

# STRANDS AND STANDARDS

## UAS LAB: EXPLORATION OF INDUSTRY APPLICATIONS



### Course Description

UAS Lab: Exploration of Industry Applications examines how various sensors and payloads are being applied to drones across all industries. It gets its strength from being flexible enough to respond quickly to emerging technology in the Unmanned Systems category. Unmanned Aerial Systems 1 is a prerequisite.

NOTE TO INSTRUCTORS: This course is designed to be adaptable to the variety of skill sets and equipment available at individual schools. You are expected to choose at least two Strands that are in line with your expertise, available drone-captured data, available drone models and associated cameras/sensors.

<b>Intended Grade Level</b>	10-12
Units of Credit	0.5
Core Code	40.11.00.00.056
Concurrent Enrollment Core Code	000
Prerequisite	Unmanned Aerial Systems 1
Skill Certification Test Number	000
Test Weight	0.0
<b>License Area of Concentration</b>	CTE and/or Secondary Education 6-12
<b>Required Endorsement(s)</b>	
Endorsement 1	Aviation - Flight
Endorsement 2	Unmanned Aerial Systems
Endorsement 3	N/A

## STRAND 1

Students will explore drone aerial photography & videography uses.

### Standard 1

Students will demonstrate specific flight maneuvers associated with this industry.

- Use different control modes to capture photos and video.
- Use manual mode to capture various types of shots including but not limited to a reveal shot, tracking shot, panning shot, orbit, dolly zoom, setting shot, etc.

### Standard 2

Students will understand and describe differences of resolution and frame rate in relation to intended audience and hardware limitations.

### Standard 3

Students will utilize digital camera settings to control, manipulate, and effectively utilize aperture, white balance, shutter speed, and exposure value.

### Standard 4

Student will use industry standard tools to edit drone photos.

- Students will be able to manipulate digital photographs and optimize tools in a photo editing suite such as white balance, horizon leveling, contrast and brightness, color correction, anomaly removal, and sky balancing.
- Students will be familiar with and understand how to edit RAW and standard image types using destructive and non-destructive methods.
- Students will demonstrate an understanding of aspect ratio modifications and resolution profiles.

### Standard 5

Student will use industry standard tools to edit drone video footage.

- Students will be able to manipulate videos and optimize tools in a video editing suite such as white balance, contrast and brightness, color correction, and frame rate.
- Students will be able to clip/trim videos from multiple sources and apply music synchronization.
- Students may use digital effects in their films. (e.g. After Effects and animated pan/zoom of still images.)

### Standard 6

Students will prepare digital assets for publishing.

- Students will prepare photos and videos for publishing on social media (e.g. YouTube, Facebook, etc.)
- Students may practice live streaming drone footage. (May include footage of flight, pilot perspective, or First-Person View (FPV))
- Students will prepare photos and videos for publishing on web pages and digital portfolios.

### Standard 7

Students will apply acquired skills in an industry-related setting.

- Students will apply acquired knowledge and skills that require capturing, processing, and publishing high-quality digital photographs in support of a specific industry application (real estate, marketing, news reporting, infrastructure inspections, etc.).
- Students will apply acquired knowledge and skills that require filming, processing, and publishing high-quality videos in support of a specific industry application (filmmaking, real estate, marketing, news reporting, infrastructure inspections, disaster response, etc.).

## STRAND 2

Students will understand the principles of digital photogrammetry and orthomosaic manipulation systems.

### Standard 1

Students will demonstrate planimetric mapping, stereoscopic calculations, and effective use of photogrammetric software (such as Pix4D and Agisoft).

### Standard 2

Students will describe quantitative and qualitative methods and industry standards for quality assurance and accuracy assessment of photogrammetry data products.

### Standard 3

Students will determine flight characteristics (height, position, etc.), object dimensions, and conduct precise measurements from a photo and its embedded data tags.

### Standard 4

(optional) Students will develop a suitable flight plan, adjust drone camera settings, perform collection of overlapping digital photos, and process the photos using photogrammetric software to produce an orthorectified mosaiced image that can be displayed in a GIS.

### Standard 5

Students will apply acquired knowledge and critical thinking skills to solve a real-world problem with appropriate digital photogrammetry aerial data collection, processing, and analysis methods (e.g., aerial mapping, aerial surveying, volumetric calculations of earth material removal/movement/acquisition).

## STRAND 3

Students will understand the principles relating to thermal remote sensing systems.

### Standard 1

Students will understand the Electromagnetic Spectrum, including the boundaries and applications for the divisions/bands of energy used in remote sensing applications.

### Standard 2

Students will understand the principles of thermal imaging systems.

### Standard 3

Students will describe the basic principles of heat and processing of thermal image/video data.

### Standard 4

Students will describe quantitative and qualitative methods and industry standards for quality assurance and accuracy assessment of thermal-derived data products.

### Standard 5

Students will assess the strengths and weaknesses of various thermal imaging platforms and instruments for a broad range of application scenarios.

