CEC Continuing Education Center

DesignNews

Using Drone-Based LiDar

DAY 4 : Project Structure and Benefits

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Webinar Logistics

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Louis W. Giokas

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Course Overview

During this program, attendees will learn how to convert data collected from a LiDAR mission into a point cloud comprised of over 6 million points, which will be used to create highly accurate digital surface models and contours. Watch the entire process and learn how you can start saving time and money by adding drone-based LiDAR to your workflow. In particular you will learn the components of UAV LiDAR; how to save time and money with drone-based LiDAR as part of workflows; evaluate the benefits of drone-based LiDAR; how to create a 3D point cloud with a visual data demonstration.

Class Overview

This class will concentrate on the project structure using LiDar and UAVs for visualization. Different goals may require different structures and we will look at the supporting technologies required. We will also look at the benefits of using LiDar and UAVs as opposed to other technology options.

Agenda

- Project Overview
- Plan
- Fly
- Process
- Visualize

Project Overview

- A key goal of any project is efficiency.
- This requires significant planning and execution.
- Large areas are often involved, and as we have seen, large amounts of data.
- Project goals need to be clearly defined.
  - The desired end result will drive the selection of sensors, UAVs and software.
- We will look at a project from planning to processing of the data for the stated purpose of the project.

Project Overview

Project stages

Plan

- Clear and concise goals are essential.
  - This drives the selection of all components and operational parameters.
- Elements of a plan include:
  - Area to be mapped
  - Density of the point cloud
  - Type of data to be collected
  - UAV capability

Plan

- Size and shape of the area under consideration affects the flight plan chosen.
  - Known points must be identified.
- Density of points required affects flight time.
- Capability of the UAV must be considered.
  - This influences the selection of the UAV as well as its operation.
  - Duration is another consideration
    - Electrically powered vs. gasoline

Plan

- Another, often overlooked consideration, is weather.
  - UAV might be affected.
  - Sensor performance in various weather conditions must be considered.
- Skilled operators are required, since precision in operating the UAV is essential.
- There may be restrictions on flying height and consideration of obstacles in the area of interest must be overcome.
  - This is an interplay between sensor technology and project goals.

Plan

- Fortunately, there are solutions.
  - Automated tools for planning are available.
  - Companies that do this as a service are available and have deep expertise in all aspects of the process.
    - This might be the best choice for many organizations.
    - These companies generally bring with them an integrated suite of tools for the whole process.

This slide is a placeholder for a participant question.

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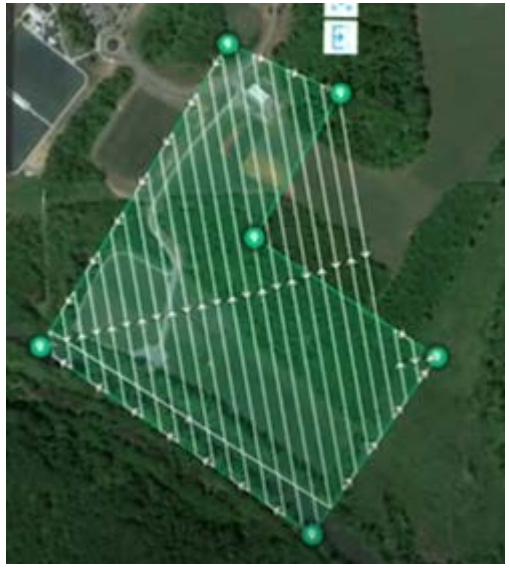
Fly

- Most UAVs can be flown using automated flight control.
- After the plan has been developed, an operator uses a control interface to enter the flight plan.
- On-site work must be performed to identity way points and control points based on local conditions.
- Many variables to be considered.
  - As mentioned, sensor performance and required point densities are two major factors

Fly

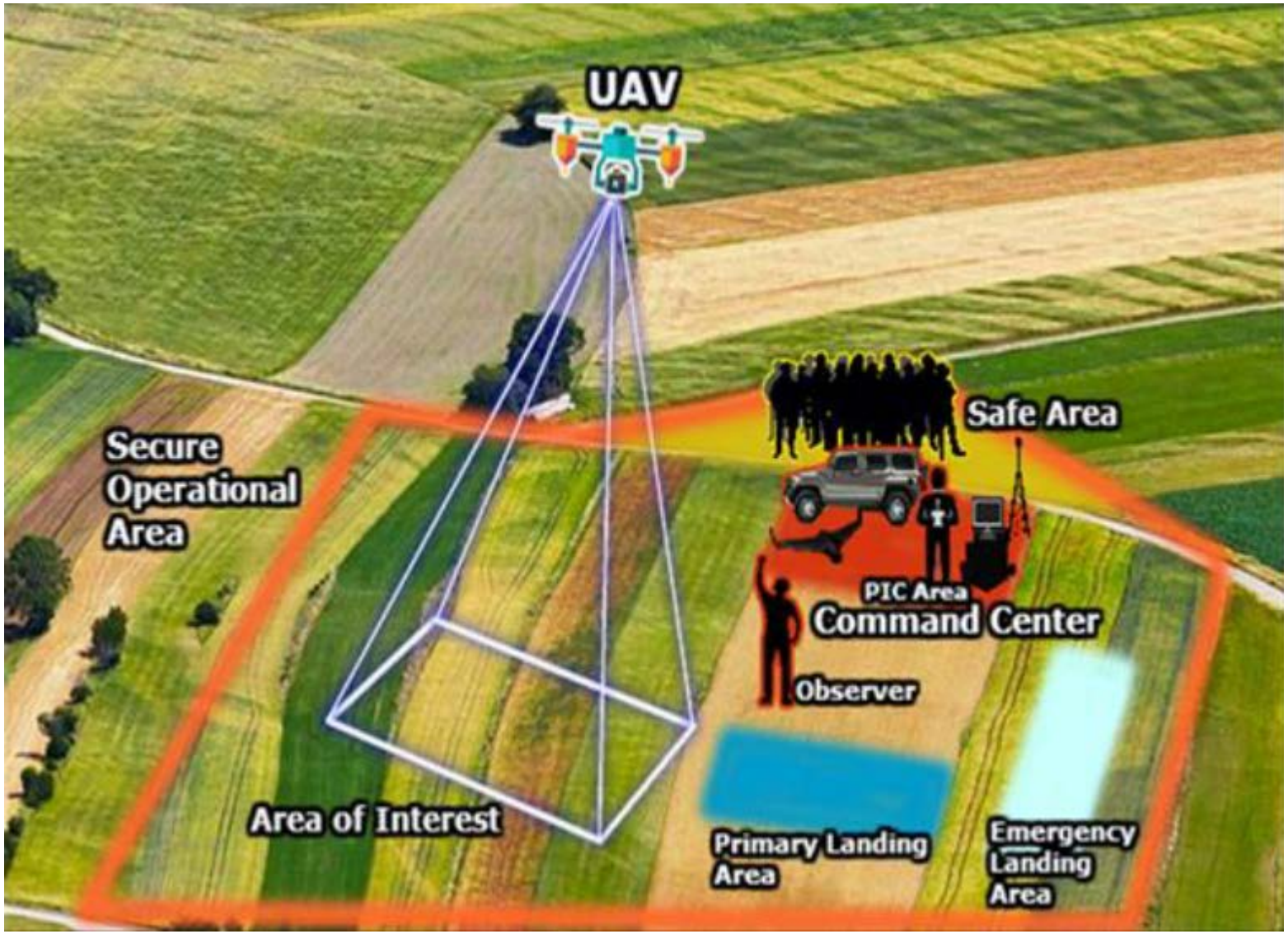
- Most systems allow for feedback on flight performance during the flight.
  - The operator uses this feedback to determine if project goals are being met.
  - If not, a portion of the scan may need to be repeated.
- Drone setup and attachment of the payload is usually performed on-site
- Calibration is also a consideration.
  - This includes the sensor and the position tracking systems.

Fly



Flight Planning Examples

Fly


UAV
Safe Area
Secure Operational Area
PIC Area
Command Center
Observer
Area of Interest
Primary Landing Area
Emergency Landing Area

Fly


ToolBox
Longitude
135
Go
Latitude
35.012
KMZ
KMZ
Fixed Altitude
Terrain Following
Line Segment Spacing
10 m
Lidar Sensor +
Lidar Settings +
Flight Parameters +
Calculate Flight Plan
Project LiDAR Swath
LiDAR Swath Density
LiDAR MTA ZONE

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Process

- Many advanced systems use cameras as well as LiDAR sensors.
  - This allows a more detailed product to be produced, merging the point cloud data with imagery.
  - The imagery can aid in coloring the point cloud and in registration.
- As we have seen, point clouds have lots of detailed information that must be processed to produce usable images.
- Tools to perform the analysis required are available, as we saw in the previous lecture.

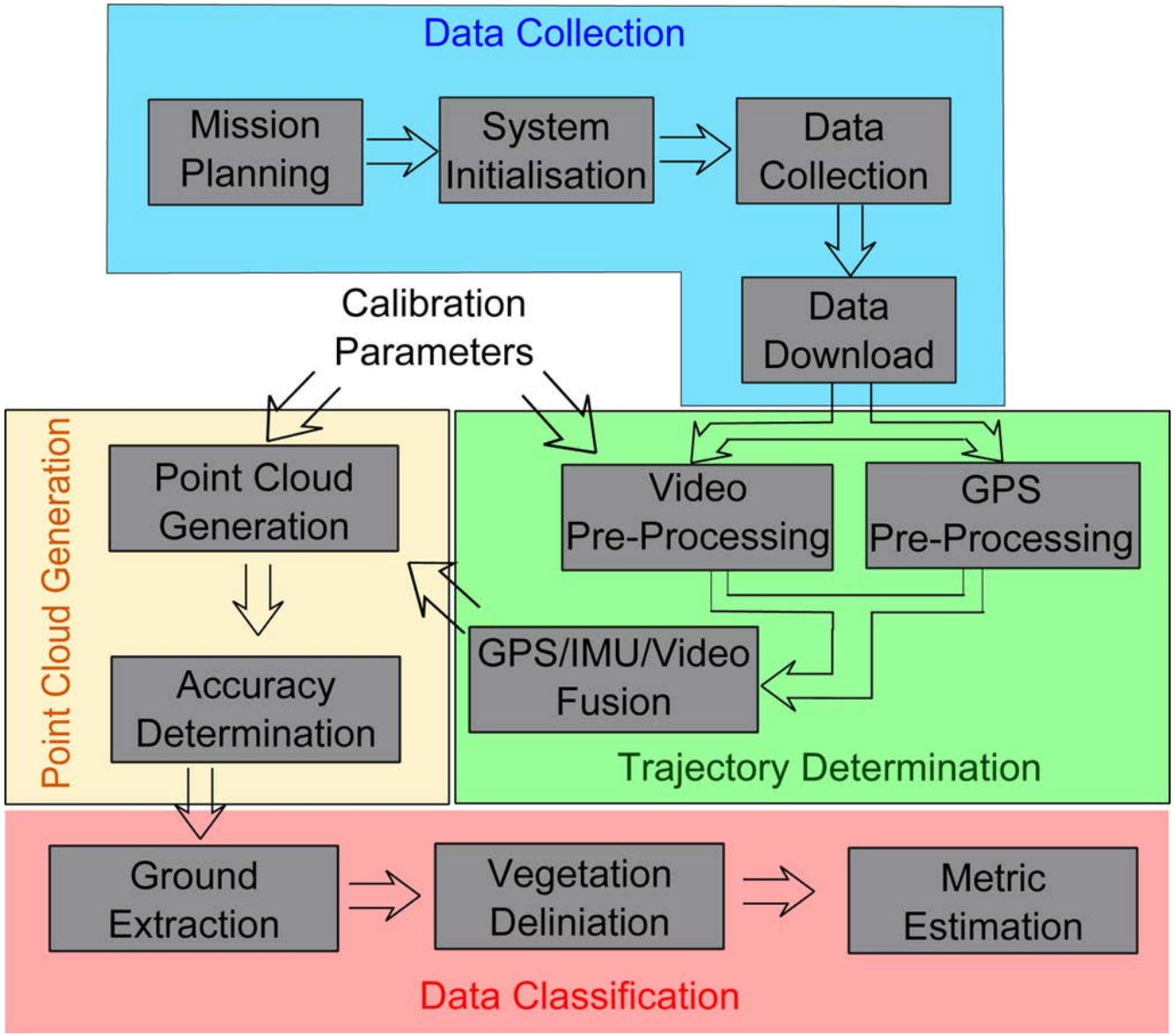
Process

- Being able to process data to some level while flying helps to ensure that project goals are being met.
  - This does not have to be full processing, but enough to determine the quality of the scan.
  - This might include factors such as:
    - Accuracy of position data (using the waypoint measurements).
    - Measurement of the attributes of the scene being measured.

Process

- Once the raw data has been collected, it is generally taken back to a processing location.
- Many steps are performed to merge the raw data into a usable point cloud.
- The tools we discussed before are applied to perform essential tasks such as registration and calibration.
  - The use of overlapping measurements can be useful in the calibration process

Process


Data Collection
Mission Planning
System Initialisation
Data Collection
Data Download
Calibration Parameters
Point Cloud Generation
Point Cloud Generation
Accuracy Determination
Video Pre-Processing
GPS Pre-Processing
GPS/IMU/Video Fusion
Trajectory Determination
Ground Extraction
Vegetation Deliniation
Metric Estimation
Data Classification

This slide is a placeholder for a participant question.

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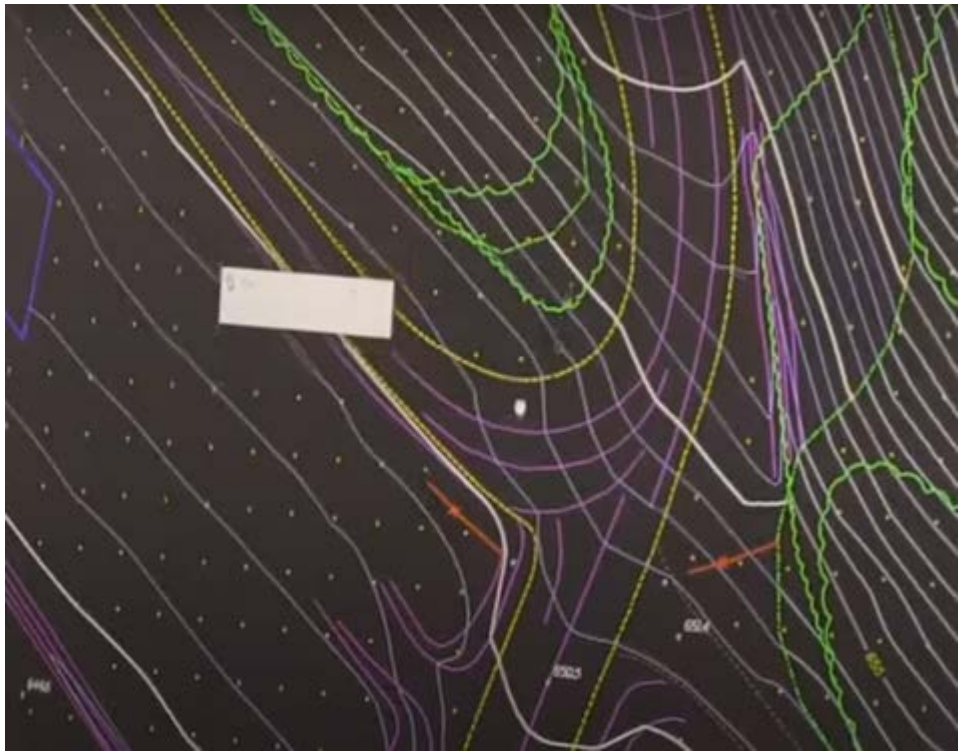
Visualize

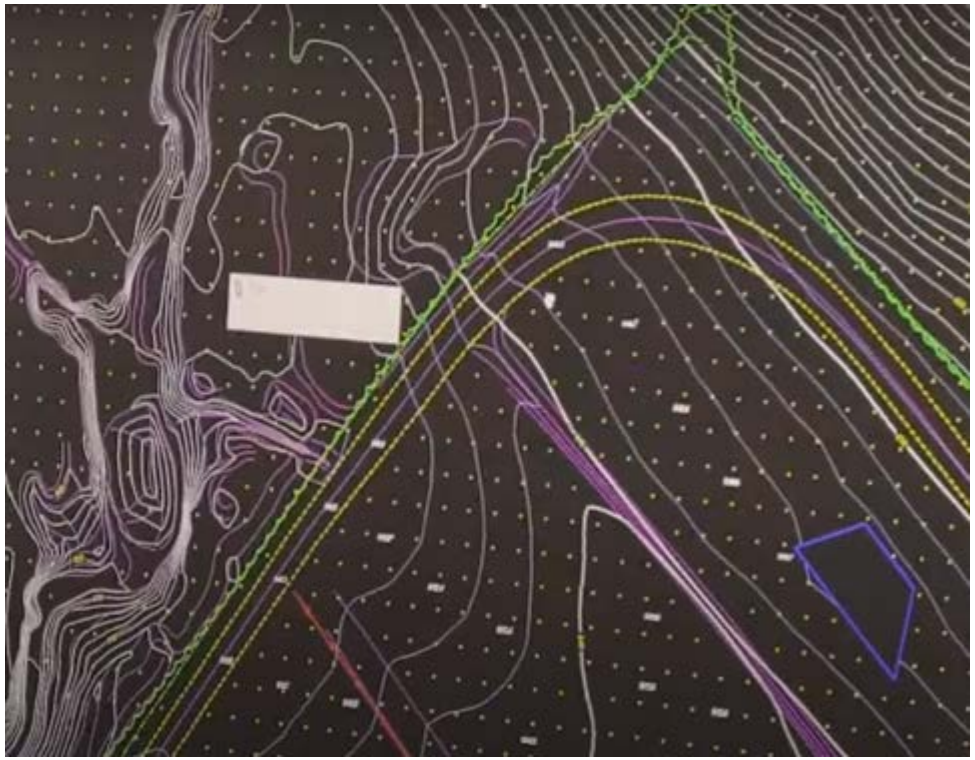
- The whole purpose of generating a point cloud is to visualize the area being mapped.
  - This is often done in various ways, each of which will be useful in some form of analysis.
  - This may include anything from vegetation analysis to building attributes.
- The tools for visualization and analysis are highly varied.

Visualize

- Typical visualization tools include GIS and CAD systems.
- Types of visualization required will determine the tools to be used.
- The typical flow is from the LAS file as collected by the UAV/LiDAR system.
- Conversion to visualization formats has already been covered.
- The usual requirement is to identify specific features and their current state.
  - May include road surfaces and edges, utilities, buildings, etc.
- This can then be compared to standard imagery and metadata.

Visualize





Thank you for attending

- Today we have looked at the process of setting up and executing a project using UAVs and point clouds.
- The type of project considered is a mapping project, which is a typical use of UAV borne LiDAR.
- Tomorrow we will look at the process in more detail with examples.

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Thank You

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