Drone2Map: An Introduction

• Topics:
  - Introduction to Drone Mapping
  - Coordinate Systems
  - Overview of Drone2Map
  - Basic Drone2Map Workflow
  - 2D Data Processing
  - 3D Data Processing
  - Inspection Workflow
  - Summary & Close
Who should be attending?

Goals and Outcomes

• Target Audience
  - Those new to drones & drone mapping
  - Curiosity in applying drone technology to an application
  - Little or no prior experience in collecting & processing aerial imagery
  - Introductory knowledge of ArcGIS software stack

• Goals:
  - Introduce product & placement
  - Provide high level overview of software use
  - Generate ideas for applications
  - Identify additional training opportunities & resources
Complete Drone Startup Kit

- Airframe
  - Platform (Fixed Wing, Copters)

- Sensors
  - Imaging Sensor (Digital, Multispectral)
    - Lens Types (Perspective, Fisheye, Wide Angle)
    - Resolution (Sensor Resolution, GSD)
  - Positioning Sensor (GPS, IMU)

- Software
  - Vendor, Platform Specific
    - Flight planning, device management, data collection, data exchange
  - ArcGIS technology stack:
    - Drone2Map, ArcGIS Desktop, ArcGIS Enterprise
Drone Imagery Processing
Drone2Map

- Turn Drones into Enterprise Productivity Tools
- Run on Desktop or Amazon Cloud

http://www.esri.com/products/drone2map
Drone2Map for ArcGIS
Create 2D and 3D products from raw drone imagery

Drone2Map for ArcGIS is a desktop application that turns raw, still imagery from drones into orthorectified mosaics, terrain models, point clouds, 3D meshes, & more.

Orthomosaics
Digital Surface Models DSM & DTM
Point Clouds & 3D Meshes
Smart Inspection & 3D PDF
Share Drone Imagery Fast
Get Imagery Products To Your Users When They Need It

3D products

Share as ...

Scene layers
Introduction to Drone2Map Application

- Current Release is Version 1.2
- Separate Install from ArcGIS Desktop, ArcGIS Pro
- Requires ArcGIS Online Subscription (or Trial)
- Licensed using ArcGIS Organizational or Portal for ArcGIS Accounts
  - Requires Level 2 Named User
What’s New in Drone2Map Release 1.2?

- Open Projects In ArcGIS Pro
- Batch Processing
- Share Project As Web Map
- New Image Carousel Integrated With Map Clicks
- Draw Tool
- Mesh Support For LOD’s
- Support For Output Spatial Reference
- Updated 3D Textured Mesh Settings
- Additional Calibration Parameters

- Updated Ribbon
- Selection Of Image Centers (Camera Stations)
- Allow Layer Symbology Color Change:
  - Image Centers
  - Flight Lines
  - Contours
  - GCP’s
  - Project Area
- Application Quality Improvements
Drone2Map Use Cases

- Ortho Mapping
- 3D Modeling
- Inspection (Oblique)
- Visualization
Supported Platforms

- Windows 7 SP1 Ultimate, Enterprise, Professional, and Home Premium (64 bit)
  - .NET Framework 4.5 installation required if not previously installed
- Windows 8.1 Basic, Pro, and Enterprise (64 bit)
- Windows 10 Home, Pro, and Enterprise (64 bit)
Recommended Hardware Specifications…

- Windows 7, 8, 10 64 bit
- CPU: quad core or hexa-core Intel i7/Xeon
- Graphics: GeForce GPU compatible with OpenGL 3.2 and 2 GB RAM
- Hard disk: SSD

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<th># Project Images (14 MP)</th>
<th>System Memory (GB)</th>
<th>SSD Free Disk Space (GB)</th>
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<td>&gt; 2000</td>
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Coordinate Systems in Drone2Map

• Coordinate System of input data
  - Coordinate Data Recorded in Image Metadata (EXIF) Tags
    - Default Horizontal (XY) usually WGS 84 Longitude, Latitude (In Degrees)
    - Default Vertical (Z) usually EGM 96 MSL Height wrt WGS Reference Ellipsoid (In Meters)
  - What Is Actually Recorded Is Dependent On Your Flight Control Software

• Ground Control Coordinate System
  - Coordinate Reference In Which Control Points Are Defined
  - Is usually different From Image Coordinate System

• Output Coordinate System
  - Coordinate System In Which Drone2map Output Products are Defined
  - If Using Ground Control, Output Will default to Ground Control Coordinate System
  - If No Ground Control, default is UTM or User Can Specify
Impacts of Incorrect Specification