### Standard 6

(optional) Students will develop a suitable flight plan, make adjustments to thermal instrument settings as needed, and perform aerial collection, processing, and analysis of thermal images/video.

**Standard 7**

Students will apply acquired knowledge and critical thinking skills to solve a real-world problem with appropriate thermal data processing and analysis methods (e.g., soil moisture mapping, search and rescue operations, pipe leaks - water / steam, wildlife management, etc.).

**STRAND 4**

**Students will understand the principles relating to multispectral and hyperspectral remote sensing systems.**

**Standard 1**

Students will understand the Electromagnetic Spectrum, including the boundaries and applications for the divisions/bands of energy used in remote sensing applications.

**Standard 2**

Students will understand the principles of multispectral and hyperspectral analysis systems.

**Standard 3**

Students will demonstrate an effective use of analysis software (e.g., Pix4D, ArcGIS Pro, ENVI, etc.) across multiple applications (inspection, agriculture, etc).

**Standard 4**

Students will describe quantitative and qualitative methods and industry standards for quality assurance and accuracy assessment of multispectral and hyperspectral data products (e.g., false color composite images, NDVI, classified data, etc.).

**Standard 5**

(optional) Students will develop a suitable flight plan and perform aerial image collection, processing, and analysis of multispectral/hyperspectral images (e.g., false color composite images, NDVI, classified data, etc.).

**Standard 6**

Students will apply acquired knowledge and critical thinking skills to solve a real-world problem with appropriate remotely sensed data collection, processing, and analysis methods (e.g., precision agriculture, land cover mapping, damage assessment, geologic mapping, etc.).

**STRAND 5**

**Students will understand the principles of LiDAR systems.**

**Standard 1**

Students will describe the basic principles and steps for collecting, processing, and publishing drone LiDAR data with a high-level of spatial accuracy.

- LiDAR point cloud collection/processing
- Digital Terrain Models
- Digital Surface Models

**Standard 2**

Students will describe quantitative and qualitative methods and industry standards for quality assurance and accuracy assessment of LiDAR-derived data products.

**Standard 3**

Students will assess the strengths and weaknesses of various LiDAR platforms and instruments for a broad

range of application scenarios.

#### **Standard 4**

(optional) Students will develop a suitable flight plan and perform aerial LiDAR collection, processing, and analysis of DEM surfaces (DTMs, DSMs, and corresponding digital photos).

#### **Standard 5**

Students will apply acquired knowledge and critical thinking skills to solve a real-world problem with appropriate LiDAR data processing and analysis methods (e.g., landslide hazard mapping, aerial surveying, archaeology, terrain mapping/analysis, volumetric calculations of structures and earth material removal/movement/acquisition, etc.).

### **STRAND 6**

**Students will understand the principles of Geographic Information Systems (GIS) Integration & Analysis of Drone Data**

#### **Standard 1**

Students will be able to publish various drone-based geospatial data (photogrammetric; remotely sensed - thermal, multispectral, hyperspectral; LiDAR) in a GIS project using common geospatial software (e.g., ArcGIS Pro, QGIS, ENVI, ERDAS, etc.).

#### **Standard 2**

Students will apply acquired knowledge and critical thinking skills to solve a real-world problem using aerial data captured by a camera, sensor, or LiDAR instrument along with appropriate GIS data processing and analysis methods (e.g., terrain analysis, viewshed analysis, land use planning, vegetation mapping/analysis, geologic mapping, etc.).

### **STRAND 7**

**Students will understand the principles surrounding payload delivery of smaller cargo such as groceries, medical, packages, etc.**

#### **Standard 1**

Students will gain an understanding of current Federal Aviation Administration (FAA) Small Unmanned Aerial Systems (sUAS) regulations under 14 CFR Part 107 related to cargo/payloads that can be transported by a drone in the National Airspace System (NAS).

- Drones must weigh less than 55 pounds on takeoff, including everything that is on board or otherwise attached to the aircraft (such as cargo).
- Restrictions associated with flying drones transporting another person's property for compensation or hire.

#### **Standard 2**

Students will describe the basic principles of small unmanned cargo aircraft (sUCA) delivery systems.

#### **Standard 3**

Students will describe the basic principles of Center-of-Gravity for aircraft and how it can change with the addition of cargo on board. and supply-chain logistics.

**Standard 4**

Students will describe the basic principles of supply-chain logistics.

**Standard 5**

Students will assess the strengths and weaknesses of various delivery platforms and instruments for a broad range of application scenarios.

**Standard 6**

Students will apply acquired knowledge and critical thinking skills to solve a real-world problem with appropriate aerial delivery and distribution methods.

**Performance Skills**

Present and industry-related completed project.

**Skill Certification Test Points by Strand**

Test Name	Test #	Number of Test Points by Strand										Total Points	Total Questions
		1	2	3	4	5	6	7	8	9	10		