Drones: A Transportation Industry Disruptor

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Ciorba Innovation & Technology Group

Dedicated to lead Ciorba in advanced technology Solutions and help push the Civil Eng. Industry forward.

Some of **InnoTech Group** main focus for 2019 / 2020

- Automation in Design
- Drone technology
- Asset Management
- Online Solutions
- Technological solutions in bridge inspection

TALKING POINTS

The topics we will be addressing within the presentation.

1. History
2. Part 107
3. Drone Use
4. Drone Features
5. Data Processing
6. DOTs & Drones
7. Bonus Section

They LOVE their acronyms...

sUAV small Unmanned Aerial Vehicle.

sUAS small Unmanned Aerial System.

FAA Federal Aviation Administration.

LAANC Low Altitude Authorization And Notification Capability.

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1. History

How it all started and when did it boom.

This section is perfect for war heros and Air Force lovers.

HISTORY TIMELINE SUMMARY

1782
Montgolfier brothers in France use unmanned balloons

1848
Austria used bombs unmanned balloons against Venice

1966
Lightning bugs used in wars including Vietnam

1982
Israel and American military use the Pioneer

1991
At least one UAV was airborne at all times in the Gulf war

2007
The reaper was used in combat missions in Iraq and Afghanistan

2014
Popularity explosion. Military sUAV budget at $24 Bn

ASCENSION EXÉCUTÉE PAR CHARLES DANS LA PRAIRIE DE NESLES, LE 1er DÉCEMBRE 1783

1782

Joseph-Michel and Jacques-Etienne Montgolfier (Montgolfier brothers) in France used unmanned balloons.

- **Pioneer developers** of the hot-air balloon and conducted the first untethered flights.
- Discovered that **heated air**, when collected inside a large lightweight paper or fabric bag, **cause the bag to rise into the air.**
- The brothers traveled to Paris and Versailles where they repeated the experiment with a larger balloon in 1783 by sending **a sheep, a rooster, and a duck** aloft as passengers.
- The balloon floated for about **8 minutes** and landed safely about **2 miles** from the launch site.

Source: Encyclopedia Britannica

Воздушное торпедо.

Бомбардировка с аэростата. "Воздушное торпедо" О. С. Костовича.

1848

Austria used bombs unmanned balloons against Venice

- **Very little** information is preserved.
- Venice was under siege by the Austrians and bombed Venice using **untethered balloons**.
- The wind was blowing **9 out of 10** times from the sea towards the city.
- They were described as **"small Cloudlets"** since no one knew what they were.

1966

Lightning bugs used in wars including Vietnam

- Within **30 seconds** the bug was able to detect and transmit to a nearby aircraft the following:
  - Vietnamese air missile tracking, acquisition and guidance signals.
  - The sequence in which those signals appeared during engagement.
  - The frequency and operating characteristics of the warhead's proximity fuze.
- It was the first of many intelligence breakthroughs the **U.S. Air Force** "drone reconnaissance" detachment achieved in Indochina.

1991

**At least one UAV was airborne
at all times in the Gulf war**

- The **First USA UAV war** was during the Gulf War.
- Since the Gulf war, there has **NOT** been a war without the use of UAV.
- Due to the success of using drones in the Gulf War, a **fleet of drones** were used in all wars afterwards.
- However, the push for drones was very rushed and it caused **a lot of civilian casualties** due to the lack of accuracy.

Source: HistoryNet.com

2007

The reaper was used in combat missions in Iraq and Afghanistan

- The British compared the 5-ton bird to a **"mini A-10"**.
- Capable of striking enemy targets with **on-board weapons**.
- Previous Air Force Chief of staff said that "[they have] taken these aircraft from [surveillance] to carrying out **true hunter-killer** missions."
- The drone was remotely operated in **Creech Air Force Base, Nevada**.

2014

Popularity explosion. Military sUAV budget at $24 Bn

- Drones **started transitioning** from the military to commercial use.
- Started **entering the market** in the agricultural and industrial fields.
- **Boom** of all drones seen today.

2. Regulation - Part 107
What, Why, When, etc...

Get ready for a lot of quick information.

What is Part 107

The true definition is **14 CFR Part 107** of the FAA Regulations.

Why Part 107

Part 107 pertains to Commercial License of small Unmanned Aircraft Systems (sUAS).

When is Part 107 Needed

Simply put **Except for Hobby** use.

How to be Part 107 Licensed Pilot

Pass the Part 107 Exam.

What is Part 107 Exam

Is a 60 Multiple Choice exam focused on reading Aerial Maps & Safety.

Post Passing Part 107 Exam

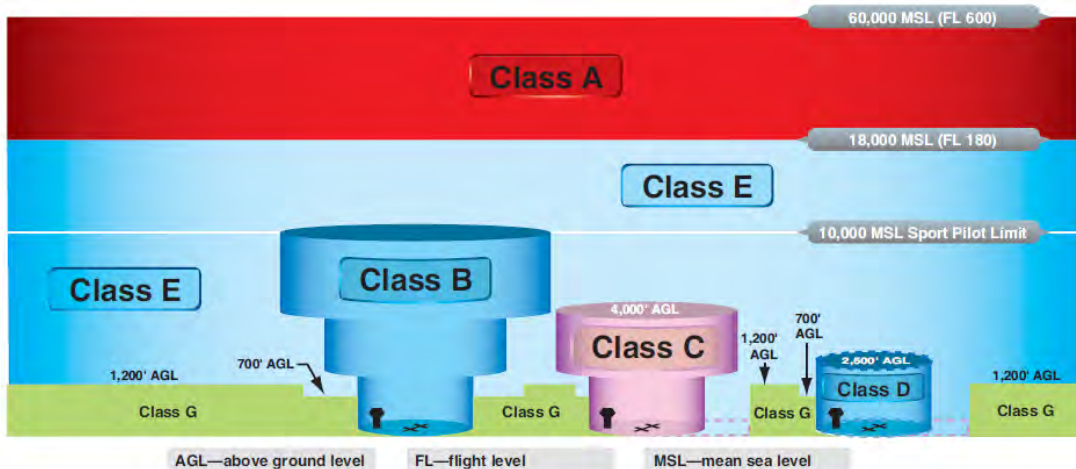# License **does not expire** but you need to retake Part 107 exam every **24 Months**.

Other Legal items than Part 107

Drones are to be registered before flight.

FAA approval is required for **Classes A, B, C, D, & E** air zone classifications.

Other Legal items than Part 107
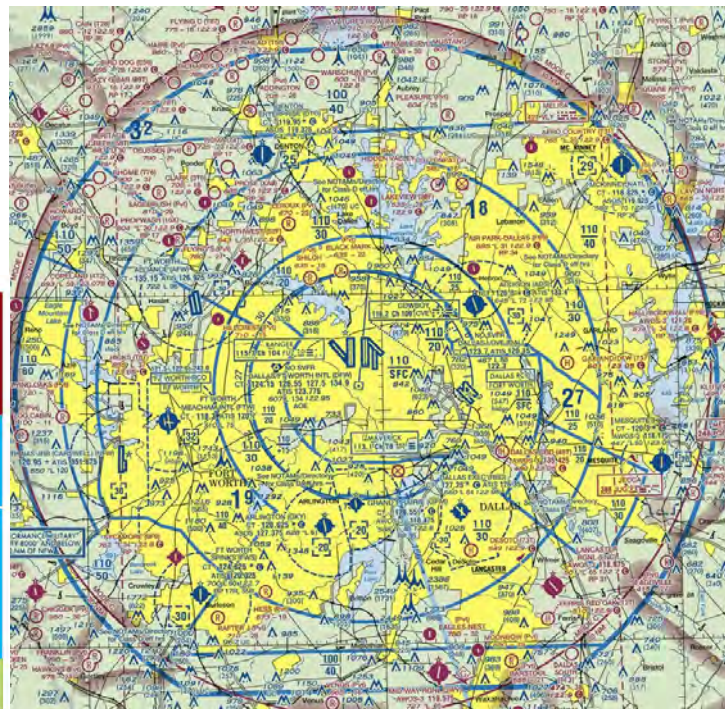
Other Legal items than Part 107

FAA does NOT approve flights at **Night Time**.

FAA does NOT approve flights **above People** not involved in the flight.

Other Legal items than Part 107

FAA does NOT approve flights **more than three statute miles** of unaided visual site.

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3. Drone Use

It's more than just a cool toy.

Get ready for some cool photos taken via sUAVs.

AERIAL PHOTOS
- Simplest use of sUAVs.
- Used for proposals.
- Website / Social Media posts.

EDUCATION

- Great use for educating students especially fresh graduates
- Paints a picture which cannot be captured but through drones.

SURVEYING   PART 1

- Most difficult and most expensive use of drones in engineering.
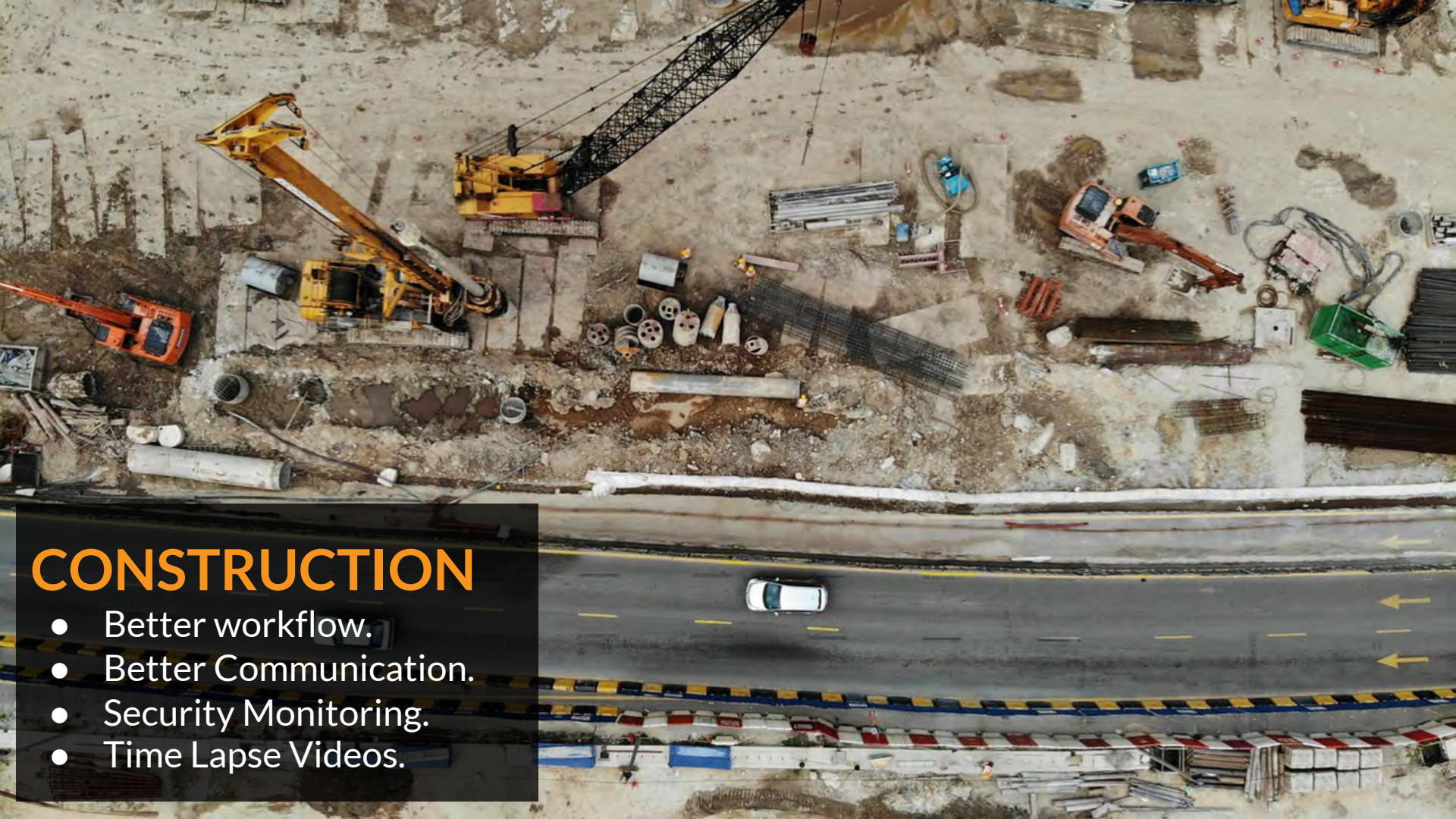- Extreme time saving solutions.

SURVEYING
PART 2

- Accuracy up to 0.4 inches (1cm).
- Software advanced enough to calculate cut and fill areas.

BRIDGE INSPECTION

- Does NOT replace hands-on inspection.
- Direct inspection cost savings.
- Reach inaccessible areas.

CONSTRUCTION

- Better workflow.
- Better Communication.
- Security Monitoring.
- Time Lapse Videos.

3D MODELING

- Create a 3D models from photos.
- Used for large structures (ex.Dams) inspection.

UTILITIES INSPECTION

- Windmills.
- Water reservoirs.
- Light Poles.

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4. Drone Features

$$ - $$$.

But first, a quick montage

Drone Features
DJI

- Great camera.
- Panoramic photos.
- Light and small.
- Drone and Controller are foldable.
- 2x Optical Zoom
- 4x Lossless Zoom
- 48MP Super resolution photos
- Crash detection and evasion

Drone Features
PARROT

- 180° camera.
- 4K Video 21MP camera.
- Light and small.
- Drone is foldable.
- FPV Ready.
- Thermal Camera.

Features Example
360 VIEW

- Above Deck

  - [Website Link](#)

- Underside of Deck

  - [Website Link](#)

- Near Bridge

  - [Website Link](#)

Drone Features
FIXED WINGS

- Take off and land Vertically.
- Up to 42MP camera.
- 0.4 in (1 cm) accuracy.
- Efficient & Precise
- Rugged & Reliable
- Multi-Purpose
  - 3D Point cloud
  - Digital surface model
  - 3D Mesh with texture
  - Index map

Drone Features
SPECIAL

- Confined spaces
- 4K + thermal
- Replaceable cage
- Attachments sold separately
  - Professional Cameras
  - Lidar

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5. Data Processing

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What happens after all the videos and photos.

Data Processing
PIX4D

Pix4Dmapper
Photogrammetry software for professional drone mapping

Pix4Dcapture
Free mobile app to plan, fly and get optimized images for professional drone mapping

Pix4Dreact
The fast mapping software for emergency response

Pix4Dbim
3D mapping software for earthworks, construction and infrastructure management

Pix4Dfields
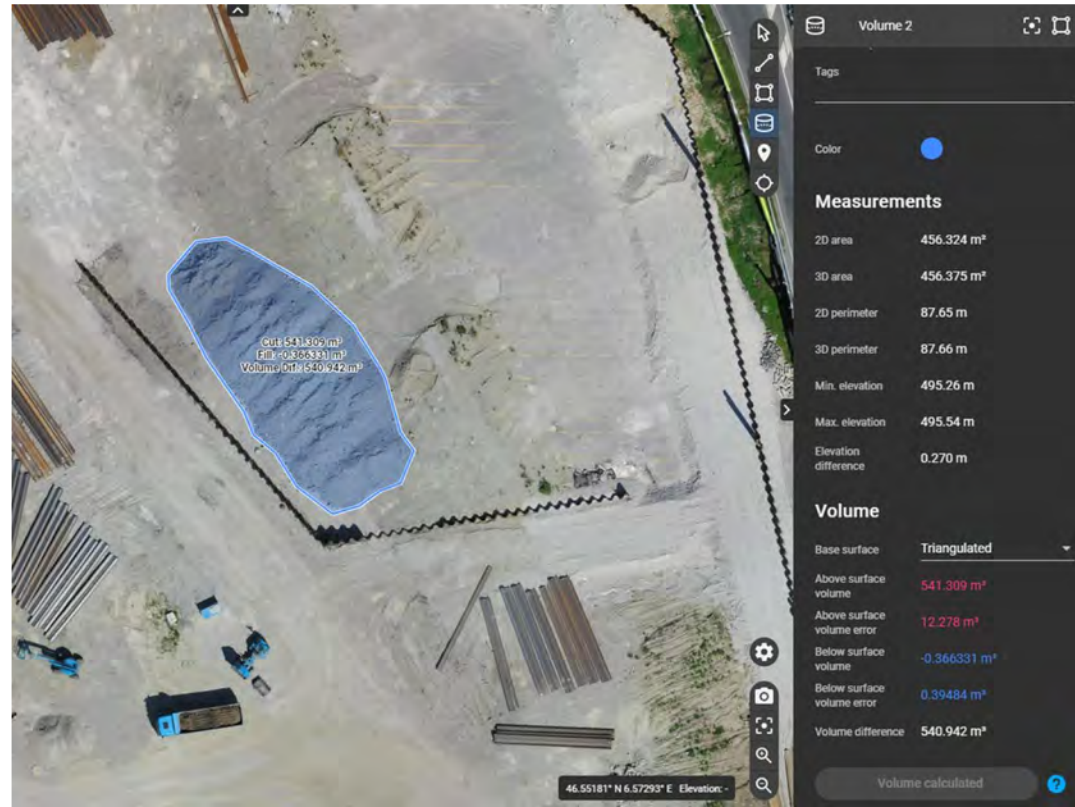Field mapping and aerial crop analysis for digital farming

Pix4Dengine
Build the future of image-based reality capture with data-driven insights for your business

Data Processing
PIX4D bim

FEATURES

- Cloud Processing
- Measure Areas, Distances & Elevations
- Calculate Volumes
- Generate Cross-Sections.
- Overlay Design Plan & Map
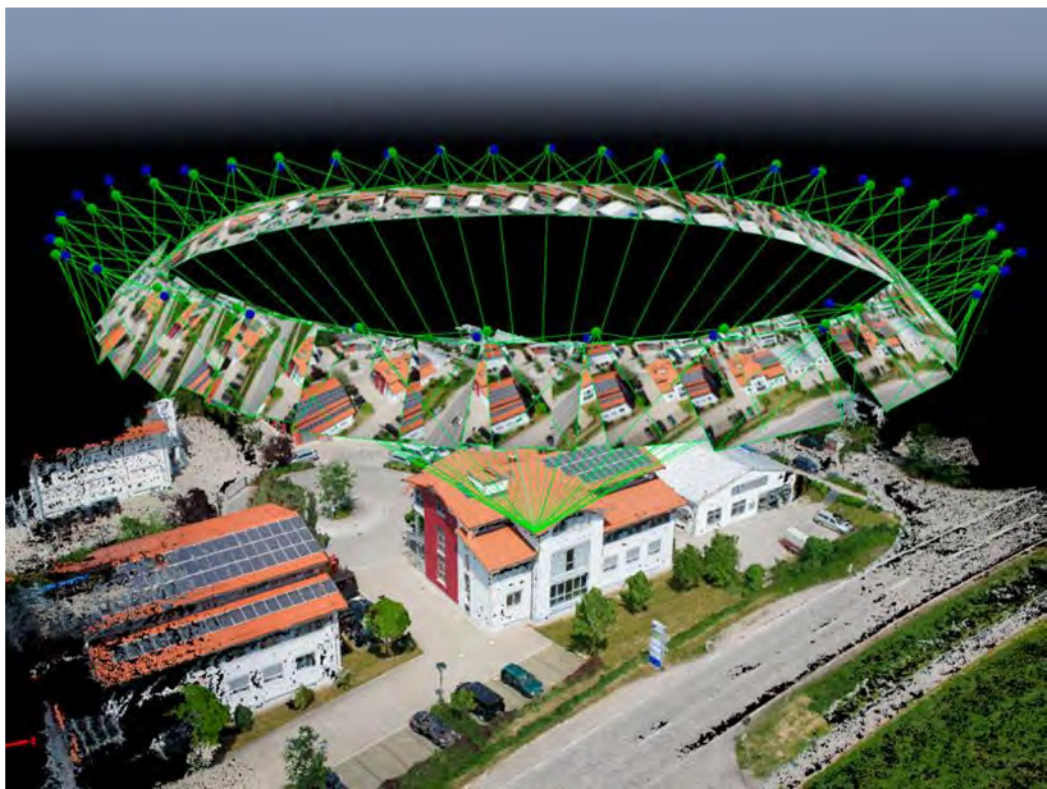- Compare Over Time
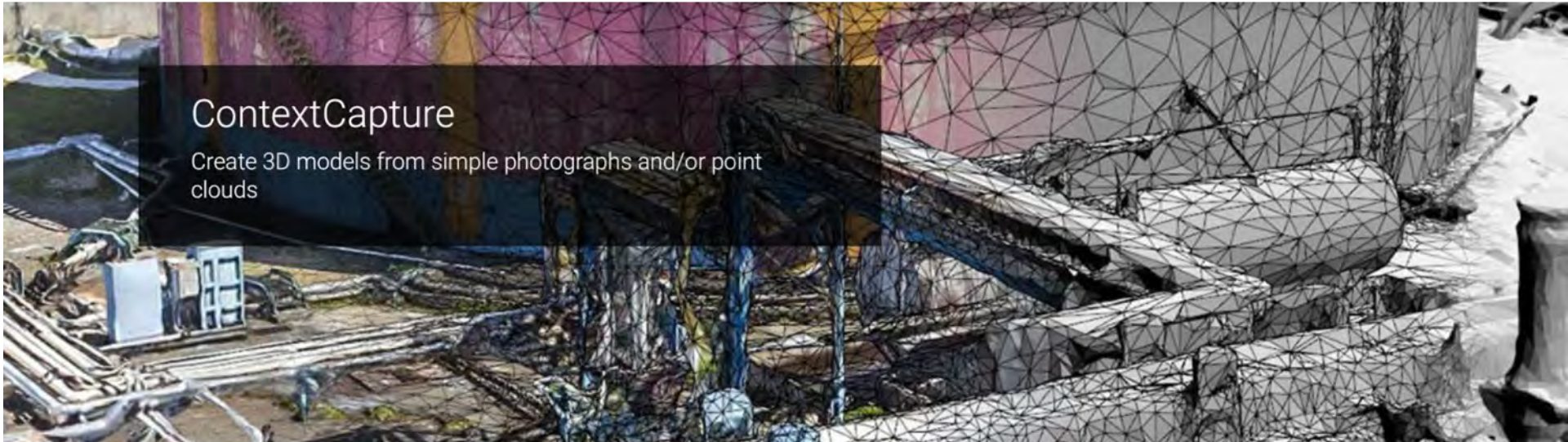- Annotate & Share

Data Processing
PIX4D model

FEATURES

- Point Cloud Editing Tools
- Post-Processing model capabilities
- Measure and annotate
- Inspect the structure through the model.
- Export 3D mesh model.

Data Processing
ContextCapture

ContextCapture

Create 3D models from simple photographs and/or point clouds

Gerpho photo aérienne

Data Processing
ContextCapture

FEATURES

- Generate 3D CAD models
- Generate 2D and 3D GIS models
- Create scalable terrain models.
- Integrate positioning data (georeference models).

Data Processing
DroneDeploy

Automated Flight
Our app will fly your DJI drone with your iOS or Android device.

Process Maps Fast
Quickly process images into detailed maps and 3D models in the cloud.

Powerful Map Analysis
Make real-time measurements including distance, area and volume.

Build Your Brand
Easily share data with clients using your own brand.

Broad Compatibility
Export data in the formats your clients need.

ROI & Customer Satisfaction
Drive productivity and customer happiness with 3x faster turnaround times.

Data Processing
DroneDeploy

SOLUTIONS

- Construction
- Inspection
- Roofing
- Solar
- Drone Services

Data Processing
Agisoft

Compare your site to design or linework in 3D overlay

Upload design surfaces or linework to see how you're progressing towards the final grade. Intuitive tools, like Progress to Design View, show how far you need to go and survey-to-survey comparisons make assessing productivity straightforward.

Fast, simple terrain editing

Removing terrain inaccuracies or obstructions takes seconds, so you know your quantities are accurate. Ensure consistency by managing who makes edits and track any as they happen.

Your data in the file formats you need

Propeller isn't a data silo. You can import your data in geoTIFF, DXF, DWG, KML, and KMZ or export as JPEG, TIFF, DXF, or LAZ files and always have the formats you need for existing workflows.

Cloud-based software and data processing

No need to download and install any programs. Just log into Propeller on your browser and see all your survey data, analytics tools, calculators. Automatically filter your surveys to flatten machinery or view bare earth with a single click.

Easy-to-use measurement and analytics tools and templates

Measuring your site takes just a few clicks, and on-screen calculators and analysis tools make measuring volumes, surface areas, road grades, elevation, cross-sections, and cut/fill a piece of cake.
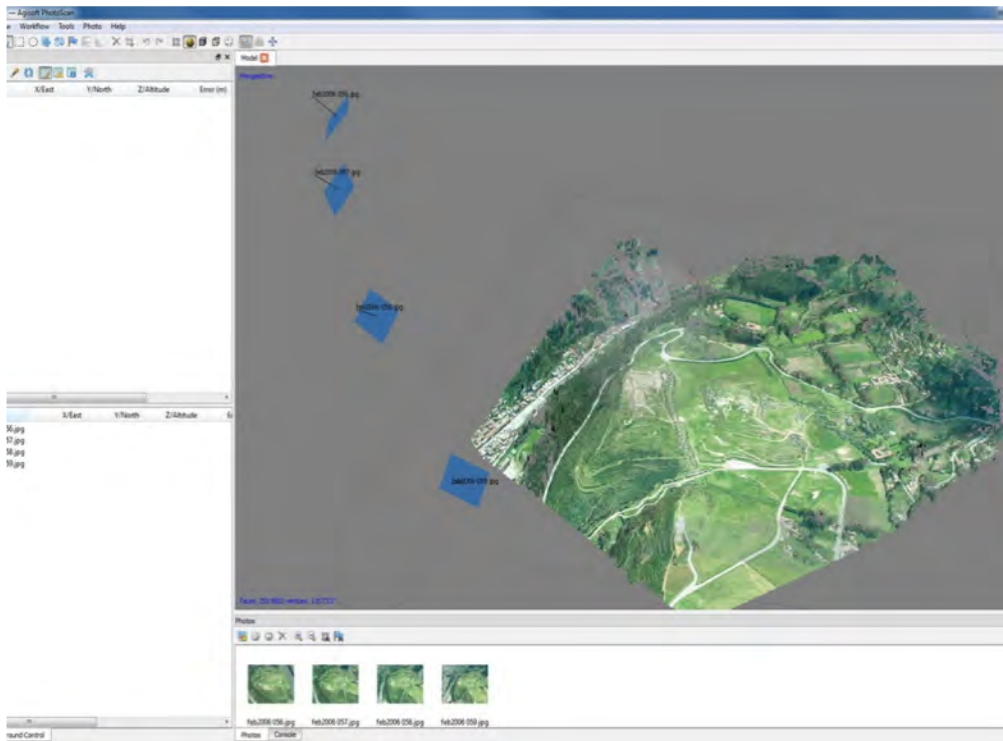
Quick, accurate data turnaround

Your surveys are processed, QA'd by our data gurus, and ready to view in 24 hours.

Data Processing
Agisoft Photoscan

FEATURES

- Ground control points: high accuracy surveying
- Panorama stitching
- Network processing (multiple nodes for huge data sets processing).
- Python scripts: customize processing workflow

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6. DOTs & Drones

Get ready for some numbers.

It's not an engineering oriented presentation without a few numbers.

A **2019** survey conducted by AASHTO officials indicates that **36 state DOTs** are funding centers / programs to operate drones.

10 state DOTs polled by AASHTO have hired staff to manage drone operations with **279 FAA certified drone pilots.**

3 state DOTs are participating in the FAA's Integration Pilot Program to fly beyond visual line of site, at night, and over people.

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7. Bonus Section
"IT. JUST. GOT. INTERESTING!"

Final thoughts, ideas, and bonus content.

FUN FACTS

Mail delivery with drones.
09.19.2019

- After **thousands** of successful attempts in Australia, FAA started a **drone delivery pilot** program in Christiansburg SouthWest Virginia.

- Drones are **10lbs** and travel more than **70mph** with up to **3lbs** packages carried.

- Can **only** fly during the day and out of the rain and transit over people.

FUN FACTS

sUAV is a crucial part of the military

- Small Unmanned Aircraft Vehicles are an **integral part** of the US and Israeli military forces.
- The army is one of the **major leaders** in drone development and drone use.

FAA Approval System

Created **LANC** System as a collaboration between FAA and the Industry.