• Products could be misaligned WRT to Base Map (Horizontal Reference Error)
• Computed Surfaces Above or Below Terrain. Products could be invisible due to being obscured by terrain layer (Vertical Reference Error)
Drone Mapping Workflow

T | C | P | E | D
Tasking (Flight Planning) | Collection | Processing (Photogrammetry) | Exploitation | Dissemination

Drone Manufacturers

Drone2Map
Flight Planning/Data Collection

- Use Case Driven
- Overlap Configuration
  - Sidelap, Endlap, Altitude
- Collection Angle
  - Nadir, Low Oblique, High Oblique
- Metadata (Exif)
  - Camera Calibration
  - Position & Orientation
  - Exposure Information
- Coordinate Systems (H, V)
Drone2Map Templates

2D Mapping
Overlapping, nadir
Orthomosaic, DEM, DSM
3D point cloud, mesh

3D Mapping
Overlapping, nadir & oblique
Orthomosaic, DEM, DSM
3D point cloud, mesh

Inspection Mapping
Overlapping, high oblique images
Annotation, attribution, visualization

Nadir (Vertical) Images
Nadir (Vertical) and Oblique (in direction of arrow) Images
Concentric High Oblique Images (different altitudes)
Demonstration Project

- Data Provided by
  - USACE, Wilmington, NC
  - McKim & Creed Engineers, Wilmington, NC
- Wrightsville Beach, North Carolina
  - Post-hurricane Beach Restoration Project
  - Independently Established Ground Control Points for Accuracy Assessment
  - Demonstrate Alternative To Terrestrial LIDAR
  - Platform Specifications DJI / ILCE QX1
  - 195 Images @ 3 cm GSD
  - <2 Hours Hour of Field Collection
  - ~4 Hours for Final Product Generation

RMS Error [ft]
- X 0.053
- Y 0.034
- Z 0.118

Point Cloud - 450 Million+ Points
Average Point Density 30 Pt/m²
Basic Workflow - Rapid Processing

- Rapid Processing
  - Ingest Source Data
  - Create low res products
  - Perform quick assessment of collection, ensure no data gaps, good focus etc.
Basic Workflow - 2D Processing

• 2D Processing
  - Used to process flights with Nadir (vertical) images
  - Ingest Source Data
  - Define Processing Options
  - Add Ground Control
  - Process Image Collection
  - Generate Output Products
    - Create detailed Orthomosaic from the overlapping images
    - Extract a detailed DSM using auto correlation
    - Create derived products by applying standard function chains to images
Basic Workflow - 3D Processing

- Used to process flights with a combination of Nadir & Oblique Images
- Ingest Source Data
- Perform a Rapid Processing to Validate Collection
- Define Processing Options
- Add Ground Control & Clip Polygon
- Process Image Collection
- Generate Output Products
  - 3D Point Cloud
  - 3D Textured Mesh
  - Orthomosaic
  - DSM, DTM
  - Contours
Drone2Map Publishing

- Publish Products to ArcGIS Online or Portal for ArcGIS
- Share Contours, Flight Points & Lines as Feature Layer
- Share DSM, DTM, Orthomosaic as a Tile Layer
  - Tiling is performed locally, then uploaded
- Share 3D Textured Mesh as 3D Scene Layer
- Share 2D products in a Web Map
  - DSM, DTM
  - Orthomosaic
  - Flight Points & Lines
  - Contours
  - Markups (using the Draw tool)
Batch Processing

- Process *multiple* Drone2Map projects in succession
- Batch job consists of one or more projects
- Open existing Batch job or Create new
- For any Drone2Map Project in the Batch job:
  - Modify Processing Options
  - Change order of Project processing
  - Remove Project from Batch job
  - Open the Project in the Drone2Map UI
Basic Workflow – Inspection Processing

• Different Use Cases From 2D & 3D
• Goal Is To Create A High Resolution Oriented Image Collection To Support Visual Inspection, Mensuration, Annotation Processes
• Increasing Demand Because Of Safety, Feature Access Issues
• Non-contact, Non-invasive Collection & Annotation
• Content Collection Can Support Work Order Generation, QC Inspections, etc.
Summary

- Drone2Map is a complete drone data processing platform for field and office use
- Provides an intuitive, user friendly experience
- Supports a wide array of platforms and sensors
- Integrated with the ArcGIS technology stack
- Permits processing of large collections of imagery supporting complex use cases
- Drone2Map product:
  - http://www.esri.com/products/drone2map
- Drone2Map Documentation: