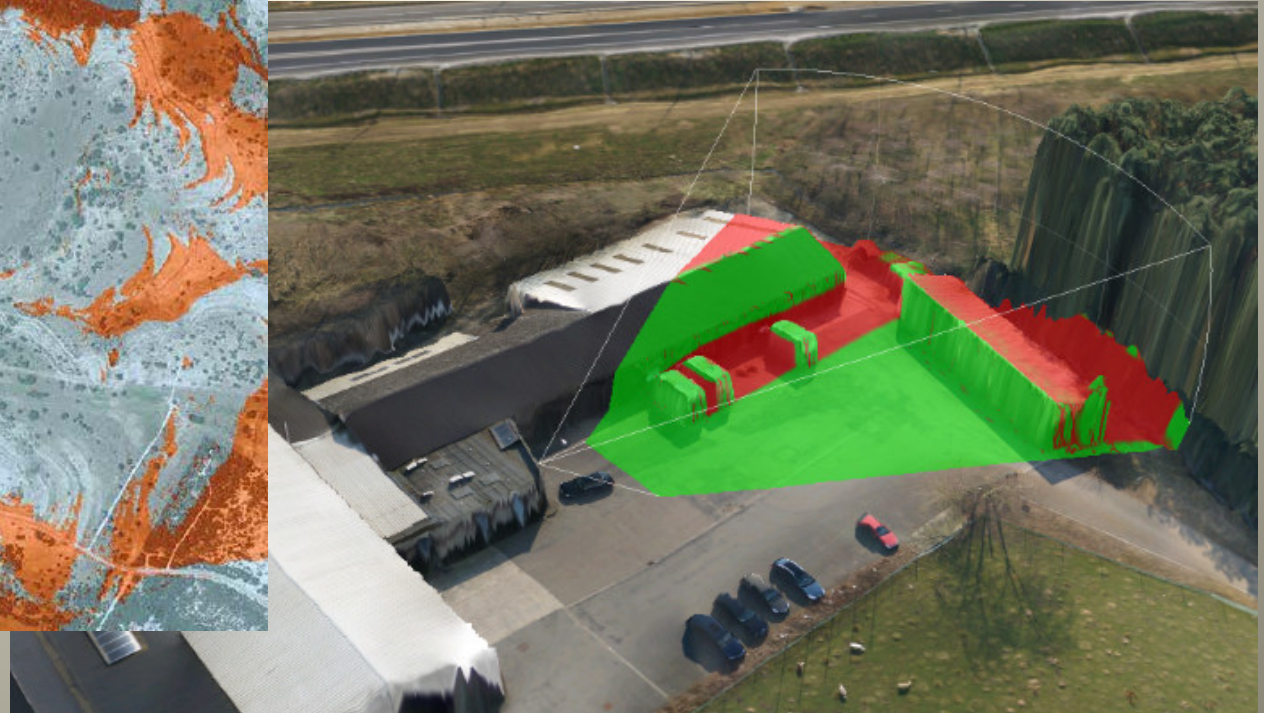
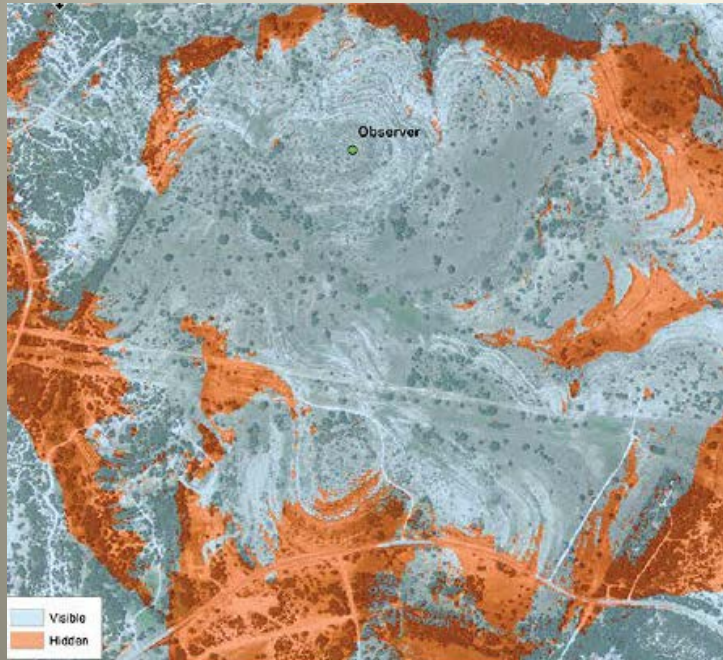
Inspections



Inspections



ViewShed / Sightline



UAS Mapping: Technologies



UAS Mapping Requirements

- UAV (fixed wing or multirotor)
- Image capture app
- Tablet, smartphone or laptop for field use
- Post-processing software
- Desktop or hi end laptop for processing
- Training (UAS, image capture, post-processing)
- FAA Part 107 certification for commercial ops

Typical Mapping Platforms



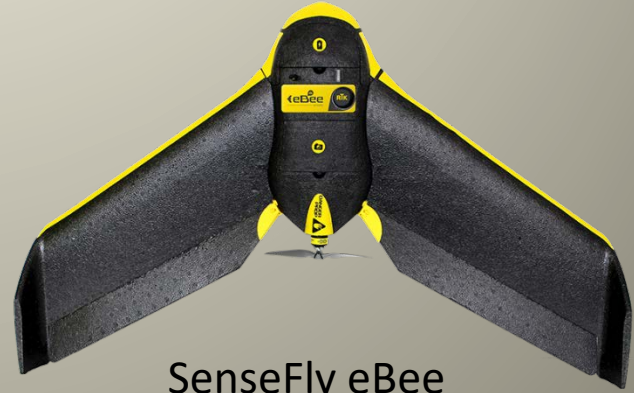
DJI Inspire 1



Robota Eclipse

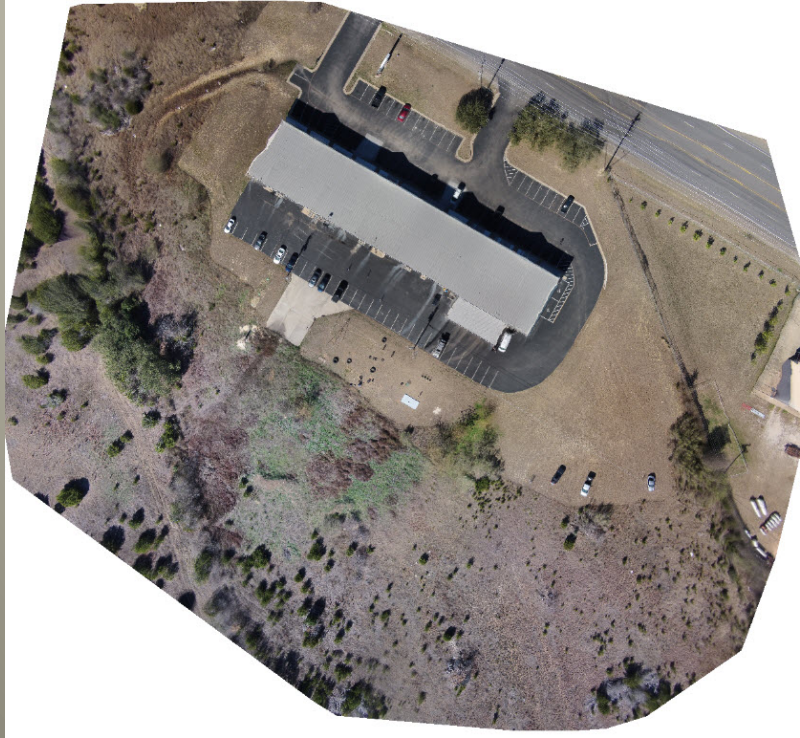


DJI Phantom 4 Pro



SenseFly eBee

Multitorotor vs. Fixed Wing





Multicopter vs. Fixed Wing

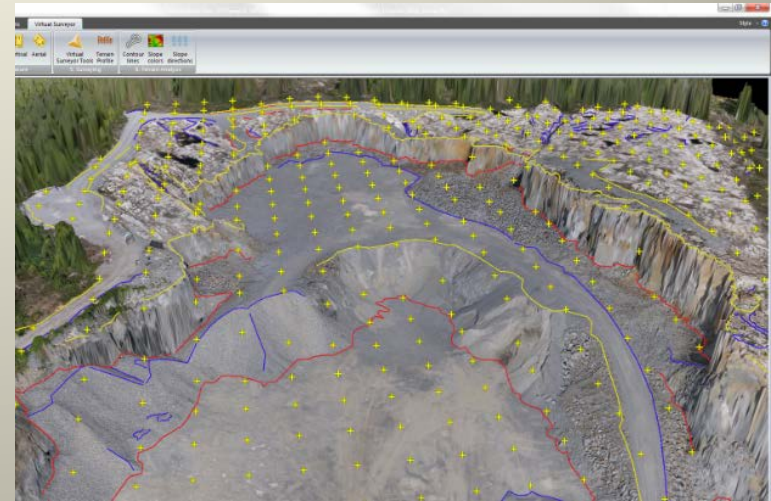
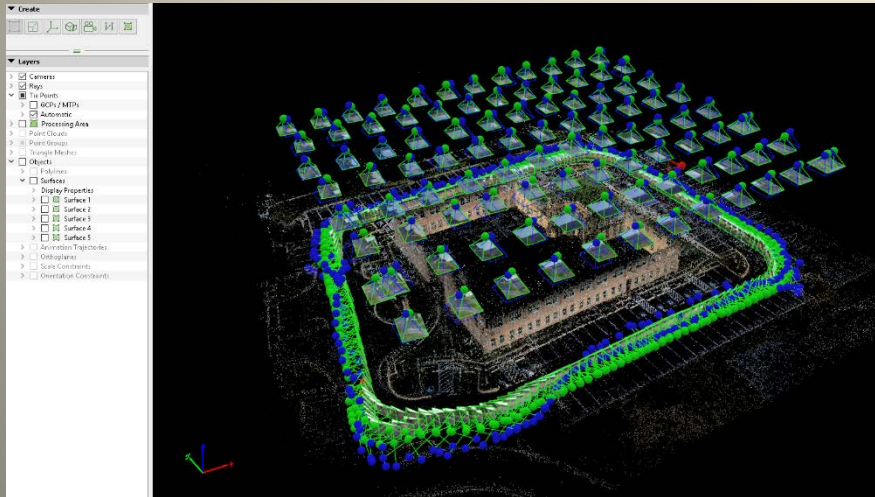
Attribute	Multicopter	Fixed Wing
Size of Project	Up to 100 ac (~30 ac /flt)	1200 ac + (~400 ac / flt)
Learning Curve	Easiest + smaller datasets	More complex (+ larger datasets)
Landing/takeoff area	Vertical (Very small)	Larger clear area for takeoff/landing
Altitude / detail	Lower alt / higher detail / less coverage	Higher alt / less detail / greater coverage
Flt times	~15-29 mins	~50 mins
Cost of entry	\$2000 - \$3000	\$12,500 - \$34,000

Flight Planning / Image Capture



Post-Processing Software

- Pix4D
- Virtual Surveyor



Online vs. Desktop Processing

Online

- Less up-front investment
- Black-box
- Ease of use
- More limited capabilities

Desktop

- Need decent PC
 - Dedicated is better
- More control
- Proof of accuracy

Accuracy

Without GCP



With GCP



Ensuring Accuracy

- Ground Control Points
- Professional Grade GPS
- Ground Control Kit





Approach Accuracy Incrementally

- Initial projects without GCP
- Hire surveyor to mark GCP
- Rent GPS equipment
- Buy equipment or RTK aircraft

Getting Started

Developing Knowledge

- **Self-Taught**

- **PROS**

- Less financial Outlay
- Much available info – Online, workshops, forums

- **CONS**

- Much longer time investment
- Requires significant research
- Will be dead ends

- **Consultant / Classroom**

- **CONS**

- Cost involved
- Finding the right people

- **PROS**

- Navigate straight through the maze
- Up front cost produces ROI
- Fewer wrong turns / repairs / re-purchases

Hybrid Approach

- Balance of Cost / Time
- Use consultant / classroom training only when needed

What Else is Involved?

- Launching Drone Services (Fri – 11:15)
 - FAA Regulations
 - Ethics / Privacy Considerations
 - Potential Business Opportunities
 - Steps to Launch Business
 - Implementation Strategies



QUESTIONS?

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