LAANC = Low Altitude Authorization And Notification Capability
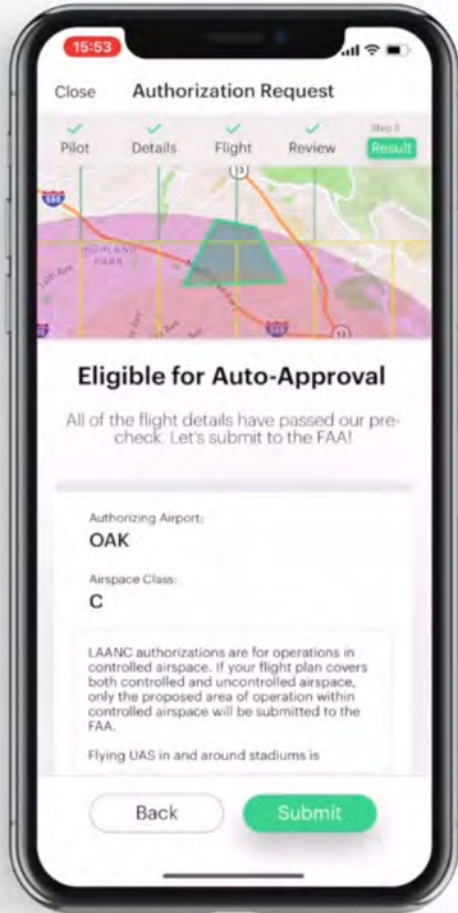
KittyHawk

Mobile App

- Available on iOS and Android.
- FAA approved LAANC UAS service supplier.
- Team Management.
- Company who helped FAA create the B4UFLY app.

B4UFLY

Mobile App

- Clear "status" indicator whether it's safe to fly or not.
- Information about airspace types, critical areas, restricted areas, etc....
- Links to other FAA drone resources.

UNDERWATER DRONES

- Great 4K UHD camera.
- Up to 4000 LED Lumens.
- Up to 6 degrees of freedom motion.
- Up to 4 Hours battery.
- Able to adjust pitch angle to +/- 45 degrees.
- Sonar add-on capability.
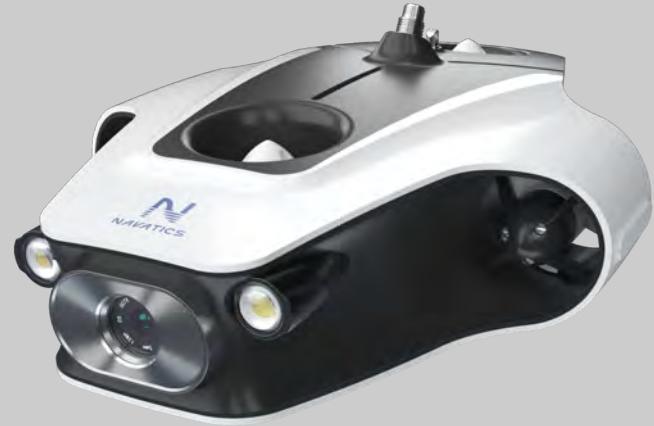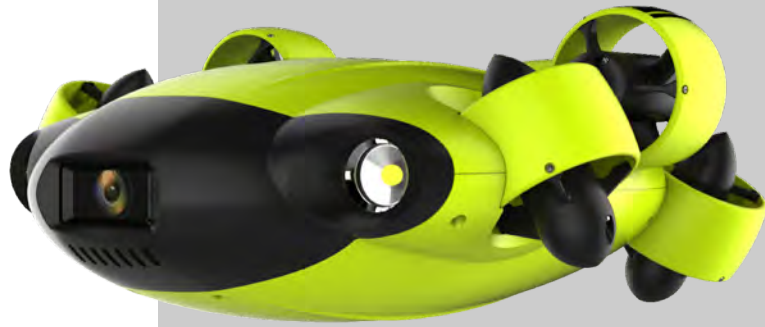
SUMMARY
Of Everything.

Well, as much as possible.

Do **NOT** fly over people, at night, or out of visual site.

Some of **Drone Uses**

- Aerial Photos.
- Education.
- Surveying.
- Bridge Inspection.
- Construction.
- Utilities Inspection.

Fly **ONLY** in class G or after FAA approval. **LAANC** system is almost automatic.

Some of **Data Processing**

- PIX4D.
- ContextCapture.
- DroneDeploy.
- Agisoft.

Some **Mobile Apps** are KittyHawk and B4UFLY.

Some of **Drone Features**

- 180 degrees camera rotation.
- Thermal imaging.
- Crash detection & Collision deviation.
- FPV ready.
- 4x Lossless zoom.
- Up to 48 MP UHD photos.

In a word,

Drone Technology has Changed our typical methods.

THANK YOU

Ciorba Group